Monumental Architecture and Landscape History of the Tongan Classical Chiefdom

by

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Abstract

Beginning ca. AD 950, increasing populations and the rise of socio-political hierarchies in Tonga, West Polynesia, resulted in the development of a dynastic, geographically integrated, paramount chiefdom. The principal island of Tongatapu was the epicentre of this polity. Ranked chiefs affirmed power and rights to land through monumental construction and a dispersed settlement pattern that fully occupied inherited estates.

In this dissertation, I characterize monumental architecture on Tongatapu, particularly the form and distribution of earthen mounds. Aerial LiDAR (Light Detection and Ranging) survey in 2011 revealed the totality of monumental and community-level construction on Tongatapu. Thousands of mounds and other earthen features, the product of some 1,000 years of funerary behaviour, chiefly competition, and conflict, are highly structured in their arrangement on the landscape.

Using a combination of automated and manual identification approaches, combined with field checks, I have mapped and characterized the mounds and other features of Tongatapu. The distribution of mounds and other monumental features reflects key elements of Tongan culture and socio-political organization, namely, the segmentary, clan-based spatial organization associated with ramage-based societies, as well as the senior-junior ranking that made Tonga one of the most socially stratified cultures in Oceania.

The LiDAR imagery also reveals evidence of the first royal “capital” of the political dynasty that would rule Tonga for nearly a millennium. Massive earthen platforms at this site suggest strategic use of power by an emergent elite at a time of apparent population increase and resumed oceanic voyaging from West Polynesia after a 1,700-year hiatus.

Keywords: Kingdom of Tonga; landscape archaeology; remote sensing; monumental architecture; burial mounds; social inequality
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Maps and illustrations are attributed to their original sources. All photographs and GIS illustrations in this dissertation are my own.
For Nina
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<td>Meaning</td>
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<tr>
<td>‘api kolo</td>
<td>residential town allotment</td>
<td></td>
</tr>
<tr>
<td>‘api uta</td>
<td>“bush” allotment for farming</td>
<td></td>
</tr>
<tr>
<td>‘esi</td>
<td>chiefly “sitting” mound</td>
<td></td>
</tr>
<tr>
<td>fa‘itoka</td>
<td>chiefly burial mound</td>
<td></td>
</tr>
<tr>
<td>fahu</td>
<td>“above the law”; female rank superiority</td>
<td></td>
</tr>
<tr>
<td>fonua</td>
<td>traditionally, land and the people who live on it</td>
<td></td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
<td></td>
</tr>
<tr>
<td>ha’a</td>
<td>group of closely related chiefly titles</td>
<td></td>
</tr>
<tr>
<td>hou ‘eiki</td>
<td>chief</td>
<td></td>
</tr>
<tr>
<td>‘inasi</td>
<td>first fruits tribute ceremony</td>
<td></td>
</tr>
<tr>
<td>kainga</td>
<td>clan or extended family</td>
<td></td>
</tr>
<tr>
<td>kolotau</td>
<td>fortification</td>
<td></td>
</tr>
<tr>
<td>langi</td>
<td>lit. “sky”; monumental tombs of the Tu‘i Tonga and family</td>
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<tr>
<td>LiDAR</td>
<td>Light Detection and Ranging</td>
<td></td>
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<tr>
<td>liku</td>
<td>windward coast</td>
<td></td>
</tr>
<tr>
<td>mala’e</td>
<td>open space or green; civic/ceremonial venue</td>
<td></td>
</tr>
<tr>
<td>mana</td>
<td>spiritual power</td>
<td></td>
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<tr>
<td>matapule</td>
<td>titled, ceremonial attendant of a chief</td>
<td></td>
</tr>
<tr>
<td>mounga</td>
<td>mountain</td>
<td></td>
</tr>
<tr>
<td>pongipongi</td>
<td>ceremonial redistribution of kava and food</td>
<td></td>
</tr>
<tr>
<td>pule</td>
<td>authority</td>
<td></td>
</tr>
<tr>
<td>sia</td>
<td>mound, hill</td>
<td></td>
</tr>
<tr>
<td>sia heu lupe</td>
<td>pigeon-snaring mound</td>
<td></td>
</tr>
<tr>
<td>tanu’anga</td>
<td>unmarked, unmounded burial</td>
<td></td>
</tr>
<tr>
<td>tapu</td>
<td>adj. off-limits, sacrosanct; n. behavioural proscription</td>
<td></td>
</tr>
<tr>
<td>tofi’a</td>
<td>hereditary estate</td>
<td></td>
</tr>
<tr>
<td>tu’a</td>
<td>commoner</td>
<td></td>
</tr>
<tr>
<td>vaitupu</td>
<td>freshwater well or cistern</td>
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Chapter 1. Archaeology and landscape history in Tonga

1.1. Introduction

Between approximately AD 950 and AD 1845, the people of Tonga, West Polynesia, transformed their island landscapes through population growth, agricultural practices, and monumental construction. In fields, family compounds, and at the intersections of paths and roads, they built earthen mounds in which to bury their dead. Those at the pinnacle of the steep social hierarchy were entombed in elaborate sepulchres faced with cut and dressed limestone. High-ranking chiefs also enjoyed privileged pursuits in life requiring the use of special-made mounds and platforms. Members of the lowest caste were buried in communal, nondescript mounds, in graves lined with coral sand. The ubiquity of such monuments is a lasting characteristic of Tonga’s many island landscapes. Nowhere is this more pronounced than on Tongatapu, the largest island and seat of power for a dynastic maritime chiefdom whose influence was felt across much of the southwestern Pacific.

In this dissertation, I present the results of my research into the archaeological landscape of the late-prehistoric Tongan chiefdom. Since 2013, I have employed remote sensing data and field investigation to describe and map the monumental and community-scale earthworks of Tongatapu, the largest Tongan island and central place of the Classical Tongan Chiefdom (ca. AD 1000–1850). The structure and content of this dissertation reflects my attempts to infer aspects of socio-political organization and long-term land use from the pattern and distribution of late-prehistoric material remains on Tongatapu. A preponderance of my attention is paid to the earthen mounds that are nearly ubiquitous on the landscape.
The earthen mounds that dot the Tongan countryside are not the work of a vanished civilization of mound builders, nor are they merely relics of a cultural "fluorescence" of centuries past. Their significance and relevance in Tongan culture persists. Many are landscape mnemonics that aid in the remembering of political or genealogical ties. Many are named and figure prominently in stories. Some mark ancient boundaries that maintain their significance today. Many, many more are the final resting places of an unknowable number of people for whom this small island, in an ocean of islands, was home. As a sovereign Indigenous kingdom that was never colonized by European powers, Tonga is remarkable in its upholding and adapting of traditions to interaction and commerce in the twenty-first century. The social, cultural, and political systems that produced the archaeological distributions discussed here continues to operate, albeit under an altered guise. Traditional politics and genealogy are the structural forces that shape and give character to the kingdom to this day.

In this first chapter, I outline my research problems and objectives and sketch out the architecture of the dissertation. I begin with a brief statement on the context of my research, situating it within current developments in archaeological prospection, landscape studies, and the history of research in Tonga. I then lay out my research questions, which contribute to my overall objective of explicating patterns in the late-prehistoric built environment of Tongatapu. I then describe my primary dataset and outline the sequence of chapters to follow.

1.2. Research context

Anthropological archaeology is concerned with aspects of human behaviour and society that are challenging to infer from the archaeological record — in addition to issues of human subsistence, mobility, and technology, we are also interested in history, politics, social structure, ideology, and more. My overarching interest in this dissertation is to examine the ways in which these facets of culture articulate with landscape and the built environment.

Human societies of all types leave indelible marks on the places they inhabit. Historical ecologists posit that much of the natural world is in fact cultural in some way
People around the world today live in and among the durable structures of past societies, and are influenced by the ways in which past peoples changed and ordered their landscapes. The physical relationships between past and present are only amplified in the case of island societies, where successive generations inherit and shape a built environment within limits defined by the water’s edge. It is especially on islands that we can see the articulation of land use, territoriality, and architecture with kinship, history, and politics.

For the last 1,000-or-so years, the people of the Tongan chiefdom built and modified their island landscapes according to a set of cultural principles, some inherited from an ancestral Polynesian template, and some uniquely evolved in their own archipelago. The islands today bear both subtle and monumental traces of these principles — in the form and layout of modern settlements, in the character and distribution of archaeological sites, and in the human-mediated environmental alteration that characterizes many colonized islands (Braje et al. 2017).

For the first time, archaeologists can view Tongan anthropogenic landscapes in their totality. Recently acquired LiDAR (Light Detection and Ranging) data for three of the principal Tongan islands give us an unprecedented record of surface archaeology related to the chiefdom period (Figure 1). This invaluable imagery is responsible for the inception of this research and constitutes its primary dataset.

As this study centres on what is ostensibly “mortuary behaviour” among prehistoric Tongans, it is worth noting that Tongans today still bury their deceased in earthen and sand tumuli, many of which crowd and converge in community cemeteries to form mounds of modern origin. I admit at the outset that I have not successfully factored all of these sites out of my analysis, the line between ancient and modern being blurry, in many cases. However, I do not consider this to be a significant deficiency in my research. The continuity of land use from the ancient past to the modern day is clear enough in my mind.

Settlement patterns and landscape are a perennial research interest in Polynesian archaeology (e.g., Green 2002), and have seen renewed interest in recent years, owing to the accessibility of new technologies for geospatial data acquisition and
analysis (e.g., Ladefoged et al. 2011, 2013; McCoy et al. 2011). Recent settlement pattern studies in the Fiji–West Polynesia region include a series of studies using LiDAR (e.g., Quintus et al. 2015a; Quintus et al. 2017) and geoarchaeological data (Quintus et al. 2015b) in Samoa, as well as conventional surface mapping in Samoa (Sand et al. 2013), and landscape studies in western Fiji (e.g., Smith and Cochrane 2011; Roos et al. 2016).

Figure 1. A LiDAR-derived hillshade model showing a concentration of earthen mounds near Hoi, Lapaha district, Tongatapu.
Despite the ubiquity of “field monuments” (i.e., earthen mounds) on the Tongan landscape, few studies have addressed them directly. Notable exceptions include Kirch’s (1980, 1988) studies of Vava’u and Niuatoputapu, Burley’s (1994, 1995, 1996) settlement pattern research in Ha’apai, and Spennemann’s (1989) doctoral research, which devoted significant energy to surveying tracts of Tongatapu and mapping mounds. Recent research targeting the political central places of the chiefdom has examined the relationships between elite monumental architecture, chiefly genealogies, and traditional history (e.g., Clark 2014, 2016; Clark and Reepmeyer 2014). A study of the island-wide monumental landscape of Tongatapu has yet to be undertaken. This dissertation documents my attempt to address this task.

Competition over densely populated land has always been, and continues to be, one of the existential issues for Tonga’s ruling elite. From ca. AD 1000 onward, there is evidence of competition, conflict, and increasing social and political stratification — all circling the use and control of the land base and the human capital associated with it. Kennedy (2012) argues that tensions over control of land have persisted from the early chiefdom period right up until the present, with the noble-commoner dichotomy being the impetus for the 2006 riots¹ in the capital, Nuku’alofa, and the subsequent changes made to the structure of Tongan government.

The ancient chiefly hierarchy was essentially enshrined in the nineteenth-century and modern-era land reforms, perpetuating a feudal system of have and have-nots. Demand for land on Tongatapu is now at an all-time high, as evidenced by government attempts to settle off-island “refugees” in marginal environments like the Va’epopua tidal flats, at the expense of Tonga’s cultural heritage²³. In this dissertation, I attempt to show how these tensions extend back in time and are manifest in the archaeological


³ “Destruction continues at star-shaped heritage site that parliament pledged to protect” Matangi Tonga May 24, 2017. http://matangitonga.to/2017/05/24/destruction-continues-star-shaped-heritage-site-parliament-pledged-protect

⁴ “Sia Heu Lupe, Vaolaki — Kingdom of Tonga” http://heulupe.com
record. The landscape of Tongatapu has held a mirror up to the politics of Tongan society for a thousand years, in ways that exceed what we typically see in other non-industrial, pre-literate societies.

1.3. Research questions

This research has followed a generally inductive trajectory, beginning with data points that together form patterns and in turn come to bear on matters of interpretation and theory. My overall research question, in its simplest form, is “How do the morphology and distribution of mounds and monumental architecture on Tongatapu confirm or challenge what we know about late-prehistoric Tongan society and political organization?” Under the umbrella of this broad question, I’ve come to focus on the following three categories of more specific questions:

1. **Characterization of monuments and their distribution.** How do the new survey data compare with what we previously knew (or thought we knew) about mounds and the distribution of sites? Do they confirm or challenge previous typologies? Do the numbers or density of sites exceed what was known (or predicted) for unsurveyed portions of Tongatapu?

2. **Late-prehistoric settlement patterns.** What does the distribution of monuments say about settlement patterns more generally? Can we infer settlement nodes or concentrations based on the presence of mounds? How does this inferred pattern differ from earlier (or later) time periods in Tongan history?

3. **Landscape and socio-political organization.** How do patterns on the landscape confirm or challenge what we know about Tongan socio-political structure? What are the implications of a direct-historical approach (cf. Lyman and O’Brien 2001) to understanding Tongan prehistory?

The order of data presentation and discussion in this dissertation broadly reflects this three-part focus, which I return to specifically in the conclusion.
1.4. The “geospatial revolution” in archaeology

Airborne LiDAR, or airborne laser scanning, is at the heart of what Chase et al. (2012) and others have called a “geospatial revolution” in archaeology. Chase et al. note that with LiDAR, the spatial extent and organization of past societies is no longer constrained by sample size, particularly in densely forested regions of the world. This is primarily a reference to the limitations of traditional pedestrian survey in areas where topographic, vegetative, or political circumstance precludes 100% “coverage” of an area. Fisher and Leisz (2013:207–208) liken the impact of aerial LiDAR on archaeology to the invention of radiocarbon dating, suggesting that both could be viewed as scientific revolutions in the Kuhnian sense of the term. The rapid, transformational change represented by LiDAR may indeed flirt with paradigmatic change, in the sense that it reflects a new way of thinking about the spatial element of human societies.

Whether LiDAR or any other scientific technique constitutes an archaeological paradigm shift is a matter to be debated elsewhere. What is clear, however, is the profound impact this and other remote sensing techniques have had on the discipline in recent years (Verhagen 2012). As with any new type and scale of data acquisition, these remote sensing methods allow new questions to be asked and new analytical directions to be explored — it is a new toolkit that requires new ways of thinking. As Verhagen (2012:314) puts it,

There is no doubt that powerful image capturing, manipulation and visualisation techniques will continue to attract the attention of landscape archaeologists in the near future. And in fact, we need time and experience with these new techniques to fully judge their applicability to the questions of prediction, detection, analysis and visualisation. But the question is: do all these developments really help us in interpreting the landscape and the archaeological record, and thus lead to new insights?

The typical application of LiDAR in archaeology is what many might think of as true prospection — that is, scouring an unfamiliar landscape for archaeological remains that have thus far eluded scientific recording and description. The reality is that relatively few studies fall into this category. Those that do, however, tend to receive wide attention in both scholarly and public media, because they seem to embody the sense of pure discovery that dominates the popular picture of archaeology.
One of the biggest recent stories in archaeological prospection has come out of Cambodia, where an international team has employed LiDAR prospection to reveal entire urban centres associated with the Khmer Empire at Angkor (Evans et al. 2013; Evans and Fletcher 2015; Hanus and Evans 2015; Stark et al. 2015). The “lost city” is in fact a previously undocumented, formally planned urban landscape that integrates the well-known temple complexes at Angkor Wat to form what the researchers claim is the most extensive low-density urban centre in the pre-industrial world. In addition to extensive residential patterning, there is evidence of massive hydraulic infrastructure, which the LiDAR has shown to include state-level and household-level management.

According to Schindling and Gibbes (2014), archaeological prospection is something that needs to be done more, and faster, as increasing populations and expanding urban development threaten undocumented cultural heritage. Traditional survey is time consuming, expensive, and can cause disturbance to a site if it involves subsurface testing. Heritage conservation legislation in some countries can create additional difficulties for site prospection. Schindling and Gibbes note that archaeologists are re-thinking how survey can and should be conducted, and many are turning to remote sensing to give them an advantage. While satellite data, orthophotography, and other airborne techniques can reveal land cover characteristics suggestive of subsurface features, they are scale limited. Schindling and Gibbes argue that LiDAR represents a gold standard for prospection of new sites, praising its sub-metre accuracy, ability to penetrate forest canopy, and totally non-destructive capability. They note that forests can actually help preserve architectural features by preventing erosion and deterring human destruction from agriculture and other activities, thereby representing richer concentrations of archaeological features. Like many commentators on this subject, however, they emphasize that remote sensing of any kind cannot, and should not, replace fieldwork entirely.

Combining fieldwork with remotely sensed data to learn more about previously recorded archaeological sites is the most common application of remote sensing in archaeology. It also represents the earliest basis for observing archaeology from the air; since the invention of aerial photography over a century ago, archaeologists have placed enormous value on being able to see their sites and landscapes of interest from above.
What remote sensing often provides is a greater landscape-scale context for individual sites, and a greater understanding of the extent to which past societies shaped and modified the physical world around them.

An example of this research strategy is the now-widespread use of LiDAR survey in the tropical forests of Mesoamerica. A group based at the University of Central Florida, led by Arlen and Diane Chase, first conducted LiDAR surveys of the forest surrounding the urban centre of Caracol, a major Maya settlement in lowland Belize (Chase et al. 2012). What was revealed by the LiDAR was a far more extensively settled landscape than had been previously imagined; the degree of agricultural terracing, road construction, and residential patterning led Chase et al. (2014) to ponder the difficulties of actually determining a Maya city’s boundaries.

Following the survey of Caracol, Chase et al. (2014) conducted what was then one of the largest LiDAR surveys specifically for archaeological purposes, covering large swathes of land to the east and north of Caracol. The density and interconnectivity of Maya urban centres is remarkable, with an almost even distribution of public architecture over the landscape. Despite this, the study found striking contrasts between Caracol and other settlements in the Belize Valley, contrasts they attribute to differences in the availability of natural resources and the political pressures those differences created. Chase et al. place great value on the data acquired through decades of excavations at these sites; that the settlement system as a whole can now be documented and visualized in its entirety allows for the synthesis of many individual projects and assemblages. Chase et al. (2017) describe a “symbiotic” relationship between remote sensing and geospatial specialists and “on-the-ground” archaeologists.

Mesoamerica has, through the advent of LiDAR, become something of a hotspot of settlement archaeology, even overshadowing Britain and Western Europe, where the tradition has deeper roots. Rosenwig et al. (2013) combined LiDAR and pedestrian

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mapping of previously recorded sites associated with the Izapa complex in the Chiapas region of Mexico. Their survey revealed settlement patterning in the undocumented areas surrounding the urban centre, as well as monumental architecture in the site core itself. By pairing their study with systematic ground truthing and recovery of diagnostic artifacts, Rosenwig et al. were able to construct a more nuanced site chronology with the added spatial element. Ebert et al. (2017) also paired LiDAR with systematic ground survey in the Belize Valley, demonstrating the important quantitative and qualitative differences that can arise between field and LiDAR data.

Fisher and Leisz (2013) used large-scale LiDAR survey to document the urban centre of Angamuco in central Mexico. In a landscape characterized by rugged topography and a closed forest canopy, the large-scale LiDAR was able to reveal the general settlement pattern associated with site core. A more intensive, higher-resolution LiDAR survey was conducted on the site core itself, documenting some 20,000 architectural features in great detail and providing an invaluable database for comparison with field data.

Following a tradition of landscape focus, some of the most intensive remote sensing work in archaeology still occurs in the British Isles and mainland Europe. Remote sensing in those countries is now so routine and cost-effective that few archaeological field studies begin without consulting a database of satellite or aerial LiDAR imagery. The most studied of landscapes is surely that of Salisbury Plain, featuring Stonehenge and all of the ditches, mounds, henges, and barrows we now associate with the immediate “ritual landscape”. LiDAR has been useful for illuminating the multitude of field systems and subtle earthworks in and between the previously recorded monuments in the vicinity of Stonehenge, and has allowed for techniques such as GIS-based viewshed analysis in a bare-earth digital landscape (Bewley et al. 2005). Even in an area of such intense archaeological research over the course of centuries, new discoveries and levels of detail continue to emerge. Many countries, particularly western European nations, are making LiDAR and spectral databases open to institutional and public use.
The use of LiDAR imagery and other remote sensing data is now relatively common in the archaeology of Oceania (e.g., Bedford et al. 2017; Ladefoged et al. 2013; Lipo and Hunt 2005; McCoy et al. 2011; Quintus et al. 2015), but island-wide studies of monumental architecture are rare. Tonga is uniquely suited to this type of study, given the generally flat topography of Tongatapu and many of the other larger islands, as well as the nature of Tongan monumental architecture, which is based on a series of large mound types that LiDAR detects easily.

1.5. The LiDAR dataset

This study was born out of fortuitous circumstances in which my senior supervisor, Dr. David Burley, became aware of the existence of a LiDAR dataset for several of the principal islands of Tonga. The dataset, which includes pre-processed imagery from LiDAR acquisition in 2011, was produced on behalf of the Australian Government for the AusAid project “Capacity Building for Tsunami Risk Assessment in the Southwest Pacific”. In 2013, the Ministry of Lands in Tonga gave permission to Dr. Burley to use the LiDAR for non-commercial archaeological purposes. He asked me how much I knew about LiDAR and GIS (the answer was not much). And so my doctoral research into late-period Tongan settlement patterns and monumental architecture began.

Airborne LiDAR is an active remote sensing technique whereby laser pulses are fired from an aircraft to the ground surface and their reflection is measured to range very accurately. Exceptionally high-resolution digital elevation models can be produced from the resulting “point clouds” and computer algorithms are used to remove interferences on the ground surface such as vegetation and buildings (Bollansås et al. 2012; Devereux et al. 2005; Doneus et al. 2008; Lasaponara et al. 2011). Thus, LiDAR is capable of producing highly accurate “bare-earth” digital elevation models that reveal very subtle microtopography, including anthropogenic disturbance of the ground surface. The ability to penetrate forest canopy and lower vegetation is among the major advantages of the technique (e.g., Chase et al. 2012).
The present LiDAR dataset, along with a set of high-resolution orthophotos, was acquired during six flights of a fixed-wing aircraft in October 2011. The survey was conducted by the Australian geospatial services company AAM Pty Ltd. Survey coverage includes all of Tongatapu, the largest and most populous island in Tonga, and Lifuka and Foa, two of the largest islands in the Ha’apai group in central Tonga. The ALTM Orion M200 used in the LiDAR survey produces a point density greater than four points per m² and can capture a minimum of four returns for each pulse, with a vertical accuracy of ±15 cm. The result is an invaluable dataset that can be used for anything from basic visualization and illustration to complex geospatial analyses.

The first published research employing this dataset came out of collaboration with colleagues in the Department of Geography at SFU, who assisted in the creation and use of automated feature extraction protocols for prospection of round/circular mounds on Tongatapu. The paper is entitled, “Automated feature extraction for prospection and analysis of monumental earthworks from aerial LiDAR in the Kingdom of Tonga” and is published in *Journal of Archaeological Science* (Freeland et al. 2016). In this dissertation, I build on the results of that paper, which provided a methodology for extracting mounds from the LiDAR imagery and determining the boundaries of the “clusters” of mounds that are so visually apparent.

### 1.6. Organization of the dissertation

I believe that the contributions of this research fall into two categories. On the one hand, I describe an approach to archaeological research that was unthinkable a generation ago — namely, the use of advanced geospatial technologies to do what archaeologists have been shivering, sweating, and bug-swatting their way through for many years: finding archaeological sites. This dissertation stands as partial documentation of the early years of this transition in field approaches. On the other hand, I believe that through this research, later Tongan prehistory is revealed, if slightly, in higher resolution and in greater detail than before.

In order to set my dissertation against an appropriate backdrop of historical context and previous research, I devote Chapters 2 to an overview of Tongan culture
and prehistory. I attempt to describe what social and political life was like in Tonga, beginning around a thousand years ago, and up until the period of intense missionization and incorporation into global commerce and diplomacy. Through this necessarily scant depiction, I aim to draw out threads of significance for the interpretations I make later in the dissertation.

In Chapter 3 I provide a summary and rationale of the methods and techniques I used over the course of my research. Far from being a road map for future studies employing high-resolution geospatial data, this methodology chapter describes the series of choices I made as the scope, objectives, and limitations of the research developed over the course of several years. I emphasize the unique advantages of navigating and data recording using this dataset, as well as its limitations. I also describe what I have referred to elsewhere (e.g., Freeland et al. 2016) as “iterative” feature classification — that is, repeated cross-checking of features in the LiDAR dataset with their appearance in the field, and vice-versa.

In Chapter 4 I present the first component of my “results” — the various products of desktop-based visualizations and analyses, and my findings from two seasons of field study in Tonga using the LiDAR in a field-portable format. I provide descriptive statistics of mounds on Tongatapu and explain the survey typology I used to categorize mounds in the dataset.

In Chapter 5 I analyze the spatial distribution of different feature types according to a series of variables, including island elevation and proximity to other features. I separate out major feature classes and assess the similarities and differences in their distribution. Here I begin to build an argument for the constitution of bounded territorial units on Tongatapu, and draw out discussion points to be addressed later.

In Chapter 6 I document what I believe to be the first “capital” of the Tu’i Tonga dynasty — a collection of massive earthen platforms in Toloa, in south-central Tongatapu. I argue in my discussion of this impressive site that it represents the origin of a new authority structure based on the genealogy of ‘Aho’eitu, the first of 39 Tu’i Tonga rulers. The socio-political transformations represented by the emergent monumentality at
Toloa occurred in the context of rapid change in West Polynesia and renewed exploration of Remote Oceania.

In Chapter 7, I draw out the major themes that emerge over the course of describing these archaeological phenomena. I discuss the nature and distribution of different mound types and the implications for our understanding of the socio-political order of the Classical Tongan Chiefdom. I explore the idea of monuments as status displays, one of many ways that social difference was communicated by the ruling elites. I examine how ancient boundaries fundamentally structure the island’s landscape and how they provide clues about interaction during the emergence and consolidation of centralized authority. I ask whether a peer-polity model of interaction is a useful framework for modelling these social transformations.

In Chapter 8, I conclude the dissertation by returning to my research questions as a final point of discussion.
Chapter 2. Tonga and Tongan prehistory in Oceanic context

2.1. Introduction

The Kingdom of Tonga is an archipelago of 167 islands, arranged in a northeast–southwest oriented chain, in the southwestern Pacific Ocean (Figure 2; Figure 3). It sits midway on the western flank of the Polynesian Triangle, spanning from roughly 15°50’ to 22°20’S in latitude, a distance from the equator roughly equivalent to that of Hawai‘i.

Figure 2. Location of Tonga in the western Pacific.
Creative Commons Attribution-ShareAlike 3.0 Australia (CC BY-SA 3.0 AU). CartoGIS Services, College of Asia and the Pacific, The Australian National University.
Some 700 km to the northwest lay the principal Fiji Islands. From Tonga’s remote northern outliers, the Samoan islands are a 300-km journey to the northeast. Travelling due east, over 1,500 km of open ocean separate Tonga from the next major island group, the Cook Islands, and New Zealand’s North Island lies over 1,800 km to the south.

In the Austral summer, southeasterly trade winds in this part of the South Pacific are interrupted by northwesterly monsoons, providing a predictable seasonal reversal that allowed early sailors to explore and colonize these islands some three millennia ago (Irwin 2008). Tonga was the first island group in Polynesia to be explored and settled by...
humans ca. 2850 cal BP. In later prehistory, Tonga became the axis of a travel corridor and exchange network between Fiji and West Polynesia and the centre of a maritime chiefdom whose influence, if not political control, extended across West Polynesia (Clark et al. 2014).

The islands of Tonga occur as parallel chains, one volcanic and the other upraised coral limestone (Makatea type). The island of Tongatapu is the largest example of the latter, at roughly 35 km from end to end (Figure 4). Like other limestone islands, the surficial geography of Tongatapu is flat to gently rolling, with a tilt along the east–west axis resulting in formidable cliffs along the south windward coast and a north leeward coast that slips gradually into the ocean. A large section of northern coastline encapsulates the Fanga ‘Uta Lagoon, a shallow, 12-km bay with the densest concentration of prehistoric archaeological sites in Tonga along its shoreline.

Tonga is known for the development of one of the most hierarchical, geographically integrated chiefly societies in Polynesia, likened by some to an “archaic state” (Clark 2016; Goldman 1970). Tonga is minimally characterized as a paramount dynastic chiefdom, matched only in political complexity by the chiefdoms of Hawai‘i and the Society Islands (Kirch 2010:27). Human history in the Tongan archipelago began with the arrival of Austronesian-speaking maritime explorers ca. 2850 BP, a colonizing event associated with the spread of the Lapita Cultural Complex (Burley et al. 2015). Archaeologists have traced a series of demographic, political, and material culture shifts over the ensuing millennia (Burley 1998a). These include a loss of ceramic technology, an increasing population, and social stratification that would ultimately lead to the development of a paramount chiefdom, characterized by centralized control, long-distance exchange and diplomacy, and monumental construction.

This latter period is also well documented through traditional histories and recorded chiefly genealogies, many of which date back several centuries (Bott 1982; Gifford 1923, 1929). European contact, religious upheaval, and civil war combined to disrupt the social fabric of Tongan society in the nineteenth century (Campbell 2015:80–92; Claessen 1988:442), leading to a series of socio-political changes that have resulted in what is now a modern, constitutional monarchy.
Figure 4. Map of Tongatapu showing administrative districts and village names. CartoGIS, College of Asia and the Pacific, The Australian National University, http://asiapacific.anu.edu.au/mapsonline/base-maps/tongatapu-1 Creative Commons Attribution-ShareAlike 2.5 Generic (CC BY-SA 2.5)
These historical and cultural processes occurred in a context of fluctuating relative isolation. At times, what was happening in Tonga was intimately related to the fates of other island societies, particularly in West Polynesia. West Polynesia is a region of the southwestern Pacific Ocean encompassing the island groups of Tonga, Samoa, Niue, ʻUvea, and Futuna, and could also be considered to include Rotuma and some of the Lau Islands of eastern Fiji (Clark and Martinsson-Wallin 2007; Kirch and Green 2001; Anita Smith 2002). The classification of these islands as a Polynesian subgroup is supported by archaeological, linguistic, and biological evidence indicating a long history of interaction — although archaeological evidence suggests substantial periods of relative isolation in Tonga and Samoa (Burley and Addison 2014:6; Burley et al. 2011). Fiji is often included within this historical sphere of interaction because of its well-documented diplomatic and trade relationships with Tonga at the time of European contact (Davidson 1977).

Many West Polynesian islands experienced influence or subjugation under the so-called Tongan Maritime Empire, a geopolitical expansion beginning around 500 BP that involved assertion of central authority within the Tongan archipelago (Burley 1995; Kirch 1984:232) and political influence and dominance over neighbouring island groups. The latter included a system of exchange of chiefly spouses, luxury goods, and tribute to the Tongan political elite (Aswani and Graves 1998; Clark and Martinsson-Wallin 2007; Clark et al. 2014; Burley and Addison 2014; Shutler and Everard 1991). Thus, the more recent histories of the West Polynesian island groups are intimately linked, as reflected in similarities in political structure (Gunson 1976), language, and material culture. They are similarly linked, however, in their more ancient past, with some archaeological evidence suggesting long-distance voyaging between Fiji, Tonga, and Samoa as early as the initial Lapita period (Reepmeyer et al. 2012).

West Polynesia is further defined by its differences with East Polynesia, which include geographical, historical, and ethnohistorical factors. For almost 1,700 years following the Lapita settlement of Tonga and Samoa, the east-central and more remote far eastern Polynesian island groups remained uninhabited by humans. The nature and timing of this so-called “long pause” — and the subsequent period of expansion and settlement in eastern Polynesia — remain hotly debated (Thomas 2008; Wilmshurst et
The Tonga-Samoa region has long been considered the birthplace of what Kirch and Green (2001) call “Ancestral Polynesian Society”, although this concept is also a matter of some dispute (cf. Connaughton 2007; Anita Smith 2002). What is clear, from archaeological, biological, and linguistic evidence, is that East Polynesia was settled from West Polynesia by a group (or groups) of maritime voyagers after a considerable hiatus in Oceanic exploration. These groups carried with them a cultural template that was successfully adapted to a wide range of new island environments with highly variable geological, biotic, and climatic conditions (Kirch 1984:17). It was this variability that resulted in the cultural diversity of descendent Polynesian societies, however closely related they are through historical connection. Recent DNA evidence from modern Easter Islanders (Moreno-Mayar et al. 2014), as well as botanical (Roullier 2013) and chicken DNA (Storey et al. 2007) is suggestive that exploration went beyond Polynesia to include some type of contact with South America.

Archaeological evidence points to population continuity in Tonga and much of the rest of Polynesia (Kirch and Green 2001:75) — contemporary Tongans derive from an ancestral Polynesian cultural base, with roots in the Lapita Cultural Complex. Tongan society reached a socio-political apex between ca. AD 1300 and the late-eighteenth century (Clark 2016; Clark et al. 2016), an interval during which the archipelago experienced periods of centralized rule from Tongatapu under the sacred paramount Tu‘i Tonga (“Lord of Tonga”) and eventually a tripartite kingship structure that included two collateral secular lineages. Tonga was unique in the Oceanic world for its integration of an entire island group under a single political system, and an expansion of influence, even hegemony, over neighbouring island groups in West Polynesia and beyond through trade and military dominance (Burley 1995; Clark et al. 2014).

Whether the Tongan maritime polity constituted an “empire” is the subject of debate. Insofar as an empire spreads ideas about socio-political organization, political economy, architectural forms, and other cultural elements to other (perhaps formerly competing) polities, either through coercion or hegemony, there is much evidence to cite in support of Tonga’s regional influence constituting a form of empire. Challengers of the term, primarily historians, point to a lack of evidence for direct, maintained political and economic control over subject societies (e.g., Campbell 2015; Ferdon 1987; Gunson
The historian Claesson (1988) argues that evidence of “circulating connubium”, that is, structural inter-marriage between the elite families of Tonga, Samoa, and Fiji, is weak. Peterson (2000), on the other hand, considers the term “empire” useful in the Tongan context, citing a form of “informal empire” under which social, political, and economic matters in Fiji/West Polynesia were dominated by an ascendant Tongan “state”, without necessarily involving direct, long-term political or military dominance. In this regard, Peterson (2000) mirrors aspects of Kaeppler’s (1978) position, that in the complex system of chiefly marriages and distribution of status goods in the Fiji-Samoan-Tonga region, Tonga was ultimately preeminent.

Several Tu‘i Tonga had strong ties with Samoa, with marriages and even residence in Samoa being relatively common (Gifford 1929:52–56). The Falefa, a group of chiefly Tongan houses and titles traditionally known as attendants of the Tu‘i Tonga, incorporated Samoan, Fijian, and Rotuman lineages (Bott 1982:97). The Ha‘a Fale Fisi (House of Fiji) are an important group of chiefly Tongan titles that arose relatively late in prehistory (mid-seventeenth century) and are associated with the Lau group in far-eastern Fiji. Clark and Martinsson-Wallin (2007:36) chart a long history of interaction between Tonga and Fiji, citing archaeological, traditional, and ethnohistoric sources. The mirroring of Tongan social structures and architectural forms in places like ‘Uvea (Clark and Martinsson-Wallin 2007:33; Davidson 1977; Sand 2008) demonstrate Tonga’s wide and lasting impact on the region.

Whether socio-political complexity in classical Tonga met the criteria of an archaic/primary/emerent state is also a matter of some debate. Kirch (2010) lays out an argument for the emergence of archaic states in prehistoric Hawai‘i, citing attributes such as endogamous social classes, divine kingship, state religion with a full-time priesthood, and institutional military organization. Certain of Kirch’s attributes are evident in late-prehistoric Tonga, and indeed the suggestion is made that Tonga could represent a second case of state emergence in Polynesia (2010:28). Hommon (2013) argues for the inclusion of Polynesia in the study of primary states, citing both Hawai‘i and Tonga as examples. Clark (2014; 2016; Clark et al. 2014; Clark et al. 2016; Clark et al. 2017) is unambiguous in his classification of the Tongan polity as a state, pointing to the maintenance of elite social interactions throughout West Polynesia and the conflict,
ritual, and monumentality in elite centres on Tongatapu. In this dissertation, I provide evidence of domestic territorial organization and a monumental architectural tradition, which together articulated with the system of chiefly tribute that reinforced centralized authority. However, I do not make any claims regarding the classification of Tongan statehood in a social-evolutionary sense, in the hope that with future, finer-grained detail regarding settlement and political systems, the question can be examined more fully in its own right. In this dissertation, I continue to refer to classical Tonga as a paramount dynastic chiefdom. I regard the “hazy boundary between ‘chiefdom’ and ‘archaic state’” (Kirch 1990:206) as being too wide a gulf for my present contribution to bridge.

Monumental architecture and control and management of space played a central role in the consolidation of authority in the chiefdom. Early centres on Tongatapu associated with the rise of the Tuʻi Tonga dynasty at Toloa and Heketa show evidence of a ritual and funerary ideology that would eventually constitute the basis of centralized authority. The third capital, at Lapaha/Muʻa, is the site of some 34 monumental stone-faced rectangular mounds (*langi*), sepulchres of the Tuʻi Tonga and later collateral lineages (Clark et al. 2008; Clark 2016). Socio-political developments in neighbouring societies, such as Samoa, resulted in distinct traditions and uses of monumental architecture (e.g., Sande et al. 2018).

A profusion of earthen mounds across the landscapes of Tongatapu and other islands is indicative of widespread mortuary practices involving the interment of individuals or large groups in purpose-built mounds (Freeland et al. 2016). Some of these mounds evidently relate to high status, and were commissioned by elite members of society for leisure and sporting in life (e.g., Burley 1996) and legacy in death. However, the sheer number of mounds shows that low-ranking Tongans must also have had access to this form of burial. Limited excavations of late-prehistoric mounds have shown that some may contain upwards of 100 individual interments (Davidson 1969), and that evidence exists for use by both high- and low-ranking members of society (Stantis 2015; Stantis et al. 2015). Stable isotope evidence indicates biological uniformity among individuals interred together in mounds and diversity between the populations of different mounds (Fenner et al. 2015), a pattern that supports the notion of community and/or familial use of burial sites.
Despite increasing centralization of power in Tonga in the centuries following posited “state” emergence between AD 1200 and 1350 (Clark 2016:8), considerable upheaval in the form of chiefly assassinations and lineage segmentation continued to characterize the political landscape. New radiometric evidence from a fortification in the third Tu‘i Tonga capital at Lapaha suggests that even during this pinnacle of political centralization there was a real or perceived threat of violent insurrection (Clark et al. 2017). Delegation of secular duties and authority by the paramount, beginning in the fifteenth century, resulted in the rise of junior lineages. Existing political destabilization was accelerated in the nineteenth century by the introduction of European disease, religion, and weaponry, resulting in a collapse in the traditional hierarchy. Deterioration of centralized rule resulted in brutal warfare between chiefs between the late 1790s and 1820s, particularly on largely heathen Tongatapu (Campbell 2015:85–89). Authority was supplanted by the reunification and eventual monarchy of Taufa‘ahau (George Tupou I) in 1845, which did not stop further conflict from breaking out in the years to follow.

2.2. Socio-political structure

Many details of the socio-political organization of the prehistoric Tongan chiefdom have been inferred on the basis of ethnohistorical data. The accounts of European explorers, including those of Abel Tasman and James Cook, have greatly influenced our understanding of Tongan society during the contact period, which in turn has been extended back in time using a direct-historical approach (cf. Lyman and O’Brien 2001).

Particularly influential is the account of William Mariner, a fifteen-year-old clerk aboard the British privateer vessel Port au Prince, part of a voyage in search of Spanish treasure and whale oil in 1806. While anchored off the Tongan island of Lifuka, the ship was seized by the ambitious chief Finau Ulakalala, and most of the crew were killed. Finau brought Mariner to live with him, first in Haʻapai and then Vavaʻu. During his enforced four-year stay in Tonga, Mariner made observations of the language and customs of his captors. After returning to England, he narrated his experiences to John Martin, who published an edited volume (Martin 1817; rewritten as “The Tonga Book” by Dale 1996). The account of William Mariner forms the single-most important resource for
early Tongan history, ethnography, and genealogical research. According to Urbanowicz (1977:249), Mariner’s words were held in such high regard that contemporary Tongans’ own historical reckoning relied heavily on them. Mariner holds particular interest for those interested in early-nineteenth century Tongan warfare, in his remarkable description, for example, of Finau’s sacking of Nuku’alofa in 1807, and in the subtle relationships between chiefly authorities of different island groups; Mariner describes, with a keen eye, the interactions between his patron and other notable persons, including the Tu‘i Tonga of the time, Fuanunuiava.

We must of course be aware of the inherent bias in leaning too heavily on the ethnographic record to make inferences about the more ancient past — what Wobst (1978:303) would call ”ethnography with a shovel”. As Gailey (1987:51) argues,

It is well recognized in ethnology that genealogies and myths can serve as charters for current practices; both can be interpreted, juggled, or otherwise manipulated to suit contemporary interests. To read backward from what eventuated in Tonga to a systematic pre-contact situation is unwarranted, especially considering the political struggles in the nineteenth century.

However, with such a rich and intact oral tradition in Tonga, it is both practical and defendable to make general inferences about Tongan socio-political organization on the basis of historically documented actions and events. The principles of eighteenth-century Tongan socio-politics have been modelled in great detail using written accounts and the testimony of specialist knowledge holders (e.g., Bott 1982). These general principles form a starting point for archaeologists interested in the centuries preceding written history. Furthermore, we have a rich comparative ethnographic and archaeological record for West Polynesian societies to back up our inferences about Tongan socio-political organization.

Genealogical/kinship ties were and are the dominant structuring principle of Tongan society, representing “a distillation of cultural constructions of rank, power and the conception of society in both divine and human terms” (Herda 1988:137). These were concepts that applied equally to the domestic and political spheres of life. Today, Tonga is a constitutional monarchy. The traditional Tongan political structure was a dynastic chiefdom — a hierarchical conical clan system, in which every member of
society was individually ranked according to the criteria of ancestry, age, and sex (Gailey 1987:47). This was an institutionalization of the senior-junior social ranking arguably inherent in all Remote Oceanic societies (Kirch 2017:284).

At the pinnacle of this configuration was the sacred paramount chiefly lineage of the Tu'i Tonga, from which all members of society were ranked downward. The Tu'i Tonga were themselves descended from 'Aho'eitu, a demi-god who descended from the heavens to rule Tonga (Bott 1982:90). While early Tu'i Tonga were both sacred and secular rulers, their role over time evolved to become more specifically concerned with sacred matters, leaving secular affairs to junior chiefly lineages. This single dynasty ruled from approximately AD 950–1865 (some 39 successive rulers; Gifford 1929:50; Clark 2015). The Tu'i Tonga received tribute from the various clans in the form of the annual or biannual 'inasi, or first-fruits ceremony. Beginning around AD 1500, lineage segmentation resulted in the creation of a second and then third concurrent ruling lineage (hau, administrative king or ruler), first the Tu'i Ha'atakalaua and then the Tu'i Kanokupolu. Both were secular rulers charged with administering special segments of Tongan society (Clark 2016). The Tu'i Tonga remained the paramount ruler until the mid-nineteenth century, at which time the title was subsumed and eventually abolished by the nineteenth Tu'i Kanokupolu, Taufa'ahau, later King George Tupou I.

Urbanowicz (1977:246) states that politics in Tonga was “kinship writ large”, and Gifford (1929:19) argued that the family was the "key to Tongan society". Encapsulated in these statements is the idea that the relationship between members of a household (e.g., an older and a younger brother) mirrored, at least conceptually, the relationship between whole groups, or ramage, of people (e.g., the kainga, clans/extended families, of a superior chief and an inferior chief). While domestic relationships were more finely attuned to the specifics of gender and seniority, the overall structure of the Tongan chiefdom could be viewed as an integrated conical clan that operated on the same genealogical principles as a single descent group (Figure 5).

The “large-size ramage” (Sahlins 1958:141) or “status lineage” (Goldman 1970) is this underlying social structure that is said to be the inheritance of all Polynesian societies (Kirch 1984). What is understood in theory, however, is rarely practiced
flawlessly in reality. As Gailey (1987:66) argues, tension-filled kinship relations and contradictory ranking principles were the “structural basis for ambiguity” in Tongan social and political life. Succession disputes were common. Deviation from the classical ramage-based succession model (favouring seniority and patrilineality) came in the form of title claims from junior or collateral kin and the higher rank of sisters (*fahu*) in Tongan society.

**Figure 5. An idealized conical clan/ramage system.**

Each individual is ranked based on genealogical proximity to a common (sometimes mythological) ancestor. Members of segment/ramage I, whose chief is the A1 individual, inherently outrank those of segment II, whose chief is the C1 individual, as a result of their closer descent from the founding ancestor. Redrawn from Kirch (1984:32) and Sahlins (1958:143).

Ramage-based descent in the Tongan context is further complicated by several critical elements. First is the very important distinction between rank and authority — roughly equivalent to the Tongan ʻeiki and pule (Bott 1982). Broadly conceptualized, this distinction meant that one’s inherited place in the social order did not equate with their actual ability to demand social or material capital. As Bott explains, the term ʻeiki first relates to rank, and only secondly relates to authority. ʻEiki is the general term for chiefs (*hou ʻeiki*), but it is also a relative descriptor; a man’s older brother is more ʻeiki than
himself. *Pule* is the term for actual power or authority. Hence, the older brother has *pule* over the younger.

Bott (1982:57) uses the term “aristocrat” to describe Tongan *hou 'eiki*; much like the British system of nobility, the real authority of Tongan chiefs was not necessarily reflected in their material wealth. The frequently cited example of this phenomenon is the relationship between the Tu'i Tonga Paulaho and Maealiuaki, the individual who likely held both the Tu'i Kanokupolu and Tu'i Ha'atakalaua titles at the time of Cook’s third visit to Tonga. By the late-eighteenth century, the latter two titles, which began as junior collateral lines, were beginning to eclipse the Tu'i Tonga in matters of everyday life. The Tu'i Tonga remained, however, the sacred paramount. Thus, while Maealiuaki’s secular authority far exceeded that of Paulaho, the latter was nonetheless the greater *ʻeiki*, and commanded respect as such.

Related to this is the concept of female rank superiority. As Kirch (1984:34) notes, while Polynesian societies display a strong patrilineal and primogeniture bias, most have some degree of flexibility in how positions of authority are attained. In Tonga, the superior rank of women in the social order was both foundational and contradictory to the hierarchy. Whereas, generally, the eldest son inherited titles (*ʻeiki*) and positions of leadership (*pule*) within the family and the larger social group, the sisters in fact outranked the brothers in terms of honour (Goldman 1970:289). This is the concept of *fahu*, whereby a woman and her children outrank her brother and his children (Gifford 1929:22). The societal principle is common throughout Polynesia; it generally encompasses reciprocal obligations between the mother’s brother with respect to the sister’s son. The pinnacle embodiment of *fahu* in Tonga was the Tamaha, a title occupied by the eldest daughter of the eldest sister of the Tu'i Tonga (known as the Tu'i Tonga Fefine, the “female Tu'i Tonga”). While the Tu'i Tonga was, at least in theory, the leader of all Tongans, the Tamaha, or “sacred child”, technically held the highest rank in society. Burley (2005) provides an account of the history and genealogy of this chiefly title and incorporates archaeological field data and oral histories to document the named historical landscape of the Tamaha on the island of Tungua in Haʻapai.
Gailey (1987) argues that anthropological models of Tongan society invariably overemphasize the patrilineal aspects of rank determination; it is her contention (shared by others, e.g., Herda 1987) that women occupied critical positions of influence, especially when decisions were made about the appropriate individuals to receive titles. Filihia (2001) has argued that the elevated status of women in Tongan society may in fact have a mythological origin, based on the association of women and chieflyness with Pulotu, the Tongan after-world.

Gradation in societal rank, though perhaps gradual from person-to-person, was truncated by the very important distinction between hou ‘eiki (chiefs) and tu’a (commoners). This chiefly/non-chiefly distinction would generally have been marked by differential access to ritual and luxury items (Gailey 1987; Kirch 1984:34), as well as other systemic aspects of social distinction such as deferential behaviour and honourific language (Gifford 1929:115–128; Haugen and Philips 2010; Völkel 2010:195). A primary material distinction was the hereditary land holdings (fonua, “lands”, or tofi’a, “inheritance”) of titled chiefs and their ability to commission mounds and other earthworks on the basis of corvée labour. The third broadly recognized “class” of people are matapule, the titled ceremonial attendants of chiefs, who ranked above tu’a but below hou ‘eiki. Goldman (1970:307) describes matapule as a gentry class, often descendent from outsiders, who, like hou ‘eiki, reinforced their status through strategic marriage (often to close relatives). Matapule occasionally came to command much wealth and authority, and passed down titles and estates. But as Gifford (1929:112) noted, at least in theory, the highest-ranking matapule was still ranked by the lowest-ranking hou ‘eiki.

There are two further terms worth mentioning because of their intimate connection to the concepts described above: mana and tapu. Mana is a general term denoting a spiritual quality in many Austronesian languages and Oceanic societies (van der Grijp 2014:51). In the Tongan context, mana could refer to a supernatural blessing (Gifford 1929:326), but also it came to describe influence and authority. All hou ‘eiki were endowed with some level of mana, which of course correlated with rank. The more mana something or someone had, the closer it/he/she was to the gods. Mana was paired with the term for sacrosanct, or off-limits: tapu. Something that was tapu was sacred,
inviolable, or forbidden. There existed a complex web of behaviours that were tapu, particularly in relation to higher-ranking individuals; thus, the relationships between hou ‘ei ki and commoners, and between members of a single family group, were structured by the concepts of mana and tapu (Völkel 2010:13).

There are several principal implications of this socio-political structure for the archaeology of late-prehistoric Tonga. Kirch (1984) has argued, on the basis on comparative research, that a basic template — a conical ramage, inherently segmentary and expansionistic, with a titular chief imbued with mana, an emphasis on senior-junior hierarchy, and territorial definition based on descent — underlies all Polynesian societies. This template thus provides us with a model for Tongan society, and potentially land use and tenure, during the earliest moments of chiefly authority. The antiquity of this social structure could date back over 2,600 years, to the loss of ceramic decorative elements associated with Lapita, and the development of Ancestral Polynesian Society in Tonga and Samoa (Burley et al. 2017; Connaughton 2007).

For later Tongan prehistory, elements of political authority and land tenure can be inferred from ethnohistoric sources. Hou ‘ei ki held hereditary tracts (fonua) in a system that was more feudal than formally administrative (Goldman 1970:314). That these territorial units could represent kainga (family, clan), or more broadly, ha’a (lineages, confederacies of genealogically related titles), provides at least a hypothetical model for connecting site distributions on the Tongan landscape with elements of social and political organization.

The concept of tapu is discussed in relation to specific sites. For example, freshwater bathing wells were commissioned by and used exclusively by chiefs — wells were tapu for commoners (Burley 1994). The existence of these and other constructions (e.g., pigeon-snaring mounds) can therefore be seen as sites of chiefly prerogative. The distribution of these sites could be interpreted as manifestations of mana, tapu, and other cultural concepts on the landscape.
2.3. Traditional histories and genealogy

Tongan traditional histories are remarkably detailed and well preserved, recounting almost 1,000 years of genealogical and political developments in some cases (Burley 1998a:369). Information regarding traditions, rites, and genealogy has been collected and kept by *matapule* (Ferdon 1987:36), and many have been recorded in writing over the past 200 years. As in much of the rest of Polynesia, Indigenous historical reckoning in Tonga forms a major basis for archaeological research (e.g., Burley 1995).

Because unwritten histories are malleable, and subject to any number of biases on the part of their tellers, their acceptance and use as objective texts is the subject of much scrutiny. Like any narrative, written or unwritten, Tongan oral histories are socially constructed (Tonkin 1995); their curation and use reflect a desire on the part of traditional knowledge holders to reaffirm the social structure in some way. Sione Latukefu was the first professional historian of Tongan origin. In his (1974) dissertation work, he used Tongan narratives to counter the written histories of the various church missions; he contended that many of the political developments that occurred in Tonga during the nineteenth century were in fact Tongan-led and had little to do with the influence of missionaries. That traditional histories are selective in what they do or do not recall is well understood; their cautious use, however, in an archaeological context, can prove fruitful (e.g., Clark 2014; Burley 1995).

Traditional historical knowledge can be categorized into a number of broad forms; narrative oratory is the most familiar to an outsider, but songs, poetry, dances, and even physical mnemonics such as named mats or monumental structures are essential components for historical reckoning. According to Kaeppler (1993), traditional songs and poems contain references to the past and to reaffirm social difference between people. Metaphorical allusions in oratory act as a social/historical “charter” (Kaeppler 1993:475). Kaeppler has also made an in-depth study of traditional dance, or “structured movement” more generally (1985), and aspects of material culture and its traditional cultural context (1971). On the subject of *ngatu*, or bark cloth, Addo’s (2013) recent book details the continued importance of this traditional commodity in linking the Tongan diaspora with elements of prestige, kinship, and history.
One of the most important sources of traditional history in the modern era is the work of Elizabeth Spillius (née Bott), who, in the late 1950s, worked closely with Queen Salote Tupou III to record the queen’s extensive knowledge of traditional history. The resulting monograph (Bott 1982) provides a detailed description of Tongan social and political organization in the late-eighteenth century, at the time of Captain James Cook’s visits. The book also contains Salote’s interpretations of Tongan legends and very detailed genealogical data for Tonga’s elite families. The work represents the most comprehensive treatment of Tongan culture and history since Gifford’s (1929) *Tongan Society*; both works have their own limitations stemming primarily from the period of time in which the research was conducted.

The most practical use of traditional history for the archaeologist is in establishing a chronological framework. The most ancient recorded lineage is that of the Tu‘i Tonga. The date of inception of this dynasty is ca. AD 950, calculated on the basis of 39 successive rulers. Archaeologists use this lineage and date as an indication of when chiefly power began to coalesce (Gifford 1929:50).

Clark (2014) explains how ritual practices of the then-dominant social structure (burial and ceremonies associated with the Tu‘i Tonga dynasty) were “inscribed” in the form of monuments at Lapaha. The variability in remembered details about the *langi* names and king lists reflect the dissolution of social and political structures that led to their construction. Historical knowledge was previously transmitted through ritual practices and ceremonies associated with these monuments (“incorporated memory”); the rise of the Kanokupolu monarchy and the banning of the ‘*inasi* created a situation where specialized knowledge of these sites no longer served the dominant political order (Clark 2014). To a lesser extent, sites and monuments associated with collateral and junior chiefly lineages have also mapped aspects of traditional history onto the Tongan landscape.

Burley (1995, 1996) has made extensive use of traditional histories in relation to landscape research in Ha‘apai. In one case he (1995) employed historical and traditional accounts of the Mata‘uvave title to augment an analysis of the historical landscape of northern Ha‘apai. In the traditional narratives, Mata‘uvave was installed as a governor of
Haʻapai by the twenty-fourth Tuʻi Tonga, Kauʻulufonuafekai, sometime in the mid-fifteenth century. Many of the monumental structures found today in Haʻapai, from his large burial mound on Lifuka, to the ten or more pigeon-snaring mounds on the island of Uoleva, are attributed to the rise and eventual diminishment of the Mataʻuvave line. According to Burley (1995:171), “These monuments and names continue to exist and for knowledgeable individuals they continue to call forth narratives of 15th century Haʻapai. They compose a mnemonic index to Mataʻuvave’s life and former significance.”

2.4. Culture history and the rise of the Tongan Chiefdom

Within the first century following the initial Lapita colonization of Tongatapu ca. 2850 BP, the remaining island groups of the Tongan archipelago were rapidly settled (Burley et al. 2015). In Tonga, as in many other areas first settled by Lapita explorers, the highly decorated ceramic vessels that characterized Lapita material culture were eventually abandoned, resulting in a Plainware phase characterized by a limited suite of undecorated ceramic types. Plainware pottery is the primary correlate for the emergence of Ancestral Polynesian Society. In Tonga, this transition to Plainware occurred relatively swiftly, in fewer than eight human generations (Burley et al. 2015:11).

Pottery in Tonga was ultimately abandoned altogether (Burley et al. 2017). New radiocarbon evidence shows that the Plainware Phase of Tongan prehistory lasted approximately 350 years and ended no later than 2350 BP. This event forms the opening bracket of what is known as the “dark age” of Tongan culture history.

There is a substantial gap in archaeological evidence postdating the Tongan Lapita and Plainware periods and preceding the chiefdom period. The “dark ages” moniker was coined by Poulsen (1974:265) at a time when the continuity of populations from the Lapita period into later prehistory was still uncertain. In both Tonga and Samoa, the term has come to be used for the period of time bracketed by the disappearance of pottery from the archaeological record and the advent of monumental architecture (Reith and Addison 2008; Spennemann 1986).
The reasons for the cessation of pottery manufacture are unknown. With the most abundant aspect of material culture abandoned, sites from this so-called dark age (Poulsen 1974; Spennemann 1986) are more challenging to locate and define (Burley 1998a:365). It may be that aspects of cooking and storage, previously employing ceramic vessels, were instead carried out using perishable materials. However, there is little evidence of cooking using Lapita or Polynesian Plainware ceramic vessels, with Polynesian earth oven cooking likely originating in Lapita times or earlier. Rahter, archaeologists tend to view the abandonment of pottery technology from the perspective of social change and the changing and evolving material aspects of social and political relationships.

The beginnings of a Dark Age, or “Formative” period (Burley 1998a:365) are defined by a clear and abrupt cessation of pottery manufacture; the terminus is marked by the advent of a new category of archaeological evidence. Between 1000–750 BP, monumental earthworks, clear correlates of emerging social complexity, began to proliferate on the Tongan landscape. The relative absence of other data pertaining to economy and social structure means that much has been inferred on the basis of later prehistory and comparative studies (Goldman 1970). Without a firm radiometric chronology of early monumental sites, an important tool for dating the emergence of the Tongan chiefdom has been genealogical chronology (Clark and Reepmeyer 2014; Gifford 1929:50). “Lineage history” (Clark 2016) of the Tu‘i Tonga dynasty puts the first ruler around AD 950, as noted, with early monumental structures occurring at the sites of Toloa and Heketa, and later moving to Mu‘a/Lapaha under the twelfth Tu‘i Tonga after AD 1400. Heketa has the earliest stone architecture in Tonga, and is associated with the tenth to twelfth Tu‘i Tonga (Clark and Reepmeyer 2014).

2.5. The Tongan Maritime Empire

The political integration of the Tongan archipelago, and the expansion of Tongan influence over other island groups remains one of the more captivating aspects of Tongan history. In addition to almost unparalleled domestic social complexity, Tongan authority abroad in the second millennium AD had a profound influence on the historical trajectory of West Polynesia (Kirch 1988:4).
The Tongan maritime polity has been the subject of recent archaeological research. On the basis of lithic geochemistry, Clark et al. (2014) concluded that the Tongan “state” reigned over a trade network in adzes and other goods. “Prestate” transfer of lithics was dominated by Tongatapu, which increased during the period of chiefdom development to the point that two-thirds of lithic artifacts from the central places of Heketa and Lapaha appear to have been sourced from Samoa or Fiji (Clark et al. 2014).

While the ascendency of Tongatapu in the region occurred early in the second millennium AD (Burley 1995), most historical accounts of Tongan dominion occur much later, after around AD 1500. Around that time, the twenty-fourth Tu'i Tonga, Kau'ulufonuafekai¹, is said to have waged a campaign of domination throughout the Tongan archipelago and abroad, sailing to and “conquering” the islands of Futuna and 'Uvea in an effort to locate and punish his father's assassins (Burley 1995:158, 1998:375; Gifford 1929:55). Sand (2008) documents a long history of Tongan influence in 'Uvea, describing generations of Tongan domination over 'Uvean culture and architecture following the fabled conquest of Kau'ulufonuafekai. A similar narrative has been recorded for Rotuma, a northern outlier of Fiji that is culturally more Polynesian than Fijian (Shutler and Evrard 1991). Political influence by Tongans may have extended to Niue, Tokelau, Lau, Tuvalu, Vanuatu, Anuta, and other distant island societies (Egan and Burley 2009:226). It is clear the northern outlier of Niuatoputapu was brought under dynastic Tongan hegemony at this time, having previously been a distinct society with Lapita roots (Kirch 1988). The Niuatoputapu dialect, all but lost in the eighteenth or nineteenth centuries, reflected this later incorporation into the Tongan polity.

Aswani and Graves (1998) modelled Tongan expansionism in the twelfth to nineteenth centuries from an evolutionary ecological point of view. Tongan hegemony in West Polynesia was, in their view, the result of a dialectical interaction between intra- and intergroup competition, whereby Tongan elites refocused local inter-chief aggression outward toward new fronts. They focus on evolutionary selection as the

¹ Fekai (“ferocious, savage”) is said to have been appended to Kau'ulufonua’s name in reference to his unwavering pursuit of vengeance (Bott 1982:96).
mechanism underlying the persistence of complex Polynesian societies, citing “individuals’ aggregate competitive and cooperative behavioral strategies to enhance their inclusive fitness” (Aswani and Graves 1998:156).

Though no historian or archaeologist would likely support the notion of sustained contact between Tonga and more remote, eastern Polynesian societies, there is evidence of at least sporadic contact and return voyaging. Clark et al. (2014) document at least one stone adze from Tongatapu that has been sourced to the Society Islands, some 2,500 km distant. More compelling, however, is the Hawaiian rock art documented by Egan and Burley (2009) on Foa Island in Ha’apai. At the site of Houmale’eia, a series of petroglyphs featuring Hawaiian-style anthropomorphs, with no developmental precedent in Tonga, are thought to date to between AD 1400–1600. Egan and Burley suggest indirect voyaging may account for this clear evidence of Tongan-Hawaiian contact, rather than a single 5,000-km voyage.

The strongest evidence for a maritime-centred polity on Tongatapu is the reclaimed land/wharf complex constructed at the foreshore of the ancient capital of Mu’a (Clark et al. 2008). Some 100,000 m³ of coral rubble fill was used in the fifteenth century to extend the foreshore and create a canoe wharf and harbour, ostensibly facilitating the arrival and departure of large double-hulled canoes for military and diplomatic purposes. Other monumental features around the Fanga ‘Uta Lagoon, especially at its entrance, reinforce this maritime focus.

2.6. Power and Monumentality

Mounds and other monuments on the Tongan landscape are widely viewed as visible symbols of chiefly power and holdings (Burley 1996; Kirch 1988; Spennemann 1989). Whereas the monumental architecture in eastern Polynesian societies can generally be characterized as ritual/sacred (marae or heiau complexes), West Polynesian, and in particular Tongan, architecture is more closely associated with chiefly authority and the socio-political order (Kirch 1984; McKern 1929:120).
The most numerous monumental constructions in Tonga are earthen mounds, the majority of which are associated with commoner burials or chiefly burial and activities in life. As Burley (1996:421) notes, “Like elsewhere in Polynesia, the built environment was a sensitive reproduction of socio-political ideology, one clearly emphasizing the power and elevated position of the elites and their ancestry.” For Clark and Martinnson-Wallin (2007:38), a monument in this context is a “non-portable, relatively permanent, and highly visible type of archaeological ‘artefact’ that continues to attract cultural response well after the demise or transformation of the individuals or society that constructed or used it.” Indeed, the palimpsest of monumental construction on the Tongan landscape, the result of centuries of labour, continues to operate in the sense that Clark and Martinnson-Wallin express. Writing about the Kandyan kingdoms of Sri Lanka, Duncan (1990:182) explains that the landscape “… was consciously designed to foster a certain hegemonic reading that spoke of the power, benevolence, and legitimacy of the kings in their capital” — this description fits equally with the Tongan situation.

Apart from the ubiquitous earthen burial mounds, monumental architecture in Tonga comprises pigeon-snaring mounds (Burley 1996), chiefly sitting mounds (McKern 1929:10), and the more elaborate stone-faced rectangular mounds, most notably the sepulchres (langi) of the Tu‘i Tonga at Lapaha and Heketa (Clark et al. 2008; Clark 2016), but occurring throughout the archipelago (Kirch 1980). Heketa is also the site of a unique megalithic trilithon, the Ha‘amonga ‘a Maui (“Burden of Maui”; Figure 6), comprising two limestone uprights and a beach rock lintel weighing approximately 55 tons in total (Clark and Reepmeyer 2014:1245). This is a structure with no precedent or analogue in Remote Oceania.
As Kirch (1988, 1990:218) suggests, Tongan “field monuments” may have a distributional hierarchy that corresponds to political hierarchy. On Tongatapu, the distribution of earthen mounds appears highly structured, and may reflect aspects of Chiefdom-period geopolitical organization (Freeland et al. 2016).

2.7. Traditional settlement pattern and land use

Traditionally, the interiors of most Tongan islands were evenly settled in a structured plantation system with adjacent family compounds called ‘api’ (Spennemann 1989:276). Each ‘api’ was a self-contained unit, consisting of a house, outbuildings, gardens, and possibly a burial mound, and was bordered on at least one side by a road or path (Figure 7).
Gifford (1929:176) recorded that trees and roads served as boundary markers between plots of land, with ngatae (*Erythrina indica*) and koka (*Bischofia javanica*) trees being favoured over stone markers, which could be moved more easily. ‘Api were also surrounded by woven reed fences or “living fences” of pandanus, candlenut, and other plant species (Figure 8; Figure 9). Cook and other early European observers were impressed by the extensively planted landscape of larger islands such as Tongatapu, neatly organized by fence lines and bush roads. Relatively free of large-scale industrial or residential development, much of the modern Tongan “backcountry” retains this bucolic character.
Figure 8. A hedge or “living fence” of densely planted and pruned vegetation bordering an ‘api.

The even dispersal of ‘api throughout a chief’s estate (tofi’a, “inheritance”; Bott 1982:69) is interpreted as a way to affirm rights to ancestral land holdings (Burley 1994, 1998:376). The characteristic dispersed pattern is most readily apparent on Tongatapu; Burley (1994) notes continuity in coastal settlement in Ha’apai from Lapita through to the Chiefdom period. Settlement density on Tongatapu likewise favours a lagoonal/shoreline focus; Spennemann (1989:277) suggests three east–west habitation and land-use “zones” on Tongatapu, with densely settled habitation areas within the first 1–1.5 km of the north shore, followed by a 1.5–3-km wide zone of larger plantations and more dispersed ‘api, and finally a zone of “limited cultivation and habitation” along the southern liku (windward) coast.
Figure 9. “Tombeau de Pangai”.
Published in 1833, from Dumont d’Urville’s 1826–1827 voyage on the Astrolabe. Note the house, mound with grave house, and woven fence in the background. From the New York Public Library. https://digitalcollections.nypl.org/items/510d47da-78d5-a3d9-e040-e00a18064a9
No significant villages existed prior to the nineteenth century, apart from apparent clusters of residences and the paramount precinct at the capital of Lapaha. Lands were held “in fief” (Gifford 1929:171). All lands in Tonga were technically owned by the Tu‘i Tonga, though landed chiefs had ancestral rights to lands and the people living on them. The number and organization of high-ranking, estate-holding titled chiefs has changed through time, but certain ancient titles have persisted. Many of the highest chiefs held estates in multiple islands. Constitutional reforms in the late-nineteenth century made a certain number of chiefs “nobles” in the new monarchical system (Marcus 1977). Figure 10 shows the modern boundaries of nobles’ estates, or tofi‘a, on Tongatapu, which reflect these changes to the Tongan political order following the land reforms.

![Figure 10. Map of modern nobles' estates on Tongatapu.](image)

The Polynesian political economy, as defined by Kirch (1984:40), is based on territorially defined groups, with a pyramidal social structure based on inherent senior–junior opposition, and ritually sanctioned control of production. In his study of the northern Tongan outlier of Niuatoputapu, Kirch is explicit in his link between the
archaeological correlates of land-holding units and the manifestation of the conical clan on the landscape. Monuments such as burial mounds would be located within the ancestral territory of local descent groups. On Tongatapu, Spennemann (1989:302) suggested the existence of political/administrative clusters beginning at the shoreline lagoon and running inland. Territorial divisions on the basis of monument distribution have been explored elsewhere in Polynesia, such as in Samoa (Wallin and Martinsson-Wallin 2007), the Society Islands (Cochrane 2002), and Rapa Nui (Stevenson 2002).

Kirch’s model of radial settlement for Niuatoputapu is predicated on the circular volcanic islands of eastern Polynesia, as well as in the West Polynesian islands of Futuna and Uvea (Kirch 1976:33), whereby the full range of island ecologies is available to each social group. However, even on a “flat” island such as Tongatapu, this radial pattern gives access to both shoreline and the agricultural interior.

Kirch and Green (2001:208) argued that this important link between social units and units of occupied land is a concept that originated in Ancestral Polynesian Society. The proto-Polynesian word *kaainga referred not only to land, but an estate with a principal dwelling and the social group who occupied it (Kirch and Green 2001:215). Later Polynesian languages generalized the term to relate to either kin or property. In Tongan, kainga means relative, relation, extended family, or clan. Similarly, the term fonua means not only “land” but also “homeland, and the people on the land” (Bott 1982:170).

Whereas kainga may relate more to an extended kin group, the largest political/territorial groupings in Tongan society were ha’a, groups of related chiefly titles, usually sharing an ancestral chiefly origin (Gifford 1929:30). On Tongatapu, ha’a were strongly associated with land holdings. As Maude (1965:30) noted, “On Tongatapu at least the ha’a evidently formed fairly distinct territorial units, but the pattern in the other islands was more complicated and is difficult to reconstruct.” Thus, the broadest patterns of late-prehistoric settlement structure on Tongatapu most likely relate to the distribution and land holdings of these confederations of chiefly titles.

The modern Tongan landscape is characterized by dozens of small villages surrounded by plantations and bush. Some are likely connected along many of the same
roads and paths described by European observers in the eighteenth century (Spennemann 2014). The shift from a dispersed to a nucleated settlement pattern occurred in the historical period, and is commonly associated with the civil warfare that ravaged Tonga from the late eighteenth to mid-nineteenth centuries. The wars were one part of this process of nucleation; the necessity of living within fortified settlements during this period is made abundantly clear by the stories of savage fighting between chiefs (Gifford 1929:207). Many of the modern villages, particularly on Tongatapu, are surrounded to this day by ditches and earthen embankments, evidence of ubiquity of fortifications (Swanson 1968). Some fortifications clearly predate the eighteenth century (e.g., Clark et al. 2017; Marais 1995).

Two other processes were also at work during this period of warfare. Many of the traditional ideological structures collapsed, including religious practices and aspects of the chief–commoner relationship. The efforts of missionaries were beginning to bear fruit by the mid-nineteenth century, and many of the local feuds between chiefs took on a religious element. Burley (1994:404) notes that with the loss of the traditional religion, the concepts of *mana* and *tapu* that governed the settlement of chiefly lands were no longer the structuring force they once were. Access to churches became an additional element that necessitated village-style settlement. With the restructuring of the Tongan chiefdom to a kingship by Tu'i Kanokupolu Taufa'ahau Tupou I later in the nineteenth century came a constitution and a series of dramatic land reforms that further eroded the settlement practices of the earlier social order.
Chapter 3. Methodology

Archaeological investigations into the earliest periods of Tongan prehistory are necessarily concerned with the acquisition of radiometric dates and artifacts of exotic origin or with diagnostic features that allow comparisons to be made with putative homelands (e.g., Burley and Dickinson 2010; Burley et al. 2012). Given the widespread distribution of late-period archaeological remains on Tongatapu, and the much higher visibility of these remains, the focus shifts from a concern with individual sites as units of analysis to a concern with landscape-scale phenomena (cf. Opitz et al. 2015:2).

The methodology I employed for this study encompassed both desktop and in-field survey. My primary focus was on the prospection and characterization of sites based on morphological/distributional variables. I recognized early in this research that the sheer number of sites and features made visible by LiDAR precluded an attempt at “dating” them in any systematic or statistically significant fashion. Rather, my goal would be to characterize and “ground-truth” what I saw to be a discontinuous and apparently structured organization of late-period monumental features.

The methodology followed three loosely defined stages: pre-field LiDAR processing and visualization, in-field survey, and post-fieldwork analyses. However, these stages overlapped over the course of successive field expeditions, and did not follow each other in neat succession. Part of the success in “operationalizing” LiDAR data for archaeological research comes from checking desktop against in-field observations, and vice versa, in an iterative, refining process that allows for greater confidence in identifying and categorizing features (e.g., Opitz 2017:43; Quintus et al. 2015; Skaggs et al. 2016). Manual classification of features in a desktop environment benefited enormously from having subjective experience of them on the ground, and the same was true in the other direction. This feedback process mirrors the technological and methodological development of LiDAR in archaeological remote sensing as a whole.
(Chase et al. 2016). The three methodological stages described here only represent a chronological order of events in the loosest sense.

In this chapter I describe the techniques and approaches I used over the course of roughly four years of study (2013–2017), which included two field seasons (2014 and 2015) in Tonga. My description follows the three-stage process outlined above. I conducted this research in the context of a sea-change in archaeological prospection, owing to the proliferation of user-friendly remote-sensing techniques and the continued integration of geographic information systems (GIS) into everyday archaeological research. Such changes over the past decade have resulted in the burgeoning sub-field of geospatial analysis in archaeology, in which one can now receive specialized graduate-school accreditation.¹ Prior to this study, my personal capabilities in GIS were at a beginner level, and have advanced only to the extent that self-training in specific analyses has allowed. As I discuss further below, I relied on the expertise and generosity of colleagues in the Department of Geography at SFU to assist in developing the more advanced GIS-based analyses. As for my proficiencies in field identification of late-period earthworks, various seminal studies supplied a comparative visual reference collection, but the foundation of my knowledge came from time spent in the field with Burley and local collaborators in Tonga.

### 3.1. Desktop survey

The search for archaeological features on Tongatapu brought me to the island itself, but relied constantly on analysis and scrutiny of digital imagery derived from the LiDAR dataset. In this dissertation I roll the tasks of data processing, visualization, and subjective and automated detection of features into the category of “desktop survey”.

Insofar as browsing LiDAR-derived visualization products constitutes “survey”, I have been engaged in this component of the research from the beginning, and continue to be engaged with it in the present. I have had the privilege (and have communicated

¹ For example, the “MSc in GIS and Spatial Analysis in Archaeology” offered by University College London.
as much to colleagues and friends for several years now) of being able to “find” new archaeological sites each and every time that I open and explore the LiDAR imagery. It is a remarkable experience to suddenly spot a subtle feature in a location on the landscape that I had thought had been thoroughly scrutinized. Even during the production of final maps for presentation in the dissertation, I was still finding things I hadn’t seen before.

My manual search for features has also taken a more systematic approach. At times I have studied individual imagery blocks — small frames of LiDAR-derived imagery at closer scales than can be studied intensely from top to bottom (Figure 11). These blocks were also what I used in the field, exporting them to an iPad for navigation and documentation. Below, I describe the various stages of producing and using the digital imagery that constituted my most valuable tool in the “lab” and in the field.

Figure 11. Examples of imagery “blocks” used to manually browse features and exported to iPad for field survey.
3.1.1. LiDAR data processing

Aerial LiDAR scanning produces “point clouds” of millions of x, y, and z measurement points and associated GPS metadata. Point clouds are processed to produce highly accurate, georeferenced datasets that can be manipulated using GIS software. Products produced from point clouds include digital elevation models (DEMs), which are 3-dimensional renderings of the ground surface that can be visualized in a variety of ways.

The LiDAR dataset used in this research (described in Section 1.3) came “pre-processed”, meaning that the raw data had been converted into a series of useable DEM products. The dataset includes a digital surface model, which includes the ground surface and all objects on it (buildings, vegetation) and a bare-earth digital terrain model, which simulates the ground surface as though it were stripped bare of any objects on the surface. Both are useful, but the bare-earth model is the more valuable tool for viewing subtle microtopography, particularly in areas with plant or tree cover. Occasionally, it was necessary to overlay the digital surface model to assess whether topographic features were associated with modern buildings (e.g., mounded earth surrounding the foundations of a large building, like a church) or whether apparent distortion in the imagery was the result of dense vegetation. Pre-processed products also included detailed intertidal and bathymetric imagery, which has proven useful for understanding mid-Holocene sea-level dynamics in the central Fanga ‘Uta Lagoon (Burley 2016).

3.1.2. Visualization of the LiDAR dataset

Using ArcMap 10.1, I assessed a variety of visualization techniques in order to best define the location and dimensions of anthropogenic features (as advocated by Štular et al. 2012). These different visualizations use the 3-dimensional DEM data to shade or colour the model in ways that highlights features of various sizes and with different attributes (Figure 12). The most common visualizations, or “terrain derivatives”, are hillshade, slope contrast (McCoy et al. 2011), and local relief modelling (Hesse 2010).
Figure 12. Visualizations, or terrain derivatives, produced using ArcMap 10.1.
a) original DEM colour ramp (colour based on elevation); b) local relief modelling (removes the effect of larger-scale topography); c) hillshade (artificially illuminates the landscape from an arbitrary fixed light source); d) slope contrast (darker colour indicates steeper slope).

Hillshade “illuminates” the terrain from an arbitrary, fixed light source, causing topographic features to cast shadows. Hillshade requires experimentation with illumination elevation and azimuth angles, since some features are better illuminated under different lighting conditions. The slope contrast method, which measures the gradient, or steepness of slope, is less dependent on this type of trialing. Because the natural terrain of Tongatapu is so flat, I generally preferred slope contrast for locating and inspecting mounds and fortifications. However, I found that switching between hillshade and slope contrast helped to confirm whether objects were positive or negative— that is, whether they were mounds or pits (Freeland et al. 2016:67).
I also routinely cross-checked LiDAR-derived imagery with the high-resolution ortho-photos captured during the 2011 LiDAR survey. These high-quality aerial photographs provide yet another perspective on ground cover and modern land use in relation to the anthropogenic topography. When combined, terrain derivatives and ortho-photos produce captivating and illustrative images (Figure 13; Figure 14).

Figure 13. A view of Lapaha, Tongatapu, with a semi-transparent hillshade model overlaid on an aerial ortho-photo. This visualization illustrates the relationship between monumental features and modern land use.
3.1.3. Subjective characterization of feature types

Previous studies of Tongan monumental architecture (e.g., Burley 1996; Kirch 1988; McKern 1929; Spennemann 1989) provided a set of expectations for what architectural “types” I would encounter in the LiDAR imagery. The largely complementary typologies describe a range of mound types, from the widespread, unadorned earthen burial mounds to the elaborate sepulchres of the Tongan kings. However, for the purposes of broad classification and categorization of mounds during my desktop survey, I used a fairly straightforward characterization strategy: I distinguished between round, or sub-rounded mounds, and square or rectangular mounds. The significance of this distinction, and a more detailed discussion of the use and negotiation of these typologies, is presented in the next chapter.

The passing of time and the plough have altered the morphology of many mounds on Tongatapu; presumably, a significant number are now undetectable, having been obliterated by modern development, or their sediments slowly dispersed through agricultural activity. Mounds with previously distinct square or rectangular plan shapes may now appear “softer” and less well defined. However, rectangular mounds often
retain an elongated form and a flatter top than circular mounds, which typically have a conical or rounded top. These distinctions are best viewed using hillshade (Figure 15). As I made these broad categorizations, I entered them into a GIS database. As I discuss below, my ability to make distinctions in the LiDAR imagery was greatly enhanced by “ground-truthing” these features with field survey in Tonga.

![Figure 15. Mounds near Liahona, Vaini district, Tongatapu.](image)
a) a rectangular platform mound; b) a round, conical mound; c) depressions (probable freshwater bathing wells).

### 3.1.4. Automated feature extraction

GIS-based automated feature extraction (AFE) proved to be an invaluable tool for identifying and quantifying mounds on Tongatapu. Automated extraction techniques use algorithms to detect shapes and objects in digital imagery based on the application of user-defined rule sets. An example of one such rule would be defining a circularity threshold — in other words, telling the algorithm to reject any object that does not meet a minimum measure of circularity (linear or square objects would be rejected). Recent sophisticated applications of AFE have used machine learning techniques to predict the incidence of anthropogenic features (e.g., Guyot et al. 2018).
The Freeland et al. (2016) study was framed around a comparison of two AFE techniques, object-based image analysis and an inverted pit-filling algorithm (referred to as “iMound” for “inverted mound”). As discussed in that paper, AFE techniques reveal broad patterns with relative speed and ease, making them favourable, in some cases, to strictly manual interpretation of imagery. The results, which are never 100% accurate, are useful starting points for producing data points on a large scale.

The iMound procedure proved most effective in identifying round and sub-rounded mounds on Tongatapu (Figure 16). The iMound extraction dataset (Figure 17) thus formed the starting point for an overall GIS inventory of mounds, which included basic information for each mound (latitude, longitude, and mound height). I corrected false positives and false negatives in the iMound inventory manually over the course of desktop and field survey.

Figure 16. A frame showing mounds extracted using the iMound AFE procedure. (from Freeland et al. 2016:70).
3.2. Field survey

I had opportunities over the course of two field seasons in Tonga to conduct field survey that, at the time, I called “ground checks” of the LiDAR imagery. These checks compare what features look like in reality with how they appeared in the visualizations. In 2014, I investigated a handful of mounds and other features in Lapaha district with undergraduate students as an instructor on the SFU South Pacific archaeological field school. Students were assigned field-mapping exercises that provided excellent opportunities for checking the accuracy of the LiDAR imagery.

In 2015, I returned to Tonga with the express purpose of visiting as many mound sites as I could to photograph, measure, and get a sense of their proportions and morphology. I conducted some survey on my own, some with local collaborators, and some with Burley.
3.2.1. Field-portable imagery

As I have mentioned already in this chapter, field survey was greatly aided by the use of field-portable LiDAR imagery, which I uploaded to an iPad and explored using a mapping application called Avenza maps. The application allows you to “navigate” through georeferenced mapping imagery, showing you where you are in relation to mapped features, and to document sites that are visited. For example, while standing on a mound on Tongatapu, one can “pin” the feature (Figure 18), categorize the feature type, and record notes and photographs (Figure 19). Data from the Avenza Maps application can be uploaded to a CSV (spreadsheet) file.

My typical procedure while in the field would be to study high-resolution maps of an area in the evening, “pinning” features of interest that I would visit the following day. If I could navigate to the feature (fences, brush, and packs of dogs were the primary obstacles), I would place a secondary “pin” marking field visit sites and record whatever information was necessary. I took photos (dense brush often precluded photography) using a high-quality digital camera (rather than the built-in iPad camera) and recorded each photograph in a catalogue, cross-referenced with site visit “pin” numbers.

3.2.2. Assessment of LiDAR accuracy

The metadata accompanying the LiDAR dataset states that it has a vertical accuracy of ±15 cm, making it more than sensitive enough to detect anthropogenic relief of the scale I am interested in. The imagery employed in this study was based on 1-m² bare-earth DEMs — meaning that each pixel represents 1 m². The accuracy of the LiDAR, and its reliability in terms of representing the location, scale, and morphology of features was confirmed, if subjectively, many times over in the field. The student projects mentioned above provided the opportunity to record the diameters of at least a dozen mounds on the Nukuleka peninsula, in northeastern Tongatapu, providing a series of comparative measurements. All were comparable to measurements taken from the LiDAR, within a very small margin of error; as well, the error is more likely to have been in the fieldwork, given ground cover and subtlety of surface feature boundaries.
Figure 18. Screenshot from the Avenza Maps iPad application showing different feature types flagged by colour-coded pins.
Figure 19. Documentation interface in the Avenza Maps iPad application, allowing for categorization, note-taking, and photography for each “pinned” feature.
3.2.3. Post-hoc analyses

Once field visits were complete, I conducted a series of analyses and calculations in the ArcMap 10.4 GIS environment. I generated descriptive statistics for mounds using the two attributes that were easily calculable for the whole dataset: mound location (X,Y) and mound height (Z). Using X,Y data, I looked at spatial relationships such as mound distribution relative to elevation above sea level and distance from the coast. I also used these data to look at mound clustering, using a series of cluster analyses in ArcMap to determine areas of dense mound construction. Using Z data, I was able to examine height relationships between mounds and determine where the “higher” mounds were located. Post-hoc analysis also involved parsing the different mound types and examining the contrasting spatial distributions of each type.
Chapter 4. Feature characterization and survey typology

There is considerable variability in the form, diameter, height, and volume of earthen mounds on Tongatapu. While some tower over 10 m high and span 60 m in width, others barely reach 40 cm high and are nearly imperceptible beneath long grass or cultivated crops. In this chapter, I describe this range in scale and morphology, providing descriptive statistics and broad characterizations of feature types. I begin with my own observations and measurements before comparing these data to what previous studies of Tongan mounds have described. Before concluding the chapter, I provide a description of other non-mound feature types, including linear ditches and fortifications.

4.1. Descriptive statistics for mounds

After manually correcting false positives and negatives in the iMound extraction output, I arrived at an estimated 9,420 mounds on Tongatapu (Table 1). The value of these data points was twofold: each mound polygon allowed for the calculation of basic metric data, and the latitude/longitude associated with the polygons allowed these metrics to be analyzed geographically.

The only readily calculable statistic for the entire inventory was height. Mound heights were estimated by subtracting the minimum from maximum elevations ($Z_{\text{max}}-Z_{\text{min}}$) from each mound polygon. A 10-m buffer around each polygon helped to correct for influence of pits or ditches encircling the mounds, which would otherwise artificially increase the height of the mound relative to the surrounding terrain. The negative impact of this 10-m buffer became clear with mounds along the south coast of Tongatapu, close to steep drop-offs in elevation. Obvious cases of erroneously high mounds were removed from the height estimation sample. Figure 20 shows the
frequency distribution of mound heights by size class, and Figure 21 shows actual height
distribution. The majority of mounds are under 3 m high, but most also exceed 1 m.

**Table 1. Descriptive statistics for mounds on Tongatapu.**
Diameter estimate based on a random sample of 200 manually measured mounds. A handful of
exceptionally large mounds have diameters that exceed the stated maximum of 56 m.

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<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td><strong>Total mounds</strong></td>
<td>9,420</td>
<td></td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>min</td>
<td>0.48 m</td>
</tr>
<tr>
<td></td>
<td>median</td>
<td>1.37 m</td>
</tr>
<tr>
<td></td>
<td>max</td>
<td>10.42 m</td>
</tr>
<tr>
<td><strong>Diameter</strong></td>
<td>min</td>
<td>19 m</td>
</tr>
<tr>
<td></td>
<td>median</td>
<td>32 m</td>
</tr>
<tr>
<td></td>
<td>max</td>
<td>56 m</td>
</tr>
</tbody>
</table>

![Figure 20. Histogram showing the distribution of mound heights on Tongatapu by 1-m height class.](image-url)
Figure 21. Histogram showing distribution of mound heights.
Height on x axis in m with three decimal places.

Mound diameter was difficult to assess across the entire *iMound* dataset, given that polygons produced using that procedure did not always encompass entire mounds, nor did they always accurately reflect mounds’ plan shapes. In order to estimate the distribution of mound diameter across Tongatapu, I acquired a random sample of 200 mounds (using a random number generator and the ID code of each polygon in ArcMap) and manually measured maximum diameter using the ArcMap measurement tool. Manual diameter measurement was necessarily rounded to the nearest 50 cm, and required me to visually interpret mound boundaries and assess the direction of the greatest dimensions. This time-consuming process could potentially be automated to generate a larger, more accurate sample. However, the hours spent measuring mounds in ArcMap pale in comparison to the time and logistics of measuring 200 mounds in the field. Figure 22 illustrates the relationship between mound height and diameter in this sample of 200.
Figure 22 shows considerable variability in the relationship between mound height and diameter. Height appears to correspond to diameter fairly closely among smaller mounds. However, large-diameter mounds show significant variability in height, which is unsurprising given that some of the largest-diameter mounds are known to be relatively low, flat, rectangular platforms. A significant factor influencing this ratio is the degree of preservation — many large-diameter but low mounds are the result of plough action and other erosional processes, while some very high mounds with lower diameters (steeper slope) have been avoided, preserved, or are still in use today and have been added to over time. The linear trend line on Figure 22 has an $R^2$ value of 0.308, meaning that the linear equation represented by the line explains 30.8% of variance in the data.
4.2. Morphological types

While height and diameter measurements were made in a mostly objective fashion, categorization of mounds on the basis of morphology required a degree of subjective reasoning, backed by previous research on mound forms and functions. On a site-by-site basis, careful survey, excavation, and testimony from local informants can go a long way toward identifying the function and significance of individual features. However, in order to arrive at island-wide patterns from which significance could be inferred, I required a relatively simple survey typology that would allow me to place mounds in one category or another — knowing, of course, that my distinctions were at times arbitrary and could be contradicted by oral tradition or more detailed archaeological investigation.

McKern (1929) created an initial typology of Tongan mounds based on emic linguistic categorization, resulting in a typology of ʻesi (chiefly resting/sitting mound), faʻitoka (chiefly burial mound), sia heu lupe (pigeon-snaring mound), and langi (tumuli generally reserved for the Tuʻi Tonga), all of which are still in use. Sia is the general term for an artificial mound of any type. The term malaʻe (a cognate of East Polynesian marae) generally denotes a communal ritual or meeting place or cemetery (e.g., the Malaʻekekula, burial place of the modern monarchs of Tonga in Nukuʻalofa). McKern’s mound types were based almost entirely on what his Tongan informants said of the mounds’ past functions and associations, to the extent that mounds with important differences in morphology were occasionally grouped together under the same linguistic category. For example, McKern applied the term ʻesi to denote mound function in both round and rectangular raised platforms, some with stone retaining walls and approach ramps, and some without.

Subsequent classifications have not diverged significantly. Kirch (1988:210) created a formal typology of Niuatoputapu mounds based entirely on morphological traits that roughly accords with traditional Tongan linguistic categories. Due to the abundance and clear importance of mounds with natural or cut stone slabs facing their edges, Kirch made a primary distinction between mounds faced with stone and those without; the former are the exclusive entitlement of chiefs and high-ranking persons. Further
distinctions were made on the presence or absence of paved surfaces, “central depressions”, and other modifications.

Spennemann (1989) argued that generic round field monuments on Tongatapu comprised both house and grave mounds. He made this functional distinction on the basis of excavations, which showed burials to be associated with coral sand and purported house mounds to have post holes and other evidence of habitation structures.

There is no difference in overall form between house mounds and the burial mounds without stone facing. Burial mounds can only be distinguished by coral sand eroding from the graves. The presence or absence of eroding coral sand, however, could only be recorded on mounds which were either under garden or had a considerable portion of their surface exposed. During the survey grass- or vegetation-covered mounds were recorded as mounds of unspecified function (Spennemann 1989:279).

In the absence of additional data to corroborate or refute Spennemann’s claim regarding house mounds, I necessarily must collapse this distinction for the purposes of creating a LiDAR survey typology. I observed mounds in Tonga with and without coral sand present, and if this is indeed the only way short of excavation to distinguish between house and grave mounds, I am precluded from making the distinction across the entire dataset for the time being. As Spennemann (1989:327) concludes, not every family could have lived on a house mound — I would argue that it is probably possible to separate out house mounds from grave mounds based on a combination of morphology and surrounding features.

It is highly unlikely that the vast majority of generic, round-topped field monuments represent house platforms. Mounds that have been interpreted as house platforms based on the presence of post molds or other subsurface features may in fact have been burial mounds with large, well-maintained grave houses, as recorded in historical engravings and descriptions (Figure 23; Figure 24). Yam gardening also requires digging deep holes that make interpretation of subsurface features like post molds difficult.
Figure 23. Illustration of a burial mound with grave house, “Tombeau de Chef Tongamana”. Published in 1833, from Dumont d'Urville’s 1826–1827 voyage on the Astrolabe. From the New York Public Library https://digitalcollections.nypl.org/items/510d47da-78c0-a3d9-e040-e00a18064a99.

Figure 24. Illustrations of Lavaka’s house, “Maison de chef Lavaka”, and a chief’s burial mound, “Tombeau d’un chef”, 1827. Published in 1833, from Dumont d'Urville’s 1826–1827 voyage on the Astrolabe. Note that Lavaka's house is constructed on flat ground, while the grave house is atop a low mound. From the New York Public Library https://digitalcollections.nypl.org/items/510d47da-78e5-a3d9-e040-e00a18064a99.
The most detailed information regarding the form and cultural significance of pigeon-snaring mounds was conducted by Burley (1996), who made a careful study of mounds on several islands in the Haʻapai group. Burley distinguished three pigeon-snaring mound types based on the presence/absence of stone retaining walls, access ramps, and central depressions. On Tongatapu, there are three roughly parallel categories of pigeon-snaring mounds, each increasingly complex in construction. For the purposes of the survey typology, however, I have collapsed these distinctions.

For the overall categorization of the majority of Tongatapu mounds, Kirch's Niuatoputapu typology is the most useful, but requires adaptation for this context. Although a complete field inventory has not yet been conducted, relatively few mounds outside of the political centres of Heketa and Lapaha show evidence of elaborate, or cut-and-dressed, stone facing. Natural (i.e., uncut, undressed) stone retaining walls are sometimes found, especially in contemporary cemeteries. It is possible that more stone-faced mounds existed in the past, and that the stones have since been scavenged on this more densely populated island. Stone-faced monuments occur throughout the Tongan archipelago, and the presence of stone, whether natural or dressed, remains a distinguishing feature of “high-ranking” mounds (Burley 1998b). However, due to the sheer scale of the mound inventory, and the near-impossibility of detecting stone facing via LiDAR, categorization of Tongatapu mounds more fruitfully begins with a distinction based on plan shape. That is, whether a mound is more rectangular or more circular/sub-rounded.

“Rectangularity” is, in nearly every case where documentation exists, firmly associated with status. In scale and in locational context, rectangular earthworks demonstrate social/political importance. The massive square and rectangular langi at Lapaha, and the smaller ones at Heketa, are the clearest examples (Clark 2016; Clark et al. 2016). However, low rectangular platforms are found in what is likely the first “capital” of the Tuʻi Tonga dynasty at Toloa, and are also found in surprising abundance along an east–west corridor on Tongatapu that was likely the route of the primary road linking the ends of the island in prehistory.
I have arrived at a conservative estimate of 116 mounds (including langi) on Tongatapu with a square or rectangular plan shape, of which 29 are at Lapaha, eight at Heketa, and seven at Toloa. A further 25 are located within a 5 km radius of Lapaha. Outside of the political centres, the remaining 47 square/rectangular mounds are often part of what appear to be elite residential compounds, with one or more circular mounds in close association, as well as freshwater wells and occasionally enclosure ditches. It is possible that rectangular mounds functioned as elevated house platforms, but I have no new evidence to support this interpretation.

For this study, I created what I refer to as a “provisional typology” — a hierarchical categorization of mounds based on heuristic mound types with circularity vs. rectangularity being the primary distinction (Figure 25). These types are based on both Tongan linguistic (emic) and outsider/researcher (etic) classifications, and thus represent a blending of McKern’s and Kirch’s respective mound typologies.

![Figure 25. Provisional survey typology of Tongatapu mounds.](image)

The typology is provisional because it represents morphological categories that are distinguishable in the LiDAR data — some mound attributes are not represented. The presence or absence of stone facing, for example, is nearly impossible to distinguish in the LiDAR imagery, and is therefore not a significant attribute in the typology. In order to arrive at island-wide distribution of feature types, it is necessary to exclude certain details. Once the broad patterning of mound type distribution is arrived at, finer distinctions can be made, and significance of the patterning from both emic and etic perspectives can be discussed (Figure 26).
Figure 26. Research workflow showing the place of the provisional typology in the research cycle.

4.2.1. Round/sub-rounded mounds

The vast majority of mounds on Tongatapu are round or sub-rounded in plan shape, with rounded or sometimes conical tops and generally no special adornments (e.g., stone facing; Figure 27). These “field monuments” comprise a majority of burial mounds and a minority of mounds with some other function.

While it has been noted that superimposition of smaller-scale commoners’ graves could result in mounding, the majority of mounds are likely intentional, one-time constructions (Burley 1991). One such mound, excavated in the 1970s, was found to have 41 individual grave deposits, all of them likely commoners or low-ranking people (Spennemann 1989:43). Excavations at ʻAtele revealed over 80 burial features in one mound, some with multiple interments (Davidson 1969; Pietrusewsky 1969; Scott and Buckley 2014; Stantis 2015; Stantis et al. 2015). There are many unmounded burials (tanu’anga) on Tongatapu, which are encountered regularly during construction work and archaeological excavation.

Some otherwise typical round mounds have access ramps leading up to their tops — a characteristic feature of pigeon-snaring mounds. The distinction between these mounds with ramps and pigeon-snaring mounds is in the size and flatness of the top platform, as well as their location relative to other features.
4.2.2. Pigeon-snaring mounds

Pigeon-snaring mounds are an easily recognizable mound type with a clear pattern of spatial distribution. As described by Burley (1996), pigeon-snaring mounds represent visible symbols of chiefly rank. The Pacific imperial pigeon (*Ducula pacifica*) was snared by chiefs and their attendants from the tops of these conical platforms in a highly ritualized and competitive but poorly understood sport. Burley describes pigeon-snaring mounds in Ha'apai as belonging to one of three types: mounds with central depressions, lacking stone retaining walls; mounds with stone walls and access ramps; and flat-topped mounds. On Tongatapu, several clear examples of the second type occur at Va'epopua, in the Ma'ufanga area east of Nuku'alofa (Figure 28). However, the majority are relatively unadorned, truncated cones (Figure 29; Figure 30; Figure 31). Most have a pit or depression in the centre of the flat platform, and either a ring ditch encircling the base of the mound (Figure 32) or a series of radial pits (Figure 33). Many have access ramps. Pigeon-snaring mounds are generally larger (height and diameter) than generic mounds.
Figure 28. Artist’s reconstruction of “Sia 1” the central and largest mound of the Va’epopua pigeon-snaring arena. Used with permission of the artist, Sopolemalama Filipe Tohi.

Figure 29. Artist’s reconstruction of “Sia 4”, a relatively small, outlying mound at the Va’epopua pigeon-snaring arena. Used with permission of the artist, Sopolemalama Filipe Tohi.
Figure 30. A small pigeon-snaring mound near Fahefa, Kolovai district, Tongatapu.
Red lines show the general outline of the mound and platform top. The scooter in the foreground sits on the outside edge of the ditch that encircles the mound.

Figure 31. Another view of the same pigeon-snaring mound at Fahefa. View of the encircling ditch, roughly 1 m deep, with the mound to the left and the scooter in the same position as in the above photo.
Figure 32. A hillshade image of three pigeon-snaring mounds near Fahefa, Kolovai district, Tongatapu.
All three are flat-topped truncated cones with central depressions and encircling borrow ditches. These mounds and others in the area command views inland, downhill from their position, and out to sea along the southern (liku) coast.

Figure 33. A slope-contrast image of a large pigeon-snaring mound in Nukuleka, Lapaha district, Tongatapu.
The radial pits surrounding the platform and subtle central depression are similar to some of those found in Ha’apai (Burley 1996).
Their distinctive spatial patterning is another key diagnostic feature. Pigeon-snaring mounds are often located in special places away from settlements and intensive land use. The island of Uoleva, in Ha'apai, was set aside as a “pigeon reserve”, and even today remains nearly uninhabited (Burley 1996:426; Gifford 1929:70). The use of a pigeon-snaring arena like this was an exclusive privilege of high-ranking chiefs. The pigeon-snaring mounds of Tongatapu occur almost exclusively near the coast, usually far away from other mound types, often in groups of 2–3 in clear association and similar proportion. A large number are located along the north coast of the western portion of Tongatapu, between the villages of Puke and Masilamea. Several of these mounds are very large, and are positioned well offshore from dry land in the extensive tidal mudflats that characterize this part of the coast. The well-known pigeon-snaring arena at Popua, east of Nuku'alofa near the entrance to the Fanga 'Uta Lagoon, is in a similar tidal marsh ecosystem. These areas, far removed from evidence of settlement, may have been considered off-limits to commoners, thus representing a manifestation of tapu on the landscape.

On the West Polynesian island of 'Uvea (Wallis), which came under Tongan influence in the fifteenth century AD, pigeon-snaring mounds are found in close association with vaotapu (“sacred grove”), which were carefully managed, ritually sanctioned forests where pigeons roosted (Guiot 1998; Sand 2008:89). Such a concept or area is presently unknown on Tongatapu. Other Tongatapu pigeon-snaring mounds occupy prominent ridgelines along with west and southern coasts, where steep cliffs drop off to pounding surf. There is doubtless an ecological consideration in the location of pigeon-snaring mounds, with fruit-bearing trees (e.g., Eugenia spp.) being essential for attracting wild pigeons to roost.

At least two of the mounds I surveyed along the south coast had been repurposed for burial, including one with cut-stone slabs creating a burial vault in the central depression, and one with coral sand diagnostic of a burial. Reuse of pigeon-snaring mounds for burial places has been recorded elsewhere. For example, the mound known as Houmatala, on the island of Foa in northern Ha'apai, has been used as a burial mound since the 1860s, when it was converted as a way to affirm lands given to the Tu'i Tonga (Burley 1996:428; Gifford 1929:179).
4.2.3. **Langi tombs**

The most famous and recognizable monumental structures in Tonga, *langi* (lit. “sky”) were the exclusive burial place of the Tu’i Tonga and closely related lineages. While their linguistic designation derives from this restricted function, their construction and morphology further distinguish them on the monumental landscape:

The principal criteria for identifying elite tombs is the presence of stone slabs placed edge-down and arranged in a rectangular-to-square form on the top of an earth mound or used to face one or more square-to-rectangular platforms that were filled with soil. A stone burial vault placed within a faced/unfaced platform/mound is also a marker of high status… (Clark 2016:4).

While *langi* are found throughout Tonga, their distributions are restricted to districts of significance to the Tu’i Tonga. Approximately five *langi* are found outside of Tongatapu. For example, the *Langi Mahola*, tomb of the last Tamaha (“sacred child”, eldest daughter of the eldest sister of the Tu’i Tonga), is located on the island of Tungua in Ha’apai (Burley 2005). On Tongatapu, *langi* are found at Heketa and Lapaha (Figure 34; Figure 35), two “capitals” of the Tu’i Tonga dynasty. An additional *langi* is found near northeast of Lapaha, between the villages of Hoi and Makaunga. Other tombs with cut and dressed stone are found on Tongatapu, including the *Mala’ea Kanokupolu* (burial place of the first and third Tu’i Kanokupolu) in Hihifo. Certain mounds without stone are also considered *langi* when associated with the Tu’i Tonga lineage (McKern’s [1929:37] “Type A” *langi*).

4.2.4. **Rectangular platforms**

Rectangular platforms are a class of mound characterized by a square to elongated rectangular plan shape, relatively low height (typically <2 m; Figure 36), and generally some association with other earthworks. They are not typically faced with stone, though it has been suggested that some could have had retaining walls constructed of logs in the past (Spennemann 1989:433). Rectangular mounds with these attributes are found almost exclusively in western and central Tongatapu, with only three clear examples found east of Lapaha (excluding platforms at Heketa), and approximately 70 found to the west.
Square and rectangular stone-faced langi have straight sides, right angles, and single or multiple tiers.

The largest and most stylistically complex tomb is one of the oldest at Lapaha, built between ca. AD 1300–1400 (Clark et al. 2016).
Figure 36. Two figures approaching a low rectangular platform.
The farther figure stands approximately at the base of the mound.

The scale, relative rarity, and position of rectangular platforms on the landscape, either away from densely built areas or along the east–west highway corridor, suggests an association with high status. The wide, flat tops of these mounds suggest public or ceremonial use. The platforms are often found in combination with other features, together forming groupings which may be interpreted as elite residential compounds or burial complexes, although elite compounds need not be marked by a rectangular mound (e.g., Burley 1994:400). Some of these compounds have an associated cigar- or L-shaped trench, usually parallel or perpendicular to the orientation of the platform, which may represent a borrow pit for mound building that later served another function. Bathing wells, circular mounds, and defensive ditches or fortifications are also common (Figure 37; Figure 38).
Figure 37. An “elite compound” near Ha'ateiho, Vaini district, Tongatapu.
Three rectangular platforms oriented in the same direction, commanding views inland from the height of land along the south coast.

Figure 38. An elite compound near Liahona, Vaini district, Tongatapu
Partial enclosing ditch feature that excludes two prominent mounds. The ditch segments represent various incarnations of defensive features associated with a fortification near Liahona.
4.2.5. Rectangular pyramids

Another monumental category of rectangular mound that I distinguish in the typology is what I have termed rectangular pyramids — mounds with the same plan shape as the low rectangular platforms, but with tall, steep sides and proportionately smaller platforms.

On the island of Nukunukumotu, at the western side of the entrance to the Fanga ‘Uta Lagoon, there is a massive four-sided pyramidal mound (Figure 39). First revealed through LiDAR survey, and later inspected on the ground, the mound measures some 60 m wide and 6 m high, with a large, square platform top. The estimated volume of this mound is 12,500 m\(^3\), making it one of the most substantial constructions in all of Tonga. The prominent position of the mound at the mouth of the lagoon, within eyeshot of Lapaha, suggests an observatory function related to ocean-going canoes entering or exiting the lagoon. It is also located close to the chiefly pigeon-snaring arena at Va’epopua.

![Figure 39. Rectangular pyramid on the east coast of Nukunukumotu, Kolomotu'a district, at the entrance to the Fanga ‘Uta Lagoon.](image)

Other examples of exceptionally tall pyramidal mounds with right angles are found on Tongatapu. Their function is unknown, but the existence of chiefly burials in them seems likely. They may simply represent an elaboration of the rectangular platform type already described. Their rectangular plan shape results in a broad “presentation”
face that is typically visible from major thoroughfares or other high-use spaces. Gifford (1929:201) recorded the name *mounga* (“mountain”) for the tombs of chiefs; it is unclear how he distinguished between these and *faʻitoka*, the more common name for chiefly burial mounds below the rank of Tuʻi Tonga. However, the evocative name could relate to the exceptional height of certain burial structures.

**4.2.6. Ceremonial platforms**

Distinguished on the basis of their extreme proportions, there are only two examples of presumed ceremonial platforms on Tongatapu. I use the term “ceremonial” in this context to denote a ritual or community meeting place. On the small peninsula near the village of Malapo, LiDAR revealed a very long, but low, rectangular platform, measuring roughly 250 m long, 50 m wide, and built only 1.5 m high (Figure 40). This structure is virtually unprecedented in Tonga. Its use as a public ritual or administrative site, possibly for kava ceremonies, sport (cf. Clark and Reepmeyer 2014:1254), or the installation of chiefly titles seems plausible. The only other example of this feature type is located at Toloa, and is described in greater detail in Chapter 6.

Figure 40. A slope-contrast image of the small peninsula north of Malapo, Vaini district, Tongatapu, showing a low, 250-m long platform. No known archaeological or traditional record of this massive feature exists.
Given its proximity to the shoreline and to the capital at Lapaha/Mu’a, it is also possible that this feature was a monumental hangar platform for the enormous sailing canoes of the Tu’i Tonga, working in tandem with the stone wharf/wet dock at Mu’a named Muiutuloa (Clark et al. 2008:1001). Historical illustrations convey the scale of these covered boat hangars, which were themselves forms of monumental architecture, albeit perishable (Figure 41; Figure 42).

Figure 41. Illustration of a canoe shed/hangar, “Vue d’un hangar abritant la pirogue de guerre du Chef Palou”, 1827.
Published in 1833, from Dumont d’Urville’s 1826–1827 voyage on the Astrolabe. Note the high woven fence in the background. From the New York Public Library https://digitalcollections.nypl.org/items/510d47da-78b6-a3d9-e040-e00a18064a99.

4.3. Non-mound feature types: ditches and fortifications

The modern Tongan landscape is characterized by dozens of small villages surrounded by plantations and bush. Some are likely connected along many of the same roads and paths described by European observers in the eighteenth century. The shift from a dispersed to a nucleated settlement pattern occurred in the historical period, and is commonly associated with the civil warfare that ravaged Tonga from the late-eighteenth to mid-nineteenth centuries. The wars were one part of this process of nucleation; the necessity of living within fortified settlements during this period is made abundantly clear by the stories of savage fighting between chiefs and their followers (Gifford 1929:207). Many of the modern villages, particularly on Tongatapu, are surrounded to this day by ditches and earthen embankments, evidence of ubiquity of
fortifications (Swanson 1968). Some fortifications clearly predate the eighteenth century (e.g., Clark et al. 2017; Marais 1995).

Fortifications come in a variety of forms (Parton et al. 2018). Some are relatively small and simple (Figure 43), while others are sprawling and show evidence of successive, superimposed building episodes (Figure 44). In a handful of cases, circular fortifications connect or abut to linear ditches/embankments (Burley, Tuinukuaf, and Clark 2016; Clark et al. 2017; Figure 45).

Linear ditches are a common but poorly understood phenomenon on Tongatapu. Referred to by Spennemann (1989) as “sunken roads”, these ditches may have served a transportation function, but were clearly excavated, not worn progressively with the passing of time and foot traffic. They often occur between concentrations of field monuments and other features, appearing to demarcate boundaries and perhaps, at some point, fortifying them.

Figure 43. Hillshade image of Kolo Holonga, a small, single-ditch fortification in Holonga, Tatakamotonga district, Tongatapu.
Figure 44. Hillshade image of Kolo Polonga, a large fortification near Kolonga, Lapaha district, eastern Tongatapu.

Figure 45. Hillshade image of a series of defensive earthworks in association with the Keli-'a-Pelehake linear ditch system, near Te'ekiu, Nukunuku district, Tongatapu.
Chapter 5. Spatial distribution of monumental feature types

In this chapter, I build on the description of mound types and attributes by analyzing their spatial distribution. First, I describe the overall distribution of mounds on Tongatapu without discriminating by feature type. I present data regarding mound distribution relative to island elevation, distance to coastline, and mound–to-mound visual relationships. I illustrate and briefly discuss the clustering of mounds and the significance of these clusters relative to Tongan history. I then employ the survey typology to assess mound distribution by type, demonstrating how certain feature categories have differing spatial distributions.

I note in advance that the collapsed chronology of mound construction on Tongatapu presents a degree of uncertainty regarding the spatial relationships between mounds — it is impossible to know, on an island-wide scale, exactly how many and which mounds were built and used at the same time, or to what extent the presence of earlier mounds impacted the building of new ones. There are morphological and spatial attributes that may be used to infer a relative chronology of mounds, which I discuss further below. However, the fact that we have relatively poor chronological control does not totally undermine the significance of the spatial patterning I present in this chapter. Consider, for example, two scenarios: one in which all mounds were built within a very short period of time, and according to strictly defined territorial prescriptions and proscriptions; and one in which the same pattern is achieved slowly, over the course of many centuries. In both scenarios, equal significance is placed on territorial organization, or top-down control of the landscape. The difference between the two scenarios, which could prove to be one of subtle gradation or be punctuated by building episodes, will have to be illuminated with further field study that incorporates a systematic radiocarbon-dating strategy.
Differential preservation is an important factor in “… moving from data collection to archaeological interpretations” (Cowley 2017:147). The more urbanized and developed areas of Tongatapu, particularly in and around Nuku’alofa and Fua’amotu Airport, are relatively blank in terms of a surface archaeological record. A bias toward preservation of earthworks, either through deliberate avoidance or mere abandonment of a certain area, can equally influence interpretations that are predicated on the presence, absence, and relative abundance of data points. Luckily, however, no large-scale deliberate destruction of mounds seems to have occurred, with the notable exception of government-sanctioned mound destruction in Va’epopua noted earlier. The major advantage of the island-wide LiDAR capture of mound distribution is that small-scale, restricted areas of differential preservation are seen in wider context. Subsistence farming in the Tongan countryside does not appear to have had an overly destructive impact on mounds, which are detectable even after years of ploughing and planting.

As I stated at the beginning of the dissertation, the purpose and interest behind examining the distribution of earthworks on Tongatapu is to try to understand how landscape and built environment articulated with social and political organization. This focus is similar to Kirch’s (1988) analyses of site distributions on the northern outlier island of Niuatoputapu. Kirch was able to propose a system of territorial organization on Niuatoputapu that combined ecological data with monument distribution.

Commenting on the issue of territorial organization on Tongatapu, Spennemann (1989:278–279) stated:

In principle, a discussion of the spatial distribution of sites might arrive at a reconstruction of prehistoric territorial and possibly even administrative boundaries. In the ideal situation the territorial boundaries are field monuments, such as the stone-walled field and household (ward) systems of Samoa or the soil-walled vuci gardens of Fiji, to quote two regional examples. This, however, is not the case in the Tongan context, due with [sic] its lack of stone and absence of irrigated or swamp taro cultivation.

The intensification of dryland systems such as the Tongan subsistence regime will not necessarily have boundaries defined by infrastructure like irrigation or pondfields, but will instead be reflected by the extent of settlement itself. Spennemann was particularly
concerned about the ability to plot the totality of all sites when modelling boundaries. The LiDAR dataset provides the opportunity to meet Spennemann on both challenges: to plot the totality of sites, and to attempt to reconstruct territorial or administrative boundaries.

5.1. Mound distribution relative to island elevation

Tongatapu is a relatively flat, upraised coral limestone island that “tilts” on an east–west axis. The north shore of the island grades almost imperceptibly into sea level, while the south coast is elevated to a maximum of 65 m above sea level (asl) in the Fua’amotu area (Figure 46). The mostly gentle slope is punctuated by a series of paleoshorelines (Dickinson 2007; Dickinson et al. 1999). The greatest concentration of Lapita and later Plainware material is found along the most recent mid-Holocene paleoshoreline (see Figure 46 transition from sky- to navy-blue).

Late-prehistoric mounds occur on Tongatapu at differing frequencies depending on the elevation. In order to assess mound distribution relative to elevation, I created 13 5-m elevation intervals and calculated the number and proportion of mounds occurring in each of them (Table 2). I calculated the density of mounds for each elevation interval from a GIS-based estimate of the total area (km²) for each interval.

Given that elevation peaks in the far south of the island, and the island appears subtly cone-like in profile, the area of each elevation interval is highly variable, with 70.8 km² of land at or below 5 m asl, and only 2 km² of land above 60 m asl. Direct comparison of the density (n/km²) of mounds within each of these somewhat-linear elevation “bands” is thus slightly misleading. For example, to directly compare the density of mounds occurring in zones shaded yellow in Figure 46 with those occurring in zones shaded dark-red would fail to account for the wide east–west breadth of the yellow zone and the relatively limited range of dark-red areas.
Figure 46. Digital elevation model of Tongatapu.
Table 2. Mound distribution relative to island elevation above sea level.

<table>
<thead>
<tr>
<th>elevation range (m asl)</th>
<th>area of elevation range (km²)</th>
<th>n mounds</th>
<th>% of total</th>
<th>mounds/km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5</td>
<td>70.8</td>
<td>1,340</td>
<td>14.2</td>
<td>18.9</td>
</tr>
<tr>
<td>5–10</td>
<td>57.3</td>
<td>2,914</td>
<td>30.9</td>
<td>50.8</td>
</tr>
<tr>
<td>10–15</td>
<td>43.2</td>
<td>2,029</td>
<td>21.5</td>
<td>47</td>
</tr>
<tr>
<td>15–20</td>
<td>24.8</td>
<td>1,024</td>
<td>10.9</td>
<td>41.3</td>
</tr>
<tr>
<td>20–25</td>
<td>29.5</td>
<td>767</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>25–30</td>
<td>15.6</td>
<td>357</td>
<td>3.7</td>
<td>22.9</td>
</tr>
<tr>
<td>30–35</td>
<td>11.3</td>
<td>257</td>
<td>2.7</td>
<td>22.7</td>
</tr>
<tr>
<td>35–40</td>
<td>7.3</td>
<td>183</td>
<td>1.9</td>
<td>25.1</td>
</tr>
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<td>40–45</td>
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<td>190</td>
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<td>48.7</td>
</tr>
<tr>
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<td>1.4</td>
<td>86</td>
<td>0.9</td>
<td>61.4</td>
</tr>
<tr>
<td>50–55</td>
<td>1.3</td>
<td>67</td>
<td>0.7</td>
<td>51.5</td>
</tr>
<tr>
<td>55–60</td>
<td>2</td>
<td>133</td>
<td>1.4</td>
<td>66.5</td>
</tr>
<tr>
<td>60–65</td>
<td>2</td>
<td>73</td>
<td>0.7</td>
<td>36.5</td>
</tr>
<tr>
<td>total</td>
<td>270.4</td>
<td>9,420</td>
<td>100</td>
<td>41.3 (avg)</td>
</tr>
</tbody>
</table>

However, the elevation data provide several key points relative to mound distribution. First and most salient is the fact that the majority of mounds occur relatively close to sea level. A surprising number are located within the first 5 m asl, with many actually occurring at or below sea level. Nearly half of the mounds are located at or below 10 m asl, and three-quarters of all mounds are accounted for at or below 20 m asl (Table 3).

Table 3. Proportion of mounds occurring at or below 10 and 20 m above sea level.

<table>
<thead>
<tr>
<th>elevation</th>
<th>n mounds</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>at or below 10 m asl</td>
<td>4254</td>
<td>45.2</td>
</tr>
<tr>
<td>at or below 20 m asl</td>
<td>7307</td>
<td>77.6</td>
</tr>
</tbody>
</table>

The densest mound distribution within these lower elevation intervals is 50.8 mounds/km² between 5 and 10 m asl, significantly higher than the average 41.3 mounds/km². This is, not coincidentally, one the most densely occupied habitation zones on the island, both in prehistory and in the present. Most of the larger modern-day villages occur in this elevation interval, and nearly all of the density-based mound
“clusters” overlap with it at some point (discussed below). The great east–west travel corridor occurs within this elevation interval (discussed below).

5.2. Distance from coast

Distribution relative to island elevation is not exactly the same as distance from the coastline, though the pattern is mirrored in certain aspects. Distance from the coast provides a related but different way of looking at x,y distribution of mounds on Tongatapu.

Figure 47 illustrates the distribution of all mounds, not discriminated by type, relative to Tongatapu’s coast. These distances were calculated using the Near tool in ArcMap, and show the shortest possible distance from each mound to a single point along the coast (using 0 m asl as a proxy for coast).

Figure 47. Histogram showing the distribution of mound distance to the coast. Distance along x axis in m.
The histogram shows that the majority of mounds occur somewhere between approximately 100 and 1800 m from the coast, with relatively few more than 2 km from the coast. This pattern would not reject a null hypothesis of even distribution, as available land “shrinks” when one measures distance inland from all directions (360°). However, this pattern, coupled with the elevation data (Table 2), does appear to support the notion of the highest density of habitation being within 1 km of the coast and below 20 m asl. Table 4 further illustrates the proportion of mounds occurring at distances from the coast.

**Table 4. Distance of all mounds to coast.**

<table>
<thead>
<tr>
<th>Distance from Coast</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>within 200 m of coast</td>
<td>n = 358</td>
<td>(3.6%)</td>
</tr>
<tr>
<td>within 500 m of coast</td>
<td>n = 1923</td>
<td>(19.6%)</td>
</tr>
<tr>
<td>within 1000 m of coast</td>
<td>n = 4373</td>
<td>(44.6%)</td>
</tr>
</tbody>
</table>

Distance from the coast can be further interrogated by looking at mound heights. Figure 48 shows the relationship between mound height and distance from the coast. While mounds of all sizes occur throughout the island, there is a slight overall decrease in mound height as one moves inland. There are at least two explanations for this trend. First, it is easy to see that many of the tallest mounds occur close to the coast and near sea level, which certainly impacts the trend line seen in Figure 48. Second, as shown in the subsequent section, higher mounds tend to occur near higher mounds — that is, greater numbers and densities of mounds tend to produce higher average mounds. As the amount of land at distance from the coast and at increasing elevation decreases, the relatively smaller number of mounds means that they will tend to be shorter in height.

The pattern emerging through these data recalls Spennemann’s (1989:277) inference regarding density of settlement relative to the north coast of Tongatapu. Spennemann posited three settlement bands or “zones” of decreasing settlement density as one moves south from the north coast at sea level. The present data do not reject the notion, and further indicate that mound height also decreases as one moves south/inland from the north coast and lagoon. However, as the analysis of mound
clustering below indicates, the pattern of settlement density is overall more perpendicular than parallel to the north coast.

Figure 48. Chart showing the relationship between mound height and distance from the coast.

5.3. Mound height relationships

Perhaps unsurprisingly, while low mounds (<3 m) occur with similar frequency throughout the island, higher mounds (> 3 m) occur in greater frequency in areas with greater concentrations of mounds overall. The majority of the 3 m+ size class appear to be in central and eastern Tongatapu (Vaini, Lapaha, and Tatakanotonga districts), and are located within the largest and densest concentrations of mounds, particularly in the vicinity of Lapaha. Western Tongatapu has its share of large mounds, some exceeding 7 m in height, but these are more dispersed and are less likely to share a visual relationship.

On Tongatapu, mounds of exceptional height are probable indications of societal rank. Within clusters of mounds, it is reasonable to argue that the highest ones are associated with higher-status individuals; however, correlation of mound size, labour expenditure, and societal rank/status in Tonga has been debated (see Kirch 1980 and Cordy 1981). Comparison of mound heights between different regions of the island is more problematic. One cannot overlook the visual relationship that densely constructed
mounds have with one another — mound height, in other words, may be best judged on a local, case-by-case basis, rather than on an island-wide scale. Chronological factors, multiple successive building episodes, and assumed contemporaneity are potentially misleading in this regard as well. It is also clear that height, on its own, does provide a sufficient measure for relative status, given that certain known monuments (e.g., the Malae Kanokupolu, and even certain of the sprawling langi at Lapaha) are not remarkable in their height relative to other mounds in the surrounding area. What sets them apart is their overall volume, morphology, and the presence of adornments, such as the presence of cut-stone facing and paving. However, the spatial distribution of mound height classes across Tongatapu remains an important aspect of the overall picture, even if the relationships between mounds of different heights are best viewed as relative (i.e., height “begets” height).

I assessed the extent to which surrounding mound height influences the height of a given mound — in other words, I asked, “do higher-than-average mounds tend to be located close to other higher mounds?” To answer this, I employed a simple GIS buffering procedure to generate a dataset for hypothesis testing. First, I found all mounds on Tongatapu exceeding 4 m, this consisting of 192 mounds. I arbitrarily classified this sample as “exceptionally high mounds”. I then applied a 300-m buffer to each exceptionally high mound and extracted all of the other mounds occurring within the boundaries of these buffers (there are 2,942 mounds within the sample of 300-m buffers). I calculated the min/max, mean, median, and standard deviation of heights of all mounds in this sample. I then repeated the same procedure for two additional samples of 100 randomly selected mounds (Table 5). Figure 49 provides a visual example of this sampling procedure.

The descriptive statistics for these samples suggest a difference in the average mound heights within random 300-m buffers and within 300 m of exceptionally high mounds (boldface in Table 5). The median height of mounds in the latter category is 1.56 m.
Table 5. Descriptive statistics of samples used to assess mound height relationships.

<table>
<thead>
<tr>
<th>sample</th>
<th>sample size</th>
<th>n mounds within buffer</th>
<th>min height (m)</th>
<th>max height (m)</th>
<th>mean (m)</th>
<th>median (m)</th>
<th>standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>mounds over 4 m, 300-m buffer</td>
<td>192</td>
<td>2,942</td>
<td>0.61</td>
<td>10.42</td>
<td>1.91</td>
<td>1.56</td>
<td>1.11</td>
</tr>
<tr>
<td>mounds over 4 m, 300-m buffer (original &gt;4m mound removed from sample)</td>
<td>192</td>
<td>2,750</td>
<td>0.61</td>
<td>3.98</td>
<td>1.7</td>
<td>1.5</td>
<td>0.76</td>
</tr>
<tr>
<td>random sample #1, 300-m buffer</td>
<td>100</td>
<td>1,894</td>
<td>0.61</td>
<td>9.06</td>
<td>1.66</td>
<td>1.41</td>
<td>0.8</td>
</tr>
<tr>
<td>random sample #2, 300-m buffer</td>
<td>100</td>
<td>1,834</td>
<td>0.59</td>
<td>6.83</td>
<td>1.66</td>
<td>1.44</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Figure 49. A section of southwestern Tongatapu showing 300-m buffers encircling exceptionally high mounds (blue) and randomly selected mounds (red).
The high mound category is further subdivided in Table 5 by removing the original 192 high mounds, arriving at a new median of 1.5 m. The median heights of mounds in the two 100-mound random samples were lower, at 1.41 m and 1.44 m, while the overall median mound height on Tongatapu is 1.37 m. At face value, the trend appears to support the hypothesis that higher mounds tend to have a visual relationship with other high mounds.

5.4. Mound clustering

Mounds are a nearly ubiquitous feature of the Tongan landscape but dense clusters are present particularly in Vaini, Lapaha, and Tatakamotonga districts. In an apparent accordance with historical observations of a dispersed, plantation-style settlement pattern, the concentrations of mounds often occur far inland from the coast, suggesting, perhaps, the importance of dryland agriculture relative to coastal access, but probably even more indicative of the nature of the socio-political landscape.

Kernel density is a qualitative analysis that shows the relative density of points in a GIS. Using the points output from the iMound protocol (Freeland et al. 2006), I generated a kernel density isopleth or “heat map” to show where mounds were concentrated densely and where they were more dispersed (Figure 50). The result is a map that is intuitive to understand but provides no absolute statistical information.

Immediately apparent in Figure 50 is the dense and discrete clustering of mounds along the shoreline of the southwestern arm of the Fanga ‘Uta Lagoon, as well as the southern and eastern regions of the island. The area just to the east of Lapaha/Mu’a features one of the densest concentrations of mounds on the island, as does the area inland from Kolonga along the northeastern coast of the island.
Figure 50. Kernel density "heat map" showing relative concentration of mounds on Tongatapu.
Spennemann (1989:280) noted:

Within the assessed areas [cross-island survey transects], the mounds do not occur in village-like clusters, but are more or less randomly distributed. Thus a dispersed settlement pattern is indicated and we have to imagine that everybody lived in their own plantation. This pattern is similar to that observed by early European visitors.

The present data modify, rather than reject Spennemann’s observation. On a macro scale, mounds are certainly not randomly distributed. However, within each of the mound clusters, individual mound tend to have “breathing room”.

The minimum distance between mounds, even in densely mounded areas, seems sufficient that everyone could still have lived on their own small ‘api or allotment. Space existed between mounds for houses, gardening, and fencing. The use of space in these densely mounded areas may give some indication of the kind of space that was available to common people relative to what was available on the island.

The mound clusters are often separated by strips of land that are notably free of prehistoric earthworks. On the basis of survey data from a north–south transect of Tongatapu in the Ha’ateiho area, Spennemann (1989:302) noted:

Based on the present data, we could argue that the distribution of mounds does in fact represent three political/administrative clusters running from the lagoonal shore inland. Settlement sites would tend to be located away from boundary lines, thus creating the empty space between the units.

In some cases, linear ditch/embankments are present, transforming these apparent boundaries into visual, physical obstacles.

5.5. Hypothetical territories

In order to factor out “patternicity” (after Shermer 2008), the human tendency to recognize patterns in meaningless noise, I used a GIS statistical tool called optimized hot spot analysis, which uses the Getis-Ord Gi statistic to identify clusters of points and
assign them a z-score. The z-score represents the statistical significance of the clustering (at 90%, 95%, and 99% thresholds) with a random distribution as the null. Figure 51 illustrates the results of the Getis-Ord analysis. The pattern mirrors what is seen in the kernel density heat map, but provides sharper boundaries around significant clusters. The result is the identification of “hot spots”, where mound clustering exceeds a statistical threshold, as well as “cold spots”, where the absence of mounds is equally significant.

![Figure 51. Getis-Ord hot spot analysis showing the statistical significance of mound clusters on Tongatapu.](image)

Few of the cold spots are actually completely devoid of mounds, and some are explained by geographic or land-use factors. For example, the urban area of Nuku'alofa appears as a cold spot, likely because mounds have been levelled for residential development. The large, triangular cold spot along the northern coast of the western half of the island, in the vicinity of Puke and Fatai (Figure 51), is predominantly an inter-tidal flat, where only a handful of heavily eroded mounds remain. The blue areas in the narrow middle of the island, in the vicinity of Pea and Ha'ateiho, genuinely have fewer
and more dispersed mounds. Notably, the same is true of the Pelehake-Fua'amotu area of south-central Tongatapu, an area of interest for the origin of the Tu'i Tonga dynasty and the subject of a subsequent chapter in this dissertation.

In Figure 52 I have used the 90% threshold for hot spots to delineate 12 “hypothetical territories” that can be examined in more detail to determine their internal structure and external points of comparison. These “territories” are arbitrarily defined; however, from a historical perspective, they do tend to coincide with real political boundaries, as to be examined. Again, this is based on presence/absence of mound points, and does not distinguish based on mound type.

![Figure 52. Hypothetical territories based on statistically significant clustering.](image-url)
Table 6. Descriptive statistics for mounds within statistically defined hypothetical territories.

<table>
<thead>
<tr>
<th>territory</th>
<th>n mounds</th>
<th>median height</th>
<th>std dev</th>
<th>n &lt;2 m (%)</th>
<th>n 2–4 m (%)</th>
<th>n &gt;4 m (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>645</td>
<td>1.68</td>
<td>0.79</td>
<td>425 (65.9)</td>
<td>214 (33.2)</td>
<td>7 (1.1)</td>
</tr>
<tr>
<td>2</td>
<td>118</td>
<td>1.55</td>
<td>0.94</td>
<td>78 (66.1)</td>
<td>37 (31.4)</td>
<td>3 (2.5)</td>
</tr>
<tr>
<td>3</td>
<td>592</td>
<td>1.5</td>
<td>0.81</td>
<td>428 (72.3)</td>
<td>153 (25.8)</td>
<td>11 (1.9)</td>
</tr>
<tr>
<td>4</td>
<td>277</td>
<td>1.32</td>
<td>0.95</td>
<td>226 (81.6)</td>
<td>46 (16.6)</td>
<td>5 (1.8)</td>
</tr>
<tr>
<td>5</td>
<td>367</td>
<td>1.53</td>
<td>0.8</td>
<td>271 (73.8)</td>
<td>91 (24.8)</td>
<td>5 (1.4)</td>
</tr>
<tr>
<td>6</td>
<td>2207</td>
<td>1.47</td>
<td>0.88</td>
<td>1581 (71.6)</td>
<td>569 (25.8)</td>
<td>57 (2.6)</td>
</tr>
<tr>
<td>7</td>
<td>323</td>
<td>1.41</td>
<td>0.67</td>
<td>248 (76.8)</td>
<td>60 (18.6)</td>
<td>15 (4.6)</td>
</tr>
</tbody>
</table>

avg: 1.5 m  avg: 72.3%  avg: 25.8%  avg: 1.9%

<table>
<thead>
<tr>
<th>territory</th>
<th>n mounds</th>
<th>median height</th>
<th>std dev</th>
<th>n &lt;2 m (%)</th>
<th>n 2–4 m (%)</th>
<th>n &gt;4 m (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>375</td>
<td>1.33</td>
<td>0.75</td>
<td>302 (80.5)</td>
<td>65 (17.3)</td>
<td>7 (1.9)</td>
</tr>
<tr>
<td>9</td>
<td>66</td>
<td>1.25</td>
<td>0.7</td>
<td>54 (81.8)</td>
<td>11 (16.7)</td>
<td>1 (1.5)</td>
</tr>
<tr>
<td>10</td>
<td>53</td>
<td>1.2</td>
<td>0.66</td>
<td>46 (86.8)</td>
<td>6 (11.3)</td>
<td>1 (1.9)</td>
</tr>
<tr>
<td>11</td>
<td>34</td>
<td>1.33</td>
<td>0.79</td>
<td>26 (76.4)</td>
<td>7 (20.5)</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>12</td>
<td>62</td>
<td>1.56</td>
<td>0.82</td>
<td>49 (79)</td>
<td>12 (19.3)</td>
<td>1 (1.6)</td>
</tr>
</tbody>
</table>

avg: 1.33 m  avg: 80.5%  avg: 17.3%  avg: 1.9%

An east-west distinction is apparent in Figure 52 and Table 6, which I explore further in a subsequent chapter. Immediately apparent are the differences in size and number of mounds between eastern (1–7) and western (8–12) territories, where the former are larger and more coherent and encompassing units. Territories 1–7 also tend to have greater median mound heights and greater proportions of mounds in the middle height category (2–4 m).

5.6. Distribution of rectangular mounds

Up to this point, I have considered mound distribution based solely on presence/absence and have not distinguished between the mound types described in Chapter 4. I focus in this and in subsequent sections on the distribution of general mound types, beginning with the general distribution of rectangular mounds.

1 Median height for mounds island-wide is 1.37 m.
Rectangular mounds have a spatial distribution that differs from the overall pattern of mound clusters. In the histogram showing overall mound distance from the coast (Figure 47) overall mound density increased within the first roughly 500 m from the shoreline, then declined, with the majority of mounds occurring within 1800 m and very few exceeding 2 km from the coast. A different pattern emerges for rectangular mounds, as the histogram below (Figure 53) illustrates. Rectangular mounds occur most frequently near the shoreline, within the first 200–300 m, and decline precipitously moving inland. However, rectangular mound density increases once more between 2500 and 3500 m inland, a result of their unique distribution along an interior corridor in the western half of Tongatapu (Figure 54).

**Figure 53.** Histogram showing the distribution of rectangular mound distance to the coast. Distance along x axis in m.

Rectangular mounds are concentrated near the coast in central and eastern Tongatapu, and inland in the western portion of the island (Figure 54). Their distribution suggests a roughly linear east–west arrangement, which coincides with the probable route of the primary travel corridor that connected east and west Tongatapu.
Figure 54. Isopleth/heat map of rectangular mounds on Tongatapu, with likely route of the east–west Tongatapu travel corridor overlaid.

European explorers frequently commented on the extensive road/footpath system that connected different parts of Tongatapu and provided access to interior ‘api. George Vason, a missionary who lived on Tongatapu between 1797 and 1801, described and illustrated the extent of the bush roads that pervaded each corner of the island. His map (Figure 55), which is understood to be less an accurate cartographic representation of these roads and more a general impression of their prevalence, is nonetheless specific in its identification of a “Great Road through the Island”. The road travels east–west from the vicinity of Kanokupolu in Hihifo/Kolovai district, through the interior of western Tongatapu, along the southern coast of the Fanga ‘Uta Lagoon, and inland eastward toward Kolonga.
Modern roads follow the route of this old route in most places, except for some sections where a diverging path can be discerned in both LiDAR and aerial photo imagery, and the alignment of monumental features suggests the former route. In the central portion of the route, between the villages of Ha’ateiho and Lapaha, the old road largely exists beneath the modern Taufa’ahau Road. West of Ha’ateiho, the old road exists beneath the modern Loto Road, which travels northwest to Hihifo. East of Hoi, the old road runs roughly parallel to Taufa‘ahau Road as it extends toward Kolonga. In this section it is probably maintained as a footpath or bush road, and aerial imagery shows changes in field alignment relative to its position. The reconstructed route of the old road in Figure 54 is based on this combination of existing roads and remote sensing imagery.

In describing what remained of the Tu‘i Tonga capital at Mu’a, Gifford (1929:96) commented:
There is every indication that the old road did not follow the present course of the highway through Mua [sic]. Rather, it avoided the fortified area, passing south and east of the embankment and extending east and northeast to parallel the eastern margin of the row of langis.

Gifford further noted that the “new” road passed straight through what was once the great malaʻe, or public ceremonial space, of the Tuʻi Tonga, and that the grounds of the Catholic church had likewise encroached. Looking at a present-day map, it is easy to see how the alignment of smaller roads in Lapaha, running roughly parallel to the main highway, veer farther east as they approach what Gifford described as the “fortified area” around the Tuʻi Tonga residence. The course of the original corridor in this area has since been obscured.

The presumed antiquity of this travel corridor and its clear association with rectangular monuments further suggests that there was an element of display involved in the design and arrangement of these mounds. Cook (1785; quoted in Maude 1965:28), describing the Tuʻi Tonga capital at Muʻa, wrote:

. . . each having his house in the midst of a small plantation, with lesser houses, and offices for servants. These plantations are neatly fenced round; and, for the most part, have only one entrance. . . . Great part of some of these inclosures [sic] is laid out in grass-plots, and planted with such things as seem more for ornament than for use . . . There are some large houses near the public roads, with spacious smooth grass-plots before them, and unenclosed [sic]. These, I was told, belonged to the king; and, probably, they are the places where their public assemblies are held.

Cook’ description of the Tuʻi Tonga compound at Muʻa can be extrapolated to describe the enclosed compounds of lesser chiefs elsewhere on Tongatapu. Central to this settlement pattern is a principal residence fronted by a green, or malaʻe, encircled by either a fence or ditch or both (Figure 56; see Spennemann 1989:337 for an interpretation of this layout). Although these spaces were not public in the sense that they were accessible to commoners at any time, they were important locations of interaction between chiefs and commoners during civic or ceremonial events. The presentation of horticultural tribute, along with other activities reinforcing the social hierarchy, likely occurred in these spaces.
Figure 56. Illustration of fenced residential compounds, “Clôtures des Habitations”, 1827.
Published in 1833, from Dumont d’Urville’s 1826–1827 voyage on the Astrolabe. Artist’s note indicates that fences are between 5 and 7.5 feet high. From the New York Public Library https://digitalcollections.nypl.org/items/510d47da-78dd-a3d9-e040-e00a18064a99.

It is possible, given the distribution of rectangular platforms along the east–west travel corridor on Tongatapu, that these low, flat-topped mounds represent malaʻe upon which chiefs would receive guests and conduct public events. Their elevation above the level of the road would serve as a reminder of the elevated status of the owner/occupants; in other words, an architectural invocation of the mana/tapu concepts. It is interesting to consider the probable tension created when, by sheer necessity owing to their positioning along the road, commoners passed by these elevated platforms. The mana demonstrated by the physical presence of these chiefly symbols almost certainly invoked tapu behaviours of avoidance — perhaps requiring low-ranking people to pass along the opposite side of the road, or, as suggested by Cook’s observations, to avoid looking upon the structures and the high-ranking people atop them. This contradiction between the basic need to travel along ostensibly public roads and the social principles of avoidance would have served as a powerful daily reminder of the low position of common people.
5.7. Chiefly estates

Of all the high-ranking chiefs in Tonga, only 33 nopele (nobles) were created during the constitutional reforms of the nineteenth century (Marcus 1977; Völkel 2010:58). The status of nopele was enshrined in a form of landed aristocracy with inherited titles and tofi’a (Figure 10). While certain titles were modern creations, necessitating the partitioning and re-apportioning of lands to accommodate the newer gentry, others affirmed ancient lineages and preserved their lands according to widely observed boundaries. According to Gifford (1929:172), “These seem to include the ancient seats of the chiefs involved. In other words, George I [Taufa‘ahau Tupou I] merely confirmed the great chiefs in the holding of their forefathers’ fiefs.”

The tofi’a of modern nopele show remarkable accordance with the clustering patterns revealed by LiDAR (Figure 57). These boundaries postdate land reforms of the 1800s, which probably resulted in significant changes to the ancient pattern. And yet the divisions between certain tracts appear unchanged. For example, the boundary between the large tofi’a in the Lapaha area labelled as belonging to Tungi (titled successor of the Tu’i Ha’atakalaua lineage) and Kalaniuvalu (the titled descendant of the Tu’i Tonga lineage) follows the exact course of a very large ditch/embankment that begins at the Lapaha enclosure ditch and extends nearly across the island to the south shore (Figure 59).

Further evidence for the alignment of the great east–west road through the interior of western Tongatapu comes from the shared boundaries of estates belonging to Lavaka, Tu’iha’ateiho, Ma’afu, the King, Tupouto’a, Vaea, and Lasike. As Figure 57 illustrates, each of these estates is “fronted” by rectangular mounds, which occur on either side of the road and in combination with other features, such as round mounds and small encircling ditches.
Figure 57. Estates map and rectangular mounds overlaid on a heat map of mound clusters. Pink dots indicate individual rectangular mounds. The estates map was geo-rectified using ArcMap 10.4.
It is important to distinguish fully between the traditional system of land tenure pre-dating nineteenth-century constitutional reforms and the modern system that produced the mapped boundaries in Figure 57. As discussed in section 2.7, the largest territorial units on Tongatapu were evidently formed by ha’a, or groups of closely related chiefly titles and all those who were directly subordinate to them, organized under a major ruling chief (Völkel 2010:50). All land belong to the Tu’i Tonga, but hou ‘eiki (chiefs) held inherited tracts, which were in turn apportioned to lesser chiefs and commoners in return for horticultural tribute, military service, and corvée labour. Thus, commoners were entitled to nothing, gaining access to land only through the privilege of their relationship to a chief or by reward from services rendered. Similarly, although titled chiefs inherited rights to lands, those rights were technically subject to the whims of the Tu’i Tonga. By contrast, the constitution of 1875 organized commoners as “a small-holding peasantry subject to a centralized government administration composed of various departments and headed by cabinet ministers” (Marcus 1978:515). People were now entitled to land on an individual basis, with each Tongan male over the age of majority entitled to both a “town” and a “bush” allotment. The old chiefly hierarchy, once the basis for land delegation, was reduced in a constitutional sense to the limited group of nopele, the greatest chiefs of the old system, who retained estates/tofi’a with firmly defined boundaries. The relationship between nopele and the commoners who farmed their tofi’a became one of a landlord and a tenant.

It is arguably the overlap and contrast between these two systems that we see illustrated in Figure 46, where the old system of ha’a territories is represented by mound concentrations and the surveyed boundaries of the new system are overlaid. In central and eastern Tongatapu, the constitutional affirmation of the greatest chiefs’ authority is quite clear — mound clusters co-occurring the modern tofi’a of nopele such as Kalaniuvalu, the titled descendant of the Tu’i Tonga, Tungi, the titled descendant of the Tui Ha’atakala, and Luani and Tu’ipelehake, both high chiefs of the old order.

However, there are contradictory examples where the constitutional tofi’a do not co-occur with significant mound clusters. One example is that of Tu’iha’ateiho, a major chief of the Fale Fisi (House of Fiji). Several significant monumental platforms occur within Tu’iha’ateiho’s estate, including his burial mound at the shoreline of the western
arm of the lagoon, as well as the chiefly compound illustrated in Figure 37. However, there is no significant concentration of round mounds in the coastal or inland portions of the tofi'a. One possible explanation for this case is the relatively late instalment of the Tu'ihateiho title, which came into existence only in the seventeenth century, perhaps postdating the period of intense mound building.

The distribution of another archaeological feature type contributes to the emerging picture. As introduced in section 4.3, linear ditch/embankment features occur throughout Tongatapu, but are most commonly found in the central and eastern districts (Vaini, Tatakamotonga, Lapaha), where in many cases they form boundaries between mound clusters (Figure 58). Their co-occurrence with mound clusters does not, in this regard, seem coincidental. Given the alignment of mound clusters with tofi'a in this part of the island, it is unsurprising to see examples of ditch/embankments lining up closely with modern boundary lines.

As discussed in Chapter 4, I consider these linear features to be a phenomenon separate from fortifications, which were often round or square enclosures irrefutably used for defence from raids (Burley, Tuinukuafe, and Clark 2016). Most fortifications likely date to the period of civil war between the 1790s and the 1850s, although at least one fortification in Lapaha is significantly older (Clark et al. 2017). Efforts are underway to acquire radiocarbon dates for other fortifications on Tongatapu, some of which are suspected to pre-date the civil war (Clark pers. comm.; Parton et al. 2017). The linear ditch/embankments, however, have not been dated. They may prove older than or contemporaneous with the proliferation of nineteenth-century fortifications. Alternatively, they may prove to be simply linear defensive features, used in tandem with refuge forts as part of the military strategies of the day; albeit one has to question the logistics of defending boundaries as long as the Keli-'a-Pelehake in western Tongatapu (Figure 58).
Figure 58. Estates map and linear boundary ditches overlaid on a heat map of mound clusters.
Yet another contrast emerges between the western and eastern halves of Tongatapu. Associated as they tend to be with dense mound clusters, the linear ditch/embankments occur in much greater frequency and density in the eastern parts of the island (particularly Tatakamotonga and Lapaha districts), while enclosure fortifications are far more common in the central and western parts (particularly Kolovai and Nukunuku districts). Those forts that do occur in eastern Tongatapu include five small forts in the extreme south near Fua’amotu, two along the northeastern coast near Kolonga, and of course the two forts in Lapaha (the larger of the latter two I include in Figure 58 because of the linear element, “Fisi-Tea”, that extends southeast across two-thirds of the island’s width). Some 28 fortifications are found west of Vaini (Burley, Tuinukuafe, and Clark 2016; Clark et al. 2008; Clark et al. 2017).

A closer look at ditch/embankments in central-eastern Tongatapu shows just how closely some of them align with modern boundaries (Figure 59). Particularly evident is the definition of estates held by Kalaniuvalu by ditch sections. Some of these ditches align with modern (and probably prehistoric) roads. For example, the short section of ditch/embankment that neatly follows the eastern boundary between the estates of Tu’ipelehake and Tungi is in fact an embankment along the side of a modern road, as is the dividing line along the eastern boundary of the large Kalaniuvalu estate in the upper right of Figure 59. However, most of these features do not co-occur with modern roads. The ditch dividing the Tungi and Kalaniuvalu estates, oriented northwest–southeast and originating at the Lapaha ditch enclosure, is named Fisi-Tea and referred to by Clark et al. (2017:3) as a linear fortification. It forms a boundary between modern ‘api uta and runs roughly parallel to modern roads.
5.8. Distribution of pigeon-snaring mounds

As discussed in Chapter 4, pigeon-snaring mounds throughout Tonga have distinct spatial distributions. In northern Ha’apai, for example, pigeon-snaring mounds occur predominantly in protected areas on sparsely inhabited or uninhabited islands, away from large populations — areas that were presumably forested and therefore attractive to pigeons in the past (Burley 1996). On Tongatapu, they occur exclusively in areas near the coast (Figure 60; Table 7), often in concentrations of three or more, and generally dissociated with other feature types.
Figure 60. Histogram showing distribution of pigeon-snaring mound distance to coast.
Distance along x axis in m.

Table 7. Pigeon mound distance to coast.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>min</td>
<td>30.45 m</td>
</tr>
<tr>
<td>median</td>
<td>312.8 m</td>
</tr>
<tr>
<td>max</td>
<td>1442.49 m</td>
</tr>
<tr>
<td>within 200 m of coast</td>
<td>n = 12 (28.6%)</td>
</tr>
<tr>
<td>within 500 m of coast</td>
<td>n = 33 (78.6%)</td>
</tr>
</tbody>
</table>

Regarding the small number of mounds over 1 km from the shoreline in the histogram (Figure 60), these are predominantly mounds in the vicinity of Masilamea village, which occupy the paleoshoreline along northwestern Tongatapu (Figure 61). They occur on the periphery of arable land, overlooking mangrove and tidal flats to the north. Thus, even these mounds are considered “coastal” in their location (Figure 62).
In addition to pigeon-snaring mounds being off-limits, or tapu to commoners, the location of mounds away from areas of intensive land use or human populations may also reflect the ecology of the pigeons. The Pacific imperial pigeon is predominantly frugiverous (feeding on fruit and buds) and roosts, sometimes in large numbers, in high trees.

My conservative estimate for the number of pigeon-snaring mounds on Tongatapu is 42, of which at least nine are located at the Popua pigeon-snaring arena/complex (the dense cluster on the north-central peninsula east of Nuku'alofa), and all but four are in the western half of Tongatapu. This pattern contributes further detail to an apparent east–west dichotomy in mound types and concentrations on Tongatapu. They therefore constitute a relatively rare feature type, but one that has great significance for the interpretation of land use on Tongatapu.

Figure 61. Distribution of pigeon-snaring mounds (green dots) relative to general mound concentrations. Mound concentrations according to Getis-Ord Gi statistic (hot spot analysis).
5.9. Freshwater wells

Conical freshwater wells (*vaitupu*) are a distinct feature type in Tonga that relate directly to chiefly prerogative (Burley 1994:394–396). These conical depressions were excavated for the exclusive use of chiefs, giving their location relative to other site types special significance. Most are simple inverted cones dug to a depth that allowed access to the water table, which on limestone islands like Tongatapu lies beneath bedrock. Prehistoric *vaitupu* are difficult to discern from historic or modern wells or cisterns without intensive investigation or associated traditional histories. This makes wells the least certain feature type in LiDAR survey, subject to a significant degree of interpretive error (typically false positives).
However, based on generalized characteristics of \textit{vaitupu} as described by Burley (1994), I mapped all examples of depressions likely representing wells using hillshade imagery (Figure 63). Wells appear in hillshade imagery as inverted or reversed mounds (Figure 15).

![Figure 63. Distribution of freshwater wells or depressions (sky-blue dots) relative to general mound concentrations.](image)

The distribution of wells is probably partially based on the depth of the water table. The abundance of wells in Nukunuku district, in western Tongatapu, inland from the mid-Holocene paleoshoreline, likely reflects the availability of water at an accessible depth in this area. The same is likely true of the wells in the low-elevation areas of northeastern Lapaha district in the vicinity of Kolonga. However, there is also an indisputable co-occurrence of \textit{vaitupu} with mound concentrations in central-east Tongatapu, notably in areas without significant numbers of modern inhabitants (i.e., unlikely to be modern wells/cisterns). In these areas, \textit{vaitupu} are located well inland, within the centre or toward the southern limit of mound concentrations. \textit{Vaitupu} are not
restricted to low-elevation areas; clear examples of vaitupu in the Fuaamotu area, ~60 m above sea level, demonstrate that the topography of the water table broadly mimics that of the ground surface.

A pattern noted by Burley (1994) in Haʻapai was the co-occurrence of vaitupu and chiefly burial mounds, a phenomenon with at least 17 known examples in that island group. Well/mound associations are also present on Tongatapu (e.g., labelled “freshwater bathing well” in Figure 37). Some vaitupu have traditional names and stories associated with them. For example, an informant near Pea, Tongatapu believed that a daughter of an unspecified Tu‘i Tonga drowned in a small well (now overgrown and filled with refuse) on his ʻapi.

Without dedicated field study, the distribution of real or possible vaitupu must be viewed with scepticism. However, insofar as their distribution mirrors that of other known archaeological feature types, the pattern illustrated in Figure 63 can be taken as preliminary evidence of this phenomenon and an additional aspect of chiefly privilege on Tongatapu.

5.10. Fortifications

The oft-cited dispersed, plantation-style settlement pattern on Tongatapu underwent a dramatic shift beginning in the early nineteenth century and possibly earlier. Burley (1994) has shown that settlement nucleation was in fact the norm throughout much of prehistory in other regions of Tonga. However, there is broad consensus that on Tongatapu, the only significant densely populated areas were those associated with the paramount (i.e., Lapaha/Muʻa). It was not until political collapse and all-out warfare that significant numbers of people lived in organized villages, and it was at this time that the majority of fortifications (kolotau) are assumed to have been built. This assumption has proven unreliable in the case of the two fortifications associated with Lapaha/Muʻa, which date to the establishment of that political centre (Clark et al. 2008; Clark et al. 2017). Other fortifications have historical evidence that is either contradictory or lacking, and more may prove to predate the civil war of the early–mid nineteenth century (Clark pers. comm.).
Today, earthen *kolotau* are among the most visible archaeological features on the landscape. They are easy enough to recognize during field survey (Swanson 1968) and are rapidly catalogued using LiDAR (Parton et al.; Figure 64). Nearly every modern village has an associated *kolotau*, either nearby or encircling the village itself. Some represent permanent fortified villages, while others are likely “refuge” forts of the type common in Fiji (e.g., Burley, Freeland, and Balenaivalu 2016).

![Figure 64. Distribution of fortifications relative to general mound concentrations. Fort locations derived from Burley et al. (2016).](image)

*Kolotau* thus constitute a tangible link between prehistoric and modern land use, bridging the gap between the territorial priorities of the Classical Chiefdom and the constitutional monarchy. Their position on the landscape provides clues to understanding the dynamics of warfare on Tongatapu during this violent interval and the defensive priorities of the parties involved (Burley et al. 2016). While not a survey priority for this dissertation research, the locations of the 38 surviving Tongatapu *kolotau* are
mapped in Figure 64 to show how they relate, geospatially, to other monumental feature types. This spatial relationship is examined further in Chapter 7.

Of the 38 identified kolotau, 27 are located in the western or central districts of Tongatapu (Kolovai, Nukunuku, Kolofo’ou, Kolomotu’a, and Vaini districts). This distribution contributes further to a pattern of east–west differentiation on Tongatapu. In this case, the disparity is clearly linked to the specific conflicts that occurred in the western part of the island between the western chiefs of the Ha’a Ngata Motu’a and rivals from elsewhere (Burley et al. 2016:2). Areas in central and eastern Tongatapu with the densest concentrations of mounds tend to have fewer kolotau, possibly an important indication of the timing of mound construction relative to later developments. As discussed in Chapter 7, kolotau appear to have a fourth distinct spatial distribution (the first being generic round mounds, the second being rectangular mounds, and the third being pigeon-snaring mounds).

5.11. Chapter summary: Connecting the dots

In this chapter I have attempted to show the broad pattern of monumental feature distribution on Tongatapu, beginning with a look at the totality of mounds and then discriminating by the feature types as described in Chapter 4. I summarize some of the broad themes here, but discuss their significance in more detail in subsequent chapters.

Anthropogenic features are ubiquitous on Tonga’s largest island, but are not evenly or randomly distributed. Overall, mounds tend to be clustered together in ways that demonstrate the importance of boundary maintenance through time. The presence of certain feature types in some areas, and not others, is a critical line of evidence for reconstructing boundaries, land use, and the manifestation of socio-politics on the landscape.

Viewing the LiDAR-based mound dataset without any prior knowledge of Tongan society or history, one would tend to arrive at a hypothetical territorial scenario like that illustrated in Figure 52: settlement nodes, or concentrations, based on nothing more than
the statistical significance of mound clustering. One would perhaps arrive at the conclusion that eastern Tongatapu was more heavily populated in the past.

If the opposite were true — if one were to approach the situation from the perspective of Tongan ethnohistory, lacking any knowledge of the distribution of archaeological sites, one might predict a pattern like the one illustrated by these isopleth maps: concentrations of features following the lines of anciently known boundaries, with the densest and largest features along the shoreline of the lagoon and along the great road that connected the east and west ends of the island. That the two datasets, the archaeological and the ethnohistoric, appear to align so neatly is affirming but also calls for great care and scrutiny.

The data presented in this chapter demonstrate the likelihood that large kinship or corporate groups, possibly ha’a, divided Tongatapu into a series macro-territories, which were then divided and allotted down to the level of the ‘api, which itself is difficult to discern archaeologically. It is perhaps no accident that Gifford (1929) recorded 16 extant ha’a groups in the early 1920s and that the archaeological distributions suggest somewhere in the realm of 12 hypothetical territories.

In central and eastern Tongatapu, these territories tend to begin near the shoreline of the Fanga ‘Uta Lagoon and run inland. The ubiquitous round mounds, the majority representing burials, are densest near the water’s edge. Three-quarters of all mounds occur less than 20 m above sea level, and nearly half of all mounds are located within 1 km of the water. Taller mounds tend to be located closer to sea level, and there is a clear function of mound height related to surrounding mound height.

Viewing all mounds as presence/absence points presents an interesting enough picture, but when looking at distribution by type, that picture becomes much more complex, with different mound types presenting vastly different distributions. Rectangular mounds, which differ in their proportions but all suggest the gravity of elevated social status, tend to occur along the lagoonal shore and along a well-travelled east–west corridor that lies today, for the most part, under Taufa‘ahau Road. The more common variation of these platforms, those that are not langi tombs, have a spatial distribution that is in several respects unrelated to the overall distribution of mounds. They may have
been civic/ceremonial sites within the residential compounds of chiefs. More ephemeral sites, such as *vaitupu*, add another layer of land use complexity.

The co-occurrence of rectangular platforms, linear ditch/embankment features, and the boundaries of modern-day *tofi'a* (inheritance) reinforce the idea that boundary maintenance in Tongan (pre-)history is a standalone subject worthy of in-depth investigation. The fact that so much of the archaeological evidence appears to line up with ethnographic descriptions, historical events, and modern territorial indications strongly suggests that the archaeological data can be read to interpret at least late-prehistoric territorial organization, and possibly earlier.

The somewhat puzzling contrasts between eastern and western Tongatapu, including the density and presence/absence of certain feature types, has been noted before (Spennemann 1989). An explanation for these differences will necessarily draw on multiple lines of evidence: historical records from explorers like Cook, who noted a settlement disparity between eastern and western Tongatapu in the late-eighteenth century; traditional historical data that explain the rise and fall of certain chiefly titles associated with different regions of the island; and archaeological data that may, one day, provide a chronological record of mound construction in different areas.
Chapter 6.  Toloa: first capital of the Tuʻi Tonga

6.1. Emergence of the Tuʻi Tonga dynasty

According to tradition, the first of some 39 successive Tuʻi Tonga was ʻAhoʻeitu, son of the god Tangaloa ʻEitumatupuʻa and a human mother. ʻAhoʻeitu was installed by his father as the ruler of Tonga, replacing an earlier line of kings (Bott 1982:90; Gifford 1929:52). Through genealogical estimations, ʻAhoʻeitu is thought to have reigned sometime around AD 950, at a time when archaeologists believe mound-building and monumental construction began in Tonga.

While details of ʻAhoʻeitu’s life are remembered in traditions, specifics concerning his immediate successors are lacking. The balance of the first nine Tuʻi Tonga are known in name only. The historical record picks up again during the reign of Momo, the tenth Tuʻi Tonga, who is said to have moved his residence from somewhere in south-central Tongatapu to Heketa, on the northeastern coast. At Heketa, the first known use of stone slabs between AD 1320 and 1390 and the construction of an elaborate ritual/political compound demonstrated the growing authority of the dynasty. The Haʻamonga ʻa Maui stone trilithon is interpreted as both an entrance to the ceremonial centre of the site and as a metaphor for the act of carrying a burden, pointing to the ʻinasi ceremony in which participants carried tribute suspended from poles resting on their shoulders (Clark and Reepmeyer 2014). Traditions indicate that Tongan influence and hegemony in the southwestern Pacific began around this time. Under the twelfth Tuʻi Tonga, Talamata, the royal residence was once again moved, this time to Lapaha/Muʻa, where immense stone-faced tombs of unprecedented scale indicate the pinnacle of ritual and secular authority. Extensive land reclamation and a harbour/wharf complex cemented the dynasty as a maritime polity with ocean voyaging and diplomacy at its core (Clark et al. 2008).
The exact location of the first Tuʻi Tonga residence, or “capital”, has eluded historical and archaeological research. Gifford’s (1929:52) record indicates that Momo moved to Heketa from “central or southeastern Tongatabu [sic]”. Bott (1982:92), in recording the historical knowledge of Queen Salote Tupou III, says the “early Tuʻi Tonga lived inland on the island of Tongatapu, roughly in the region where Toloa is now”. The move may have been in response to the aggressiveness of the people of the Talafale/Tuʻifaleua lineage, the descendants of one of ‘Ahoʻeitu’s half-brothers, today represented by the Tuʻi Pelehake. This provides some indication of the general area where ‘Ahoʻeitu’s early descendants may have lived. The place name Toloa itself is merely recorded as a district on Tongatapu (Gifford 1923:225).

While there is no reason to suppose that the first nine Tuʻi Tonga necessarily resided in a single place, the area around Toloa (Figure 65) has traditionally been regarded as the first “capital” of the dynasty. Archaeologically, we may expect to find early monumental indications of the incipient authority recorded in these traditions, dating to AD 1200 and perhaps earlier. New evidence of monumental structures at Tupou College Toloa, gleaned from LiDAR imagery, strongly suggest that there was indeed a first “capital” and that its architecture reflects an early evolutionary step toward the degree of monumentality that is evident at the later sites. In this chapter, I describe the extraordinary features at Toloa and discuss their context in Tongan and Oceanic prehistory.

6.2. Previous research

At least two attempts have been made to find archaeological evidence of a Tuʻi Tonga capital near Toloa. Spennemann (1989:439) describes how three separate areas were surveyed to record monumental architecture in the vicinity of Toloa: his own surveys at Fuaʻamotu Airport and Beulah College in Vaini, and Jens Poulsen’s earlier survey (as cited in Spennemann 1989:440) at Tupou College Toloa east of the village of Pelehake (Figure 66). However, Spennemann did not conclude that one or the other was the exact location of a first Tuʻi Tonga capital. Cut-and-dressed stone, like that later used at Heketa, is not evident in the area.
Spennemann’s (1989:443) expectations for the “shadowy” first Tu’i Tonga site were that “if there is a first capital place somewhere in the Toloa area, it consisted of a conglomeration of earthen mounds, which may have had retaining walls of wood, like those reported for some mounds at the time of early European contact”. Spennemann (1989:513) continues,

Certainly there is no archaeological evidence to differentiate Toloa decisively from other parts of Tongatapu, as there is with the other traditional capitals and the clusters of high-ranking, slab-faced monuments… Chronologically, it fits nicely into the period between our archaeological identification of the emergence of differentiation (house mounds, quarrying of beachrock) and the traditional date for a capital place at Heketa… In an evolutionary sense it would have the expectable characteristics, being a conglomeration of unfaced earthen mounds, perhaps with beachrock slabs used for vaults within the burial mounds…

Locationally, the emergence of Toloa makes sense… Toloa was clearly a land-based, Tongatapu-focused political centre, supported by horticulture. In this it fits well with the propositions of power accompanying the surplus production of horticultural food, which could be judiciously deployed during periods of food shortage. It should be stressed, however, that there is certainly no archaeological evidence for this in the Toloa case…

Poulsen’s survey of Tupou College, as reported by Spennemann (1989:441), revealed a significant cluster of features within and adjacent to the campus, including
round and rectangular mounds, some with borrow ditches (Figure 66). It is this concentration of mounds that I investigated using LiDAR imagery and field reconnaissance.

Figure 66. Sketch map of mounds surveyed at Tupou College Toloa in the 1960s. Figure reproduced from Spennemann (1989:441), in turn based on Poulsen's fieldnotes.
6.3. LiDAR mapping

Spennemann’s expectations of a conglomeration of earthen mounds fits well with what Poulsen mapped at Tupou College and with what is visible using the present LiDAR dataset. Visual evidence from LiDAR maps confirms the existence of a concentration of unusually large mound features in and around the campus at Tupou College, particularly on its eastern flank (Figure 67; Figure 68).

Hillshade imagery (Figure 68) shows that several of the mounds mapped by Poulsen are in fact square or rectangular in plan shape. However, the general alignment and orientation of features and Poulsen’s identification of small ditches or trenches broadly matches what survives today and is visible in the LiDAR.

Although Vaini and Tatakomotonga districts in south-central Tongatapu feature some of the densest concentrations of mounds on the island, particularly near the coast, the inland cluster near Toloa is isolated and unusual for its alignment of round, square, and rectangular mounds (Figure 69). The longest rectangular mound, in the centre of the cluster and directly adjacent to campus buildings, is nearly unparalleled on Tongatapu for its length, although it is quite low. At 105 m long, it has a length/width ratio of roughly 2:1. It is surpassed in these measures only by the long rectangular feature just 3 km north at Malapo, which is 250 m long and has a length/width ratio of 5:1 (Figure 40). Several other large mounds are located around the periphery of this cluster, and the Mala’e ‘Atuli ki Langi, traditional burial mound of the Tu’i Pelehake and purported burial place of the first six Tu’i Tonga (Clark 2015:5), lies approximately 1.8 km to the east.
Figure 67. Aerial orthophoto of Tupou College Toloa and adjacent fields and forest.
Figure 68. Hillshade image of earthworks at Tupou College Toloa.
6.4. Site reconnaissance

Field survey of Tupou College Toloa was carried out on July 25, 2015. Using iPad LiDAR field imagery, we navigated to the southeastern corner of the school grounds. The campus abuts a portion of the Toloa Rainforest Reserve, a small area reserved for the conservation of endemic Tongan forest species. The longest rectangular mound feature lies just southwest of a service road on the edge of the campus within a planted stand of hardwood trees (Figure 70). It is low, barely exceeding 2 m above the surrounding terrain. Recognition of this gentle rise as a constructed mound would be difficult if not impossible without the aid of LiDAR. Poulsen apparently failed to recognize it as one continuous platform, mapping several small mounds in the area instead.
Figure 70. View southeast toward the central rectangular platform at Toloa. Currently part of the Toloa Rainforest Reserve on the margin of Tupou College Toloa.

The relatively well-defined edges of the mound in the imagery are almost indiscernible amidst the leaf litter of the plantation. The lack of visibility is true for two smaller rectangular platforms immediately south of the larger feature, though their southern margins are clearly defined by linear, cigar-shaped ditch running perpendicular to their orientation.

Moving east out of the hardwood plantation and into a neighbouring field, other features associated with the complex are more easily identifiable (Figure 71). Looking east, several large square/rectangular and round mounds dot the rolling landscape, currently a mixture of fenced pasture and coconut plantations. In the absence of coconut trees, the small height of land on which the Malaʻe ʻAtuli ki Langi sits would surely be visible.
In the LiDAR imagery, a relatively straight ditch/pathway feature is seen originating in the central mound complex and continuing south toward Fua'amotu Airport. It was clear upon inspecting this feature that it was not recent in origin.

6.5. Site characterization

The features mapped and visited at Tupou College Toloa may have been part of a series of important sites in the area, including the concentration of mounds to the south near the airport, to the north near Vaini, and the Mala‘e ‘Atuli ki Langi to the east. However, the features at the college are distinct in their design, scale, and arrangement, obvious outliers in an area of Tongatapu with no shortage of mounds. It is clearly a significant monumental precinct in an area of great mythological significance — a clear
rejection of Spennemann’s (1989:513) assertion that no archaeological evidence exists to distinguish Toloa from any other area. While there are significant differences between this site and the later Tu'i Tonga centres of Heketa and Lapaha, there are certain aspects of its layout and construction that could represent early forms in the evolution of the dynastic political centres.

The site consists of at least seven rectangular or square platforms and 15 or more round mounds with associated ditches and borrow trenches (Figure 72). The mounds are arranged in a roughly north–south alignment and the orientation of the rectangular platforms runs parallel to this alignment. To the north of the central complex and on the western side of the college campus, a series of particularly large round and square mounds, some with modern residences built on top, occur in apparent congruence with the overall layout. No stone appears to have been used to face the sides of any of the mounds at Toloa, though the possibility of stone slab burial vaults cannot be discounted. Notably, no stone slab burial vaults were encountered in the Mala‘e ‘Atuli ki Langi during its preparation for the interment of Tu’ipelehake in 2014. The undertakers did encounter coral sand, a clear indicator of previous burials (Burley pers. comm.). Stone slab burial vaults likely post-date the move to Lapaha.

6.5.1. Rectangular mounds

The rectangular platforms at Toloa, designated TL-1 through -7, represent the largest concentration of such features on Tongatapu. The significance of the Toloa mounds is not in their heights, which are relatively modest in the Tongatapu context, but in their lengths and widths. Metric estimates from LiDAR show the relative proportions of the seven rectangular or square mounds in the site core (Table 8). The original volume of the mounds has been estimated using a volume calculation formula for a truncated four-sided pyramid. The estimation relies on the assumption that the platform edges would have been more sharply defined when they were first built, and that, lacking enduring retaining walls, they have slumped and eroded over time. The estimated original volume of TL-2 is 10,356 m³, making it far more massive than any other mound in the immediate vicinity.
Figure 72. Sketch map of Toloa site centre based on LiDAR mapping and pedestrian survey.

Table 8. Descriptive statistics for rectangular platforms at Tupou College Toloa.

Measurements from LiDAR-derived DEM. Estimated original volume based on assumed geometrical proportions prior to erosion using a volume formula for a truncated rectangular pyramid.

<table>
<thead>
<tr>
<th>mound</th>
<th>length (m)</th>
<th>width (m)</th>
<th>height (m)</th>
<th>est. original volume (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL-1</td>
<td>60</td>
<td>50</td>
<td>1.75</td>
<td>3,272</td>
</tr>
<tr>
<td>TL-2</td>
<td>105</td>
<td>50</td>
<td>2.5</td>
<td>10,356</td>
</tr>
<tr>
<td>TL-3</td>
<td>48</td>
<td>30</td>
<td>2</td>
<td>1,840</td>
</tr>
<tr>
<td>TL-4</td>
<td>67</td>
<td>39</td>
<td>4</td>
<td>7,860</td>
</tr>
<tr>
<td>TL-5</td>
<td>40</td>
<td>32</td>
<td>2.9</td>
<td>2,407</td>
</tr>
<tr>
<td>TL-6</td>
<td>49</td>
<td>42</td>
<td>2.5</td>
<td>2,875</td>
</tr>
<tr>
<td>TL-7</td>
<td>78</td>
<td>46</td>
<td>3.5</td>
<td>8,513</td>
</tr>
</tbody>
</table>
Using the same volume formula, the monumental tomb Paepaeotelea, the largest stone-faced mound at Lapaha, has an estimated volume of only 3,293 m$^3$ (estimate based on plan measurements from Clark et al. 2016 of 41.5 x 28 m). Paepaeotelea also contains approximately 700 tonnes of stone, making it by far a larger labour investment; however, this crude volume comparison gives a sense of the scale of the presumably earlier mounds at Toloa.

Two additional square, flat-topped mounds are located on the western flank of the college campus, opposite from the central cluster of mounds (outside the area mapped in Figure 72). These, too, appear to line up with the general orientation of the site, which presents the possibility that the original centre of the site was where the college buildings now stand, flanked to the east and west with monumental square and rectangular platforms.

6.5.2. Round mounds

There are at least 17 round mounds in the vicinity of the Toloa site centre. That these are burial mounds seems likely, particularly given that few if any of them have flat tops or platforms (mounds with particularly steep slopes or rounded tops are indicated by double circles in Figure 72). Some are in very close proximity to the central platforms, which suggests their function as burial places for key family members or perhaps retainers/matapule. One tight group of six smaller mounds is found at the end of what appears to be a path or road originating in the site centre and travelling northeast.

The surrounding countryside is notably free of mounds/field monuments. In fact, only one mound, a round-topped, oblong, roadside feature exists between the Toloa site centre and the Mala’e ‘Atuli ki Langi to the east. Whether the isolation of the Toloa site centre from other concentrations of mounds is indicative of a chronological disparity (i.e., the dense mound concentrations post-date Toloa and its abandonment) is unclear.

6.5.3. Trenches and paths

The two pathways mapped in Figure 72 do not appear, from aerial imagery and field reconnaissance, to be modern roads. They run northeast and southeast of the site
The oblong, cigar-shaped trenches mapped in Figure 72 follow a familiar pattern in their association with rectangular platforms: throughout Tongatapu, it is common for there to be one or more short, wide ditches in direct association with rectangular mounds. They often occur perpendicular to the orientation of the mound (i.e., running along its width, rather than length). The simplest explanation is that they are “borrow” ditches from whence the sediments used to build the mounds are derived. However, the uniformity of their width and depth, as well as their apparent preservation as depressions (why were they not filled in?) suggests some additional function, perhaps as receptacles for ceremonial refuse, or, less probably, as cisterns or water retention features. Archaeological excavation exposing the profile of one of these ditches would confirm whether they have been deliberately kept “open” and whether there is any significant concentration of material culture within them. Such features are absent at Heketa and Lapaha, though the ditch/embankment surrounding Lapaha could have served additional functions as those suggested here.

6.5.4. Comparison with other Tuʻi Tonga sites

The purposeful arrangement of monumental platforms at Toloa recalls the notion that the capitals of Heketa and Lapaha represent chiefly residential/ceremonial compounds writ large. Spennemann (1989:450) reconstructs Heketa as a fenced chiefly residence with the typical residential and sepulchral architecture executed on a grand scale and with the key distinguishing attribute of stone used in its construction. All three sites have roughly orthogonal layouts, suggesting a level of formality or coordination in site planning (cf. Michael Smith 2007).

Apart from the use of stone, a key distinguishing feature between Heketa and Toloa is the orientation of rectangular mounds relative to the direction of their alignment. At Toloa the mounds appear to be arranged lengthwise parallel to the site alignment, while at Heketa the mounds are perpendicular to their alignment; in other words, the
Heketa mounds appear to be built in front of one another, while the Toloa mounds appear side-by-side and facing the same direction. The arrangement at Heketa is at least partly explained by the purported functions of the mounds, which include one langi and at least seven other mounds or platforms which are said to have been residential mounds (paepae) or sitting mounds (ʻesi) of the Tuʻi Tonga, his family, and retainers (Clark and Reepmeyer 2014:1248). The functions of the mounds at Toloa are unknown.

At Lapaha, the side-by-side arrangement of mounds appears to return, with an orientation and “presentation side” that clearly looks out toward the lagoon, suggesting that visibility from the perspective of incoming canoes was the intention (Figure 73). Other colossal structures around the entrance to the lagoon, including the pyramid at Nukunukumotu Island and adjacent pigeon-snaring arena at Popua, support the hypothesis that water’s-edge monumentality was a priority as the chiefdom expanded and consolidated its influence.

6.6. Toloa: Discussion

The origins of the Tuʻi Tonga dynasty lie somewhere between mythology and historical fact. Place names and geographic features around Tongatapu are associated in the traditional histories with important events from that time: the places where the demi-god ʻAhoʻeitu ascended and subsequently descended from the heavens; the locations of his mother’s liaisons with his divine father. Architecture associated with the paramount Tuʻi Tonga dynasty, at sites like Heketa and Lapaha, presumably have morphological and functional attributes derived from earlier evolutionary forms. I propose that the unique and probably ancient mound site at Toloa is the best candidate for a “first capital”, a hypothesis that admittedly will require further lines of evidence.
Tongan social transformations ca. AD 1000 occurred in the context of important developments elsewhere in Oceania, including the colonization of East Polynesia around the same time, and parallel social transformations in other West Polynesian societies. The simultaneous emergence of clear indicators of social complexity in West Polynesia and the first major Oceanic explorations in nearly two thousand years may not be a coincidence. In Tonga, we assume that the proliferation of earthworks signifies the emergence of a class structure dividing hou ‘eiki (chiefs) and tu’a (commoners). New traditions of monumental architecture emerged, including round mounds and rectangular platforms, initially without the use of stone. The consolidation of authority by a limited number of high chiefs, exercising their new prerogative through the commissioning of monumental structures, may signal status rivalry as a result of resource stress or increasing competition over land (Kennett and Winterhalder 2008). Goldman (1970:545; cited in Kirch 1984:206) described the transition that occurs as kin-based societies evolve into territorial chiefdoms: "Kin groups bud, branch, and unfold. Territorial groups
are created by chiefs. They express human agency. In this expression, they assert a radically new social idea.”

Exploration and settlement of central and eastern Polynesia began just after AD 1000 and was essentially complete within two to three centuries (Wilmshurst et al. 2011). It is important to consider that, among the “push” and “pull” factors influencing this rapid and purposeful migration, was the socio-political situation in Tonga and Samoa, the presumed homeland of these explorers. The appearance of monumental architecture associated with events dating as early as AD 950 suggests that Tongan society had developed well beyond the presumed egalitarianism of early Ancestral Polynesian Society. Early social complexity in Tonga and its earliest archaeological correlates are an important topic of inquiry that has seen relatively little dedicated research. However, as Kennett and Winterhalder (2008:93) point out, social developments in Tonga and West Polynesia at this time form the “conceptual source of hierarchical social structures” that emanated into central and eastern Polynesia.

The inherently dynastic and expansionistic nature of Polynesian social organization meant that junior lineages were faced with the decision to either accept their subordinate place in society, to compete and strategize within the dominant social system, or to leave and establish new dynastic lineages elsewhere. In Tonga, the appearance of monumental ceremonial structures ca. AD 950 indicates the arrival of an ideology that enshrined social difference — a development that subsequently occurred in central and eastern Polynesian island groups in the centuries following their colonization (Kahn and Kirch 2011). This was no doubt an elaboration of pre-existing conditions; a society that constructs earthen platforms exceeding 10,000 m³ for elite activities is one that already understands and observes the difference between a chief and a commoner. Thus, Toloa may be regarded as proxy evidence for the increasing social competition that caused a group (or groups) of sailors to probe the eastern horizon in search of new beginnings — the “hierarchical subjugation and despotic control of land [that] stimulated population dispersal” (Kennett and Winterhalder 2008:93).

It may be presumed that these social transformations accompanied an increasing population. As Burley (1998:367) points out, the “assumption” of population growth in
the middle portion of the Tongan chronology is supported by conservative estimates that point to available agricultural land being occupied and/or controlled no later than 1100–1300 BP. Thus a “full” landscape at the time of renewed oceanic exploration and the establishment of hierarchical socio-political structures seems likely. Kirch (2017:276) rejects demographically deterministic explanations of social change in the Pacific, arguing that a growing population may be a necessary condition but is not a prime mover. The social, political, and economic conditions on Tongatapu ca. AD 1000 are difficult to determine, but it may be that a combination of these factors, in addition to technological advancements in sailing technology, led sailors to explore and settle further east than ever before.

The location of this unusual collection of large mounds accords with traditional histories that place the first Tu‘i Tonga somewhere in east-central Tongatapu, in the vicinity of Pelehake and Toloa. The site is located well inland from the lagoonal shoreline and outside of the mound clusters identified in Chapter 5. Square and rectangular earthworks, clear referents to social rank later in prehistory, occur throughout central and eastern Tongatapu. However, nowhere outside of Heketa and Lapaha are there significant groupings of such platforms. The particular arrangement of mounds at Toloa evokes that of later Tu‘i Tonga sites. The size and orientation of the mounds demonstrates the ability of powerful chiefs to command a large labour force and the importance of civic/ceremonial display in the continual affirmation of that power.

Clark and Reepmeyer (2014) connect the architecture and layout of Heketa to the introduction of the kava ceremony, the ‘inasi (first fruits) tribute ceremony, and the reed dart-throwing game sika ‘ulutoa. One wonders whether the long, low platforms at Toloa, or the open spaces that front them, could have served similar civic or ceremonial purposes. Heketa is associated with the god Hikuleo and is known as the site of the first ‘inasi ceremonies that brought offerings from around Tonga. This does not, however, preclude the possibility that earlier ceremonies involving tribute and redistribution occurred elsewhere, such as at Toloa. The ostensible “presentation side” of the Toloa mounds could have fronted a ceremonial green/plaza, or mala‘e; as is the case at Heketa, such an area would be difficult to recognize archaeologically (Clark and Reepmeyer 2014:1255).
Alternatively, the Toloa platforms themselves could represent elevated *malaʻe* or civic/ceremonial spaces. With a platform surface area exceeding 3500 m², the massive TL-2 mound could have accommodated large gatherings, or activities such as *sika ʻulutoa* that would have required open, level space. *Malaʻe* as a term has origins in Ancestral Polynesian Society, and has a diversity of uses in modern Polynesian languages. As Kirch (1984:63) notes,

> The Proto-Polynesian term *malaʻe* [implies] the existence of communal assembly grounds, though these were probably little more than open yards where religious rites and community feasts were held. (Such open spaces continued to form a part of West Polynesian settlement patterns, whereas in East Polynesia the *marae* was developed in the direction of elaborate and frequently megalithic religious structures.)

Rabone (1845:162), a Wesleyan missionary in Tonga, recorded “*malae*” as “a green; a grass plat; a circus”. The *malaʻe* as a “ceremonial precinct” does not necessarily imply the construction of a platform; arguably the most important *malaʻe* in the Tongan polity, that which fronted the residence of the Tuʻi Tonga in Muʻa, was little more than a fenced, manicured lawn. *Malaʻe* in Tonga have the historically documented function of public meeting spaces where civic and ceremonial events and feasts took place. As I suggested in Chapter 5, the rectangular platforms that seem to line the major roadways of Tongatapu may have functioned as civic/ceremonial spaces, rather than house platforms, for which there is little evidence in Tongan history. They generally lack the specifically religious function of East Polynesian *marae* temples, which generally consisted of an enclosed court and a raised altar at one end (Kirch 1984:268). The more expressly religious nature of East Polynesian monumental architecture was, nonetheless, an effort by political elites to “institutionalize social hierarchies and political status” (Kahn and Kirch 2011:93).

Events that occurred on the platforms may also have included the installation of chiefly titles by the Tuʻi Tonga (Marcus 1977:227). Title installations later in time had ceremonial components (*pongipongi*) that involved a large presentation and redistribution of kava and food. During the classical chiefdom years, the establishment and division of inheritable titles was a critical competitive strategy that allowed the paramount to deflect competition, particularly from aggressive junior lineages. The
Tongan elite also encouraged rivals to direct their ambitions abroad (Aswani and Graves 1998). Thus, the preservation of the Tuʻi Tonga lineage was accomplished, in part, by establishing an ideological structure in which chiefly ambitions could be quelled through decree and strategic positioning. The early establishment of a civic/ceremonial centre at Toloa may have been one element of this ideological strategy, some physical location where potential competitors were enervated through the proliferation of inheritable titles and the granting of tofia. Construction of a steep-walled fortification at Lapaha less than 400 years later indicates that, even then, “political centralization in Tonga was likely to have been contested” (Clark et al. 2017).

Regardless of exactly what occurred on the platforms at Toloa, their size and apparently formal layout suggest a formalization of chiefly institutions at this time. The idea that the primary monumental features at the first Tuʻi Tonga capital are elevated plazas for elite display and sacred or political activities, rather than for burial, is one of the critical points of contrast between this site and the later capitals. Of the three “capitals”, the almost exclusively sepulchral architecture at Lapaha most clearly reflects the importance of legacy in death, or “architecture that materialized the genealogy of the elites” (Clark 2015:1). By contrast, only one mound out of eight at Heketa is classified as a langi, or burial place of a Tuʻi Tonga. Pre- and proto-historic chiefly residential compounds throughout Tonga generally incorporated both residential areas and associated burial areas/architecture. Crucially, Toloa is associated in both space and time with the Malaʻe ʻAtuli ki Langi (Figure 74), the reputed burial place of the first six Tuʻi Tonga. The site centre at Toloa is roughly 1.8 km from the Malaʻe ʻAtuli ki Langi, which could indicate the desire for more of a physical separation between residential and burial spaces at that point in time. The two sites should thus be considered elements of a single complex of elite structures representing early attempts to consolidate chiefly authority on Tongatapu.

While the earthworks at Tupou College do not appear to incorporate stone, their significant proportions (Table 8) suggest that early paramounts had both the prerogative and incentive to commission works on a monumental scale. Whether the Toloa mounds represent “accretionary development” of social status or purpose-built “materialized ideology” (Clark and Martinsson-Wallin 2007:31) would be better understood through
careful excavation and dating of architectural phases at the site. Archaeological investigation at Toloa, perhaps using ground-penetrating radar (cf. Clark et al. 2016:1041) and test excavations, is required to determine whether the platforms contain burials or other functional indications.

In order to confirm the association between Toloa and the emergence of social complexity in Tonga, it will be crucial to acquire radiocarbon dates that conclusively place the initial construction of one or more of the mounds in the interval AD 1000–1200. There is no reason to assume that Toloa would have been totally abandoned after the move to Heketa; evidence for the continued use of the mounds at Toloa post-dating AD 1200 would be unsurprising given the significance of the site in the Tongan social order. Therefore, a careful dating strategy will need to be employed in order to distinguish the “architectonic” (Clark and Martinsson-Wallin 2007) and chronological phases of the site.

Figure 74. Malaʻe ʻAtuli ki Langi, near Pelehake, Tatakamotonga district, Tongatapu.
The genealogy and mythology of the early Tu’i Tonga dynasty provides a road map for the interpretation of early monumental centres in Tonga; yet it also leaves us with a fairly simplistic, unilinear view of the march toward paramount chieftainship. Obscured, perhaps, by the narrative of the single dynasty, growing in authority through time, is the necessarily “messy” business of conflict, competition, and disunity that attends the transformation of any society into one that reveres a single person at its apex. Do we assume, for example, that the appearance of unprecedented monumental architecture at Toloa represents a true consolidation of authority on Tongatapu, and/or throughout the rest of the archipelago? There were doubtless other chiefly lineages that could have competed with the nascent ‘Aho’eitu dynasty. To what extent does the traditional narrative of the rise of this lineage obscure, or subsume, the political ambitions of competing kin groups?

Also worth exploring is the question of site abandonment. The traditions recall that Momo moved his residence to Heketa, where the evolution of monumental architecture continued with the advent of stone slab facing. Was this a peaceful, deliberate move, or was it in response to social, demographic, or military pressures in south-central Tongatapu? There is the suggestion, provided by Bott (1982:92), that the Tu’i Tonga residence was moved due to aggression from members of the Talafale/Tu’i faleua lineage of the Pelehake area. (Gifford 1923:225). Perhaps the decision to re-locate to Heketa, with jagged rocks and pounding surf at its back, was made with defensive considerations in mind.

Having characterized this monumental site with as much detail as the present data provide, I return now to Tongatapu as a whole and discuss the implications of the broader geospatial patterns described in Chapter 5. The focus here on one, early monumental site provides a productive context for modelling the development of the monumental landscape over subsequent centuries.
Chapter 7. Discussion

In this dissertation I have laid out a method for mapping and categorizing archaeological features associated with the Tongan Classical Chiefdom. I have described trends in the spatial distribution of specific feature types, and in doing so I have touched upon a range of themes that connect the archaeological record with the ethnohistorical picture of Tonga before contact. In this chapter I focus on what I believe to be the most salient themes and discuss them in relation to an emerging understanding of Tongan landscape history. This “big picture” encompasses roughly the last 1,000 years, from the origins of land divisions to the nucleation of settlement on Tongatapu (Figure 75).

7.1. Burial mounds: distribution and implications for socio-political structure

The best available evidence suggests that the vast majority of generic mounds on Tongatapu are burial mounds, probably community cemeteries (Figure 76; Stantis et al. 2015). Large concentrations of relatively small, generic mounds clearly represent the geographic distribution of lower-ranking people in both life and death — there are simply too many mounds for them to contain only the remains of chiefs (Spennemann 1989:329). However, the delineation of such concentrations through physical barriers is an indication of chiefly prerogative over both the land and people contained therein. Burial places were “associated with (‘owned by’) specific kin lines, an important basis for chiefly organization” (Earle 1997:163).
Figure 75. The “big picture”: One thousand years of land use and monumental construction on Tongatapu.
Our understanding of mound chronology and construction is relatively poor (Spennemann 1989:283). The only Tongatapu mounds outside of Lapaha that have been securely dated are from ‘Atele, these dating between 500 and 150 years BP (Stantis et al. 2015). Mound building is generally thought to have begun some time during the Formative Period (ca. 1500–750 BP; Burley 1998a:365; Davidson 1979), making the ‘Atele mounds relatively recent in age. The usual assumption is that the majority of mounds in Tonga were built after AD 1200, with mound construction rapidly diminishing in the nineteenth century (Clark 2015; Spennemann 1989:320; Stantis et al. 2015). As was pointed out in Freeland et al. (2016:70), with an estimated 10,000 mounds on Tongatapu,

This suggests that an average of 14 mounds were built annually on Tongatapu during a mound construction phase that lasted seven centuries. Given the relatively small surface area of the island (259 km$^2$), this is a strikingly dense built landscape (approximately 39 mounds/km$^2$).

The reality is that the rate of 14/year probably varied considerably over the centuries. Moreover, the construction of specific types of mounds was chronologically constrained. Pigeon-snaring mounds, for example, were not likely constructed until the middle years of the chiefdom period and have a *terminus ante quem* sometime in the
late eighteenth century. The collapsed chronology of mound construction hinders our ability to analyze specific monuments in spatio-temporal context. However, the accumulation of mounds in specific places over what is safely assumed to be at least 700 years tells us something on its own: that land divisions on Tongatapu have ancient origins and that structural elements of Tongan culture resulted in the maintenance of boundaries over time.

There is an inescapable cultural logic that links land and people. As previously discussed, the term *fonua* means “land, homeland, and the people on the land” (Bott 1982:170). As discussed in section 5.7, the broad distribution of generic mounds on Tongatapu may reflect *haʻa* kin groupings. I make no claims regarding the constitution or territorial organization of specific historical or extant *haʻa*. Rather, I employ the term heuristically in order to connect the broadest patterns of archaeological phenomena with Tongan social organization at its highest structural level.

During the Classical Chiefdom, there were three sets of *haʻa*, derived from each of the three paramount lineages (Tuʻi Tonga, Tuʻi Haʻatakalaaua, and Tuʻi Kanokupolu). The placement of each *haʻa* and their constituent socio-political groups (*kainga*) in the social order was predicated on the rank of their founding ancestor, and was ultimately reckoned down from the paramount Tuʻi Tonga line. This ramage-type nested hierarchy arguably had important implications for the regional organization of the population of Tongatapu. However, regardless of their size, mounds on the landscape defined “owned space, controlled by emerging leaders in the political economy” (Earle 1997:166).

7.2. Indications of status

Traditional Tonga was among the most hierarchically stratified societies in Oceania. Social status was relative — each individual held a unique rank relative to their family members, their wider social group, and society at large. Rank and status determinations were based on a complex system of birth order, gender, inherited title, and occasionally, achieved eminence through actions in life (Urbanowicz 1979:236). However, the smooth gradation in rank was truncated, abruptly and permanently, by the distinction between *houʻeiki* (chiefs) and *tuʻa* (commoners). According to Latukefu
This distinction was so elemental that chiefly birth constituted the sole precondition for entry into Pulotu, the island after-world to the west.

The landscape of Tongatapu records the accumulated evidence of some 1,000 years of this chief-commoner dichotomy. This multi-layered palimpsest shows generalized patterns of landscape use over time, but also includes important nodes, such as the early chiefdom capital at Toloa. Social difference and inequality were at the root of traditional Tongan socio-political organization; they are therefore critical explanatory factors in the form and distribution of monumental architecture on Tongatapu. In addition to monumental architecture, specialized production produced a “wealth economy” — requisite symbols of membership in the chiefly class (Kirch 2017:284). Chiefly authority was materialized in the exchange of prestige goods, typically organic items like ngatu bark cloth (Figure 77), fine mats, exotic feathers, and sailing craft. None of these are particularly visible in the archaeological record. Grave goods were few and were generally perishable. Archaeologically, therefore, we are left with the mounds as indicators of social status.

Figure 77. Women preparing ngatu bark cloth in Lapaha, Tongatapu.
In identifying ideology as a source of power in nascent complex societies, Earle (1997:143) makes an important distinction between the ideology of the ruling class and that of the broader culture: non-dominant social segments have their own ideologies that exist in opposition to the social order. It is through the strategic use of ideology, manifest in the form of “ceremonies, symbols, and monuments”, that would-be elites differentiate themselves, out-compete rivals, and recruit low-ranking members. Successful political consolidation involves persuading all segments of society to buy in to an ideological paradigm — something that evidently happened in Tonga sometime between the construction of the platforms at Toloa and the arrival of the first European visitors in the seventeenth century. The fundamental assumption I make in this dissertation is that rank, status, or a combination of the two, are reflected in the monumental structures commissioned by and for individuals. Monuments — earthen mounds, in this case — are important modes of non-verbal communication, conveying the genealogical sanction of a lineage and its founding ancestor. Taken together, the distribution, size, and morphology of mounds therefore represent at least a partial picture of how inherited rank and real authority were manifest on the landscape. They are the materialization (Earle 1997:151) of Tongan socio-political ideology.

As monuments accumulate on the landscape, they begin to resemble a model of society. Subsequent generations of monument builders and users both negotiate and capitalize on the existing monumental landscape. The labour investments of earlier builders could be seen as a form of landscape capital (or “landesque capital”; Erickson and Walker 2009; Kirch 2017:282) that could be maintained or expanded upon by the current inhabitants for social or political purposes. The term is generally reserved for permanent landscape modifications like terraces or irrigation canals that confer intergenerational advantages for agricultural productivity. On Tongatapu, agricultural intensification was predicated on systematic seasonal rotation of crops and carefully timed fallow periods rather than the construction of such features. Investment in landscape capital was instead focused on materializing the genealogical and ideological structures that cemented rights to land and to human labour.

Relative indicators of monument status in Tonga include size and complexity, rectangularity, and location relative to natural and cultural features. With respect to
location, status is conveyed through centrality in some cases (monumental platforms along the primary east–west thoroughfare, proximity to political centres) and through remoteness in others (pigeon-snaring mounds removed from densely settled areas, perhaps built on the edges of vaotapu). The positioning of monuments associated with specific titles may be compared, in a metaphorical sense, to the physical positions taken by individuals during formal gatherings:

The relative rank of individuals is visualized in seating arrangements, particularly in the kava circle, but also in the house, both at meal times and on other occasions (Gifford 1929:115) ... in the formal kava circle everyone has a definite seat (166).

The highly structured seating arrangement and serving order in the kava circle of the Tu’i Kanokupolu, for example, reflects ancient genealogical affiliations (Collocott 1927). Anyone seated out of place is privately reprimanded and asked to move. Attention is paid even to the spacing between guests in the circle (Gifford 1929:166). Centrality and proximity to the ranking member is based on a complex system of rank and traditional specializations, including, for example, the hereditary role of the chief Ata as facilitator and moderator of the Tu’i Kanokupolu’s kava circle.

It is not uncommon in global prehistory for monuments to have been located in prominent areas, including along travel routes (Falconer and Redman 2009:5). In Bronze Age Greece, for example, the location of funerary monuments on the landscape was more significant than their morphology or physical prominence. Elite tombs were instruments of display that were used to make claims on the past, and their specific location was a crucial element of creating and re-configuring “mnemonic landscapes” (Galanakis 2011). Schreiber (2009:78) notes that “... states, and occasionally smaller groups, accomplish large, visible labor-intensive, and durable great projects, permanently (or nearly so) altering the physical and cultural landscape”.

In Tonga, the notion of “great projects” is scalar, owing to the infinitely relative gradations in social rank. The location of elite monuments, whether burial mounds or ceremonial platforms, along travel routes, must have obligated low-ranking passers-by to engage in some form of reverence or genuflection. Just as individuals were required to register their inferiority through the act of moemoei, the touching of the soles of a chief’s
feet (Gifford 1929:118), it seems likely that roadside indications of status necessitated either avoidance or deferential acknowledgement — a daily reaffirmation of social difference.

Monument size, measured in width, height, or volume, is a clear indication of the resources and labour available to the individual commissioning the construction. However, as Clark (2015:5) showed, monuments associated with early state emergence, even at Heketa, are unremarkable in their proportions. What distinguishes monuments at the second capital is the use of cut and dressed stone, which signals both the ability to compel or coerce significant labour for a project, as well as the probable existence of specialist craftsmen. The platforms at Heketa, and the Ha’amonga ‘a Maui trilithon, are thus more energy expensive than anything preceding them, a trend that would continue up until the construction of langi Paepaeotelea. Clark et al. (2016:1050) suggest that upwards of 600 people, or 3–4% of the population of Tongatapu, may have been required to move the largest stone block of that structure.

In distinguishing between high-level (cosmological) meaning and middle-level (political power) meaning in ancient urban planning, Michael Smith (2007) noted that design elements like symmetry, axiality, and plazas form the interplay between these levels of significance. Whatever their significance in a cosmological sense to the people who built and used the structures, they can be viewed in an archaeological context as expressions of political theatre that drew upon meanings now lost to time and culture change.

Thus, although scholars may not know the specific symbolism and high-level meaning of, say, a particular temple or palace, we can nevertheless use information on the sizes, forms, and locations of ancient structures to infer something about the power of the state, its control over labor, and the place of commoners within society; these are all middle-level meanings. Irrespective of the specific religious goals of ancient rulers and builders, many architectural and spatial features of ancient cities served to communicate middle-level meanings to various audiences… (Michael Smith 2007:34–35).

The central places of the Tu’i Tonga dynasty are represented archaeologically by dense concentrations of mounds and, at Heketa and Lapaha/Mu’a, the presence of rectangular and stone-faced langi, which were exclusively used for the burial of Tu’i
Tonga and their families. These centres functioned as both ritual and administrative nodes during state emergence and expansion (Clark and Reepmeyer 2014; Clark 2016). However, monuments of considerable size and complexity exist outside of these central places, as do significant concentrations of smaller mounds. The sheer size of some mounds outside of political centres shows that subordinate chiefs commanded extraordinary power over their kainga (clans/extended families) and/or ha’a (confederated social group). While tribute was known to flow to the political centres of the state during ‘inasi or local first-fruits tribute ceremonies (polopolo), it is clear that corvée labour not the sole entitlement of the paramount.

The best example of this phenomenon is the distribution of pigeon-snaring mounds: occasionally massive and built using large blocks of stone, the sia heu lupe of Tongatapu demonstrate chiefly entitlement at its utmost (Figure 78). The pigeon-snaring “arena” at Va’epopua, comprising a vast complex of sia heu lupe, ‘esi sitting mounds and canoe landing platforms, is the most famous example of this phenomenon on Tongatapu (Spennemann 2016; Figure 79).

Figure 78. Four pigeon-snaring mounds north of Fatai, Nukunuku district. These mound sin close association may constitute a second “pigeon-snaring arena” in addition to the one at Va’epopua, east of Nuku’alofa.
Pigeon snaring first required the construction of a platform, drawing on a large labour pool to do so. These platforms were often elaborate and incorporated large stone blocks in their construction. The location of the platforms away from human populations was itself a demonstration of exclusivity. The act of snaring, though poorly understood, is likely to have involved a good deal of spectacle, and possibly had competitive and/or ritual elements. It was a fundamentally non-economic activity, divorced from subsistence, which required the participation of a number of subordinates.

Figure 79. Sia 1 at the pigeon-snaring arena at Va‘epopua. The mound is partially concealed by vegetation. The stones in the foreground are part of one of several stone causeways crossing the mudflats to the ramps of Sia 1.

Finally, the flesh of pigeons was strictly tapu — off limits to anyone other than hou ‘eiki. Under the modern land-use regime, sia heu lupe are located in marginal environments: brackish tidal flats, overgrown, swampy forests, and wind-beaten cliffs, far from any significant population centres. In the fifteenth century AD, however, these would have been places of preternatural significance, imbued with mana. They are the clearest cases of physical social segregation outside the chiefly political centres.
Otherwise generic round mounds occasionally have distinguishing features that may indicate ownership or use by elite individuals. For example, mounds with ramps (Figure 80; Figure 81) could reflect the performative aspect of burial. A greater proportion of mounds may have had ramps in the past; today only two examples are clear in the LiDAR imagery.

![Figure 80. Round mound with ramp (centre), near Longoteme, Vaini district.](image)

Ramp is on the southwest face.

Large, elite construction projects like pigeon-snaring mounds raise questions about the availability of labour during a given agricultural season. Traditional Tongan agriculture was broadly organized around an intensive system of shifting cultivation, fallow, and inter-cropping, with yam production being the central focus of a thirteen-month calendar (Pole 2015). Critical times during the agricultural year, particularly the yam harvest, may have precluded non-essential mound building or other corvée obligations. Burial of important persons, however, probably took precedence over other activities, with both *matapule* and *tu'a* performing special funerary duties, including the preparation of the grave (Gifford 1929:196–203). Still, economic feasibility may have dictated that monumental construction, too, followed a seasonal rhythm.
Figure 81. Round mound with ramps (centre), near Fuaʻamotu, Tatakamotonga district.
The mound has one ramp on the north face and two possible ramps on the south–southwest face.

As discussed in Chapter 2, rank and status were separate and sometimes incongruous concepts. Kin-based rank determination was not the sole factor in determining social authority: as Gailey (1987:48) notes, “Contradictory ranking principles created a situation where claims to others’ labor [sic] had to be justified through the establishment of higher rank in the eyes of the society.” In Gailey’s view, the exchange of valuables (traditional wealth, or koloa), produced and managed by women, constituted a critical component in this demonstration of social difference. It is my contention that high-ranking monuments represent nodes on the landscape that facilitated these ritual activities and elite exchange. The physical permanence of earthen mounds and platforms tied these practices to specific places and substantiated the use-rights (to both land and labour) of local ranking families.

While consumption of status goods like exotic lithics, feathers, fine mats, and ngatu was an important marker of elite social belonging, the core economy of Tonga was horticultural and essentially redistributive. Tribute that made its way up the political hierarchy largely consisted of perishable goods such as yams and pigs, which were
generally redistributed following ostentatious ceremonial tribute event like ‘inasi. Material wealth wasn’t accumulated and conspicuously consumed as such. Instead, status was conveyed and reproduced through behavioural norms and class-exclusive activities. Hou ‘eiki were defined by their cultural capital, their position in society demonstrated not just through the consumption of status goods, but by their privileged access to spaces and activities that were strictly tapu to commoners.

7.3. Boundaries and boundary markers

The study of boundaries is a traditional theme in the archaeology of Oceanic chiefdoms (e.g., Kirch 1988; Ladefoged and Graves 2006; Stevenson 2002; Wallin and Martinsson-Wallin 2007). Whether marked or not, boundaries are a critical element of the Tongan archaeological landscape. The distribution of mounds and other features reveals unambiguous empty spaces, or “cold spots”, phenomena that are equally interesting and informative as densely mounded spaces. As previously discussed, land demarcation was often accomplished by building woven fences or planting living fences and hardwood tree species (which in turn provided the additional economic advantage of being linear horticultural features). However, in some cases, particularly in central and eastern Tongatapu, land-holding chiefs took extra measures to mark the boundaries of their fonua, signalling in a way that conveyed the permanence of divinely source authority who, and what, belonged within and without.

Kirch’s (1988) landmark inventory of late prehistoric monuments on Niuatoputapu (a northern outlier of the Tonga group) established twelve chiefly estates, radially positioned around the island, on the basis of the distribution of stone-faced mounds and associated features. Lacking the current LiDAR dataset, Spennemann (1989:278) hypothesized that territorial and/or administrative boundaries on Tongatapu could be deduced by looking at the spatial distribution of sites, and that ideally, such boundaries would be further demarcated with permanent constructions of some sort. With the revelation of mound concentrations and linear boundary features, we now have evidence for a late-prehistoric territorial settlement pattern in the form of both site distribution and physical boundary demarcation.
Details about the timing of these linear constructions, relative to other feature types on the landscape, are unclear. The significant enclosure ditch at the capital of Lapaha has been shown to date to at least the early fourteenth century AD, and possibly had a function as a water conduit (Clark et al. 2008). The majority of other ditches have been associated with defensive earthworks of the nineteenth century, though few have been investigated in detail and the defensive utility of the longest ditches is questionable.

For example, the ditch referred to by Swanson (1968:22) as Keli-ʻa-Pelehake (lit. “Pelehake’s ditch”) roughly encloses an area of 6–7 km\(^2\) (Figure 45). McKern (1929:87) reported that this construction was an attempt by Tuʻi Pelehake, a powerful chief based in eastern Tongatapu, to create a fortification across the whole width of Tongatapu in the early-nineteenth century. How Tuʻi Pelehake was able to construct this ditch system from the opposite side of Tongatapu is unclear. The enormous length and discontinuous nature of the barrier raise the question of whether it was ever truly defensible. However, the practice of dividing tracts of land with empty space or visible boundaries clearly has significant time depth, and is likely related to the desire by titled chiefs to affirm their status and holdings. The meaning and function of linear ditches may have changed over time, as was the case with prehistoric linear ditches in Wessex, England (Bradley et al. 1994). In the case of the Keli-ʻa-Pelehake, the notion of an island-wide “fortification” may be more metaphorical, or symbolic, than martial.

The Keli-ʻa-Pelehake is much larger but in many ways similar to a ditch system recorded by Burley (1994) on the island of Lifuka in Haʻapai. The royal estate of Toumuʻa encompasses roughly 0.18 km\(^2\) and is partially surrounded by a linear ditch/embankment. Like many of the Tongatapu ditches, linear ditches in Haʻapai are not always continuous or even very deep. Some are little more than elaborate fencelines:

... the site is unlike any other refuge fortification in Tonga. It has an enclosure nine times larger than any other of the Haʻapai forts, and the linear distance of its perimeter is more than 2 km. The ditch and mound is also discontinuous. Along the east and southern ends it is well developed, being up to a metre high. On the northern edge it is ill-defined in areas and, along the western side, a 360-metre section seems missing altogether. From its size and configuration, it must now be concluded that this feature functioned predominantly in a symbolic role, one visibly affirming property boundaries and one assigning these boundaries a degree of permanence not afforded by the more typical fences of
interwoven bush or mats. The fact that at least a portion of this feature follows an existing road edge underscores its interpretation as a boundary mechanism (Burley 1994:400).

Like the Toumu’a boundary, some of the linear features on Tongatapu run adjacent to or underneath existing roads. Roads and pathways themselves were an important part of the plantation settlement pattern of the Tongatapu backcountry, serving as both travel conduits and boundaries between ‘api and fonua.

On the other hand, some ditch/embankment features have characteristics that support an interpretation of being defensive instalments. For example, one series of relatively short ditches in the vicinity of Malapo and Holonga, in Vaini district, has the appearance of a European-style redoubt, with right-angled protrusions or “bastions”, perhaps intended to provide a wide field of view for defensive gunfire (Figure 82). Together with nearby ditches to the east and west, this possible “linear” fortification may have been part of a series of defensive fallback positions when facing attackers from the west.

The question that remains regarding this and other linear features is their date of construction relative to the recognized enclosure fortifications on Tongatapu. Many or all linear ditches may prove to have an eighteenth- or nineteenth-century provenance, which would accord well with the devolution of the traditional political hierarchy and increase in inter-polity competition and conflict at that time. Whether linear boundary markers are ancient or modern, they confirmed or fortified pre-existing boundaries that centuries of mound construction had already made unmistakable.
7.4. The east-west dichotomy on Tongatapu

As previous research (Spennemann 1989) and the feature distributions presented in Chapter 5 indicate, there are substantive differences in the surface archaeological record of eastern and western Tongatapu. Where one draws the line between “east” and “west” necessarily fluctuates. In this dissertation I have referred to “western”, “central”, “east-central”, and “eastern” Tongatapu, or I have used the names of modern administrative districts (Figure 4). The distinctive attributes of east and west appear to border around the narrow portion of land south of the western arm of the lagoon in the vicinity of Haʻateiho. Thus “western” Tongatapu is broadly conceived as beginning at the widening of the landform west of this point and containing the modern districts of Kolofoʻou, Nukunuku, and Kolovai.

Spennemann (1989:285) also identified this east-west dichotomy and asked whether it was a function of settlement density or time depth. In other words, did more
people live in central and eastern Tongatapu throughout prehistory, or did people live there for longer?

... I am inclined to interpret the observed difference in mound density as a function of settlement time, rather than settlement density. It is highly unlikely that the plantations in the eastern district were about half the size of those in the western district, which would be the case if the settlement density were twice as high, so that the chronological argument makes more sense.

Spennemann’s reasoning was based on mound densities, inferred from survey transects, and demographic calculations that estimated the population of Tongatapu at various intervals. What Spennemann lacked was a detailed picture of how mound types varied from one region of the island to the next, specifically indications of chiefly status.

Based on the assumption that groups of mounds can be taken as proxies for population and intensity of settlement (at least during the centuries of active use of mounds for burial), the pattern of dense mound construction in central and eastern Tongatapu would suggest a higher or denser population in those areas, relative to the western portion of the island. These are areas associated with the rise of the Tu’i Tonga dynasty, first in south-central Tongatapu at Toloa, then in far-eastern Tongatapu at Heketa, and finally at Lapaha on the southeastern shore of the Fanga ‘Uta Lagoon. Spennemann (1989:286) noted this east–west difference, and suggested that inland settlement in eastern Tongatapu had a greater time depth, owing to favourable environmental conditions for horticulture. However, soil quality (mapped by Gibbs 1976) does not appear to vary significantly enough to support a major east-west distinction, nor do locations of soil units have any particular accordance with the spatial distribution of late-prehistoric archaeological sites. The time-depth hypothesis remains as the best explanation until radiocarbon dating provides a more detailed chronology.

The differences between eastern and western Tongatapu actually begin with observations made by Cook during his second (1773) and third (1777) voyages, when he described the western district as the most densely settled and the eastern being thinly settled or somewhat abandoned. In the absence of a way to verify Cook’s assessment, we must view this notion with some scepticism. However, assuming there were indeed greater numbers of people in the west during the contact period, this could
indicate a movement of people from west to east at some earlier point in history, and it suggests that the most intense period of mound building, in the east, predates the late-eighteenth century.

It is worth noting the growing influence of the Tuʻi Kanokupolu during this same time period. Based geographically in Hihifo (western district), this once junior, subordinate lineage eventually eclipsed the Tuʻi Haʻatakalaua, the first secular hau ruler, and ultimately the Tuʻi Tonga, resulting in an upheaval of the centuries-old power structure. The first Tuʻi Kanokupolu, Ngata, was the son of the sixth Tuʻi Haʻatakalaua, Moʻunga-ʻo-tonga, and a Samoan woman who brought with her many Samoan retainers. In the mid-seventeenth century, Ngata and his Samoan retinue became established in the villages now known as Kanokupolu and ʻAhau, located in the far western end of Tongatapu. The Malaʻe Kanokupolu, burial place of Ngata and the third Tuʻi Kanokupolu, Mataeletuʻapiko, is the first rectangular stone-faced tomb to have been constructed on Tongatapu outside of the elite precinct of Lapaha since its establishment in the fourteenth century (Clark 2016:12). Ngata’s investiture resulted in a proliferation of landed ʻeiki and matapule titles based in the west. Any differential settlement noted by Cook during his visits may have reflected this shift away from the traditional power centres in central and eastern Tongatapu. By the late-eighteenth century, the Kanokupolu line greatly outweighed the importance of the Haʻatakalaua, still based at Lapaha. The Tuʻi Haʻatakalaua at the time of Cook’s visit was Maealiuaki, the last to be formally appointed to this title.

Beginning in 1800, a group of western chiefs avenged the assassination of the twelfth Tuʻi Kanokupolu through brutal raids of the central and eastern district. Their war culminated in the massacre of the people of Poha, a fortified village in interior eastern Tongatapu (Latukefu 1974; Statham 2013:55). Thus, a relatively low population in the east by the nineteenth century is at least partially explained by conflict and forced relocation. A map of Tongatapu drawn in 1827 (Figure 83) illustrates a series of villages in the central and western districts, including the fortified villages of “Bea” (Pea), “Manahaou” (Manahau, a triple-ring fortification near modern-day Fatai village), and “Hifo” (Hihifo, Kolovai village). The southern and eastern portions of the island are apparently vacant. The great east–west road connecting these settlements terminates in
Lapaha/Mu’a. A map drawn a generation earlier shows the road extending to the northeastern coast (Figure 55). Note in Figure 83 the canal access from the shore of the lagoon to the village of Bea (Pea).

Implicit in the time-depth hypothesis for explaining the east–west dichotomy on Tongatapu is a relative chronology for monumental construction. The assumption is that eastern portions of Tongatapu preserve evidence of an earlier land-use and monumental building regime, as well as higher density of sites resulting from longer use, while the west shows changes in society and land-use in the centuries leading up to contact.

The east–west dichotomy appears to reinforce a difference in settlement chronology in different areas of the island, with the profusion of rectangular platforms, so dominant in the west, perhaps postdating the population movement westward. The clustering of rectangular mounds in western Tongatapu along the route of the ancient east–west highway suggests their importance in visual display, perhaps signalling to passersby on their way to present tribute to the Tu’i Tonga during the ‘inasi “first fruits” ceremony (Clark and Reepmeyer 2014). Importantly, rectangular mounds tend not to follow the clustering pattern of the more numerous circular and sub-rounded mounds. Rather, their distribution appears to reflect a distinct and independent arrangement, with an emphasis in most cases on road frontage.

Again, an east–west distinction becomes apparent with an almost total lack of recognizable pigeon-snaring mounds located in eastern Tongatapu, and a significant number (at least three-dozen) located in the west. It is here, however, that a time-depth explanation for east–west differences becomes more difficult to support. Proliferation of indications of chiefly status in the west, perhaps with new chiefly titles associated with the ascendant Ha’a Ngata (Kanokupolu lineage), may indicate later settlement. But this late expansion into the west must be reconciled with the demise of chiefly pigeon snaring. It may be that early titleholders based in the west were responsible for the construction of the sia heu lupe. However, if the assumption is true that sia heu lupe were largely out of use by the late-eighteenth century (Burley 1996:424), then their presence throughout western Tongatapu possibly pre-dated the significant western expansion posited by the time-depth hypothesis.
Figure 83. Detail from map of Tongatapu, “Plan de L’Île Tonga-Tabou”, 1827. Published in 1833, from Dumont d’Urville’s 1826–1827 voyage on the Astrolabe, based partially on observations made by earlier explorers and missionaries. From the New York Public Library https://digitalcollections.nypl.org/items/510d47da-6be2-a3d9-e040-e00a18064a99.
One possible explanation is that the builders of the western pigeon-snaring mounds located them along the western and northern margins of Tongatapu precisely because those areas were so thinly inhabited at the time. That they were so far removed from the eastern seats of power may have added to their exclusivity. There may also have been ecological reasons, such as the habitual flight paths of the Pacific imperial pigeons.

The re-purposing of monuments provides clues to changing cultural norms and land-use regimes. The pigeon-snaring mound that I visited in southwestern Tongatapu that contained a pre-contact slab-vault burial (located, interestingly, off from the centre of the flat top) may be an example of such repurposing (Figure 84).

![Figure 84. The edge of the fragmented lid of a stone slab-vault burial atop a pigeon-snaring mound near Fahefa, Nukunuku district.](image)

The coral sand visible toward the top of the photograph indicates perhaps another adjacent burial.

With the chiefly sport of pigeon snaring in decline, the remaining mounds could easily have served as burial places for high-ranking individuals. The mana/tapu of such places would likely have remained in tact and may even have contributed to the prestige of the
interment. Coral sand on the platforms of several pigeon-snaring mounds in western Tongatapu indicate probable re-purposing for burial. Another pigeon-snaring mound, near Kolovai, has several modern burials and possibly prehistoric burials as well (Figure 85). As noted earlier, the former pigeon-snaring mound Houmatala, on the island of Foa, was converted to a burial mound in the 1860s to assert land title given to the Helu lineage by the Tu‘i Tonga (Burley 1996:428; Gifford 1929:179).

Depressions possibly representing freshwater wells or vaitupu also occur in the greatest abundance in western Tongatapu, particularly along the mid-Holocene paleoshoreline on the north coast of Nukunuku and Kolofo‘ou districts. Geology surely plays a role in the distribution of these depressions, as the second major concentration in the northeast, in the low-elevation land near Kolonga, suggests. However, the fact that so many potential vaitupu occur along the north shore of western Tongatapu, in close

Figure 85. West face of a pigeon-snaring mound near Kolovai, Tongatapu, with modern and possibly prehistoric burials.
association with burial mounds, a pigeon-snaring mound complex, and the highest concentration of fortified sites on the island, suggests that there is more to that pattern than mere geological coincidence.

7.5. Centralized authority and inter-group competition on Tongatapu

The archaeological and ethno-historical records, and the data presented in this dissertation, present two linked but parallel narratives: the first concerning the growing authority of the Tu'i Tonga dynasty over time, culminating in the monumental “capitals” and waning with the rise of junior lineages late in prehistory; the second concerning the efforts by powerful chiefs lower in the social order to differentiate themselves as elites and consolidate authority over their holdings within the larger chiefdom.

The historical record tells us that the Tu'i Tonga was, for centuries, the sole paramount of the archipelago, at certain times commanding tribute from a “maritime empire” that encompassed much of West Polynesia and beyond. Archaeologically, this sphere of influence is attested by evidence of long-distance lithic transport (Clark et al. 2014). There was evidently a two-tiered settlement pattern, wherein the paramount elites resided in a small but central ritual/administrative centre, and subordinate lineages were spread throughout Tongatapu and the other island groups (Kirch 1984:226). The monumental features associated with this dynasty are among the most massive in Oceania, and are clear indicators of the authority and position of the Tu'i Tonga. Of the supreme rank of the Tu'i Tonga during the last 1,000 years, there is little question. Clark (2015:11) has argued that lineage fissioning, with creation of the collateral Tu'i Ha'atakalaua and Tu'i Kanokupolu titles, is evidence for increasing social complexity, rather than the decline of the Tu'i Tonga line as has traditionally been thought.

However, both the historical and archaeological records contain evidence that contradicts a unilinear trend toward political centralization. Traditional histories describe periods of waning influence from the capital. For example, the story of Kau'ulufonuafekai’s revenge against his father’s assassins that led him to “conquer” Ha'apai, Vava'u, Samoa, 'Uvea, and Futuna has been read as an allegorical account of
the integration or reunification of the Tongan islands following a period of declining authority outside of Tongatapu (Burley 1995:159). Oral traditions recount numerous assassinations and assassination attempts against reigning paramounts, beginning at least in the thirteenth century and remaining a relatively common cause of death for Tu'i Tonga throughout history. Assassinations and retributions are one way, albeit indirect, of showing that political upheaval and dissent were present at various times, and that actors in these instances anticipated social or political gains from their actions. Similarly, such accounts demonstrate the “natural tendency toward chiefly autonomy in the scattered islands of the Tonga Group…” (Clark 2016:12).

Through the archaeological documentation of Toloa, the story of the Tu'i Tonga dynasty now has a beginning, middle, and end. However, the rich record of prehistoric landscape use preserved in the 2011 LiDAR survey illustrates more than just the story of a single, powerful family. The position, shape, and size of every mound on Tongatapu tells us something about the local people at specific places and in specific slices of time, including the numerous subordinate chiefs and substantially more numerous commoners who lived their lives within prescribed areas on this island. This dissertation, which illuminates aspects of the archaeological record concerning the various non-paramount lineages, shows important evidence for interaction at a more local level. In other words, by momentarily removing the paramount elite from the picture, we see the importance of the interactions between individual chiefs, and the ways in which competition and conflict played out on the landscape.

On Tongatapu, local chiefs continued to compete through time, despite the rise of a centralized paramount. Various local hierarchies arguably existed prior to and during the early rise of the Tu'i Tonga dynasty — the emergence of an archipelago-wide socio-political hierarchy did not necessarily cement the position of competing chiefs. The first stone architecture in Tonga, built at the second Tu'i Tonga capital of Heketa, was relatively modest in comparison with later structures at Lapaha, and predates the full extent of the maritime empire and state that would follow. Socio-political developments contemporary with the political emergence of the Tu'i Tonga are not well recorded in traditional histories, and their archaeological correlates (i.e., mounds dating to ca. AD 1000–1300) have not been investigated.
The subjugation and absorption of competing groups likely remained important forces in this continual negotiation for power and resources. Like the most powerful Mississippian chiefs (McKivergan Jr. 1995:231), Tongan hou ‘eiki who achieved positions of authority did so through competition and strategic manipulation, in addition to kin-based status claims. This often took the form of genealogical engineering, but it clearly also involved political and martial coercion. Regardless of genealogical rank, individuals who succeed to positions of power require control over economic production among their socio-political unit, and can achieve it through force, symbolic legitimation, or more probably, both (Earle and Spriggs 2015:516). Such forces are as important in intra-group relations as they are in inter-group relations. Pigeon snaring, which is thought to have had a competitive element, is one example of a status-rivalry activity that left a permanent mark on the landscape.

According to Gifford (1929:176), it was known that when a chief died, his neighbours might attempt to encroach on his land holdings before his successor could establish or verify the boundaries. Permanent boundary markers were thus preferred over temporary or moveable indicators. This shows that even inherited holdings were negotiable, and that through coercion or subversive action the ancestral possessions of a competing chief could be co-opted. In Hawai‘i, Ladefoged and Graves (2006:263) note that competitive interaction between chiefs could result in partitioning or merging of ahupua‘a (clan-based land division) or even moku (district) boundaries. The lack of a central “judicial branch” of government in Tonga suggests that such matters, like other transgressions, were dealt with at a local level, according to the whims of a ranking chief.

With a more complete picture of monumental construction on Tongatapu, it’s worth considering some of the forces that may have shaped it, particularly in light of the preceding discussion of chiefly competition and interaction. Attempts in archaeological theory to model the role of monumental architecture in hierarchical societies invariably hinge on the question of how it was used strategically by political elites to affirm or consolidate power. Peer-polity interaction is one attempt to model socio-political change and its relationship to material culture. The basic premise of peer-polity interaction is that social change emerges from a context of equal, but competing, polities. It offers one way
of modelling landscape use in the context of increasing social hierarchy and political centralization. In this section, I briefly explore the utility of the peer-polity interaction model, with its emphasis on inter-polity interfaces, to explain patterns of landscape use and monumental construction on Tongatapu in the context of emerging and consolidating social complexity.

The peer-polity interaction model attempts to explain intensive interaction between autonomous socio-political units that result in enduring patterns of culture (Renfrew 1986). It was initially developed to explain socio-political change at the cusp of state formation — that is, the evolutionary process of hierarchically stratified but politically decentralized societies transforming into incipient states with centralized rule and bureaucratic administration (e.g., early states in Greece and Italy). It is a model with a foundation in a settlement patterns approach — group affiliation, which is recognizable from within and from outside a socio-political group, is manifest in settlement patterns (Erdosy 1995:92; Renfrew 1978). Central places of ritual and economic importance within the territories of such groups may be identifiable. In his “Wessex chiefdoms” paper, Renfrew (1973) famously identified conjectural territorial boundaries by drawing equidistant lines (Thiessen polygons) between monoliths, thus providing a hypothetical basis for the use of space by kin-based Neolithic groups. A peer-polity interaction model posits that periods of intensive interaction between such units results in greater interrelation and, in some cases, an emergence or increase in centralized authority over time (or decrease in centralization as the circumstances dictate).

The analytical framework of peer-polity interaction is the distinction between types of interactions, which in Renfrew’s original (1986) configuration amounted to five distinct but overlapping processes: warfare, competitive emulation, symbolic entrainment, transmission of innovation, and increased flow in the exchange of goods. Each of these (or, more likely, a combination thereof) could result in the emergence of hierarchical structures.

While the peer-polity interaction model has generally been applied to contexts of state formation, archaeologists have found applicability for societies of variable complexity, such as the paramount chiefdoms of the American southeast (McKivergan
Jr. 1995) and the Iroquoian polities of northeastern North America (Williamson and Robertson 1994). In its classic formulation (Renfrew 1986), peer-polity interaction best describes inter-polity interaction in the absence of a centralized hierarchy — it models interaction between groups when no obvious power disparity between those groups exists. According to Renfrew (1986), peer-polity interaction ceases to describe a society that has become totally centralized (i.e., a single authority emerges).

Recent studies have drawn a link between interaction and the emergence of hierarchical structures, and have situated peer-polity interaction in historically sensitive and nuanced analyses. For example, Creamer et al. (2014), in analyzing contemporaneous Late Archaic ceremonial centres in the Norte Chico region of Peru, found no evidence of a hierarchical relationship, concluding that each represented a relatively independent polity competing for human resources. Comparable site layout and distribution in the area was interpreted as evidence of competitive emulation. Murrell and Unruh (2016:213) similarly explained the social dynamics of Chacoan great house construction, using a social comparison model of competition to show that there were “aspiring leaders competing for legitimation of social status”. Wattenmaker (2009) argued that peer-polity relations played a role in the development of urban centres in Mesopotamia, primarily through elite construction and displays of wealth — the primary incentive for the generation of surplus being the luring of new followers.

In evaluating a peer polity model of interaction for the Tongan Classical Chiefdom, there are two fundamental questions to consider: first, can chiefly kainga or ha’a clans/land units be considered “polities”, with relative autonomy and socio-political equivalence? Second, does centralization of authority under the Tu’i Tonga dynasty negate or nullify the importance of chiefly interaction in explaining social change?

The biggest challenge in applying the precepts of peer-polity interaction in the Tongan context is the clear evidence in the later years of the chiefdom for centralization of the Tongan polity and administration of both religious and secular affairs by a small ruling elite. The Tongan Classical Chiefdom lacked the urbanism that defines most primary and secondary state societies, and yet decision-making was centralized and then executed through a series of “governing” chiefs outside of Tongatapu. The question
remains: to what extent was Tonga a “single, unified jurisdiction” (Renfrew and Cherry 1986); to what extent did the paramount exert total control, and when did this begin and end? Another relevant question, of course, is whether elements of a peer-polity interaction model are relevant to the emergence of a Tongan “state” in the context of a West Polynesian interaction sphere, given that state formation often occurs in a context of relationships with outside societies. It is worth noting that neither Samoa nor Fiji, the two major neighbouring archipelagos, adopted Tonga’s centralized form of governance, despite frequent and intense contacts over the course of centuries.

Kristiansen (1998) distinguished between a “decentralized stratified society” and an “archaic state”. Decentralized stratified societies are characterized by an absence of towns or cities, decentralized subsistence (farms scattered across the landscape), a ruling elite who control a largely landless peasantry through tribute and taxation. Kristiansen’s archaic state has a ruling elite that formalizes the conical clan structure and derives legitimation through mediation with the supernatural, the construction of ceremonial centres, and the central administration of exchange and tribute in the form of surplus or labour. For Kristiansen (1998:247), the primary difference between these societal forms is in the centralization of the economy and the ritualized genealogy of elites in archaic states.

One might argue that Tonga, during intervals in the last 1,000 years, could be characterized by either of these descriptions, or at times both. While Tonga had a formalized pyramidal social organization that structured both elites and commoners in a complex but integrated clan, it also maintained a decentralized subsistence system and lacked a formal, bureaucratically administered market economy. In Kristiansen’s view, what distinguishes a hierarchical chiefdom from a state is the formalization of hierarchy and exploitation — the latter being a critical element in the organization of labour for monumental constructions. Regarding monuments, Kristiansen (1998:247) asked, “Was it based upon occasional mobilisation through social obligations and rewarded by reciprocal feasting, or was it based upon formalised control of communities, through land ownership?”
A primary emphasis of peer-polity interaction is on durable patterns that do not exist in isolation. Intensive interaction between polities produces enduring patterns of culture, or “structural homologies”. These can take the form of common site layout and regular spacing sites across the landscape (Creamer et al. 2014:410). Cultural homogeneity is achieved even at times of bitter rivalry (Erdosy 1995:92; Renfrew 1986). The mounds and earthworks of Tongatapu are highly structured in their distribution, forming clusters with clear boundaries represented by “empty” space or permanent boundary markers. Certain mound forms have independent dispersal patterns that are no less structured. These repeated patterns in the dispersal and morphology of features arguably constitute “structural homologies” in land use and built environment across the landscape. Renfrew (1986) stressed the importance of such similarities in the context of hierarchical societies, and sought to explain them by dissecting the forms of interaction that occur between (semi-) autonomous political units. Renfrew’s initial formulation of the peer-polity interaction model was based on a distinction between five types of inter-polity interaction. I use the architecture of this formulation to explore aspects of inter-group interaction below.

Conflict

Renfrew (1986) regarded warfare as a driver of intensification on the basis that it consumes material and human resources at an increased rate. The emergence of hierarchical structures stems from the need for economic and military administration under circumstances of conflict. Even in the absence of all-out warfare, competition over resources can provide incentive for the construction and maintenance of boundaries and defensive features.

Conflict was a defining characteristic of Tongan society following European contact and the collapse of the traditional socio-political order. There is some evidence to suggest that conflict and the need for fortifications predates this time period (e.g., Clark et al. 2017; Marais 1995). The period of civil war from ca. AD 1799–1852 was particularly brutal, and led, in part, to a total restructuring of the Tongan settlement pattern from dispersed plantations to nucleated, fortified villages. Burley (1994) notes that land reforms and the increasing influence of missionaries also played a role in this
process. The conflict pitted alliances of chiefs against one another, often on religious lines, but also involved an element of feuding that arguably had origins much deeper in time. Importantly, these fortified settlements are often found within the boundaries of the more ancient “territories”, as suggested by concentrations of mounds. With further research and the acquisition of radiocarbon dates, it could be determined that the majority of ditch/embankment “boundary markers” do indeed date to the last two centuries. This would indicate defensive efforts to maintain boundaries that had already been in existence for centuries.

Campbell (1996:80), in his description of the Tongan civil wars, noted that “By 1820 the fighting had ceased, and the Tongan kingdom became a collection of independent tribes, with no chief willing able to establish a universal authority”. The fighting would resume at times over the next three decades until reunification occurred under Taufa'ahau, King George Tupou I.

Latukefu (1974:9) argued that periods of peace and stability in Tongan history were the result of balanced, reciprocal relations between Tu'i Tonga, hou 'eiki, and commoners, based on an exchange of protection for tribute. Implicit in this argument is the underlying risk of violence necessitating protection in the first place. It is worth distinguishing between active and symbolic conflict, the latter involving collective action and signalling group fighting strength without actual exposure to the risk of violence (Carballo et al. 2012). Symbolic conflict has the effect of mimicking a state of actual societal violence in its definition of in-groups versus out-groups and the incentivizing of “great projects” (Schreiber 2009:78) that substantiate these distinctions (i.e., boundary ditches).

*Competitive emulation*

Creamer et al. (2014:417) argued that spatial indicators of competition between polities included even distribution of sites over arable land. Additionally, the construction of increasingly large and impressive monuments could be seen as a strategy to attract a greater population to ritual events. In a subsistence economy based largely on dryland agriculture, the primary resources are arable land and human labour to cultivate it. Hou
‘eiki required their followers to produce surplus for the annual or semi-annual ‘inasi tribute to the Tu‘i Tonga, but also for ceremonial redistribution within their own corporate groups. Symbolic legitimation of chiefly power was achieved in part through the commissioning of monumental earthworks like tombs and pigeon-snaring mounds, which required the participation of their followers through corvée labour. Thus competition for both land and “human” capital on the bounded geography of the Tongan islands was an ongoing process. The level of territorial behaviour and competitive emulation among Tongan chiefs signals an understanding that the social hierarchy was interminably negotiable.

**Symbolic entrainment**

Renfrew (1986:8) noted several forms of interaction that are not essentially competitive. Symbolic entrainment refers to the tendency for neighbouring groups to adopt similar symbolic systems, whether they are related to writing, forms of social organization, or other structures. The primary evidence we have for a shared symbolic system in the Tongan case is in the form and layout of architecture. Forms were repeated over space and time, and appear to show agreement in certain aspects of symbolic importance (e.g., the “rectangularity” of mounds associated with high status). In the remote northern outlier of Niuatoputapu, Kirch (1988) noted replication, albeit on a smaller scale, of the same architectural forms used to indicate status and authority, including square mounds faced with cut and dressed stone. This agreement on symbolic aspects of architectural forms, including the use of public ritual/administrative areas (*mala‘e*) incorporates groups into a regional symbolic and ritual network. Elites demonstrating social “distance” through burial sites and rituals (cf. Kristiansen 1998:257) is an example of the important link between symbolism and material culture.

**Transmission of innovation**

Economic innovations are difficult to assess in the Tongan archaeological record, beyond the expansion of settlement into island interiors during the Plainware period (Burley 1998:363). The transmission of innovation overlaps to a large degree with symbolic entrainment, in the sense that the most powerful and pervasive innovation in
late-prehistoric Tonga was a shared ideology with respect to social relations, authority, and their manifestation in resource distribution and settlement layout. Aspects of language and material culture were obviously shared in common across this small island; albeit linguistic evidence shows that outlying Tongan islands retained indigenous aspects of language (Kirch 1984:234) and an honourific language reserved for hou 'elki is another exception (Völkel 2010:195). And yet, the individuality among chiefs, and the inherent differences in group affiliation, probably continued to matter if the present interpretation of settlement pattern is accurate. Renfrew (1978) noted the existence of cross-cutting circles of affiliation — thus “members” of a clan, or chiefdom, could also be “members” of a state. This further describes how peer-polity-style interaction may have continued to underlie the basis for state-level organization in Tonga. Clark et al. (2014) argue that long-distance lithic networks were important conduits for transmitting information about social organization to other regions of Oceania.

_Increased flow of exchange_

For the paramount elite of Tongan society, there is clear evidence for an “external value system linked to foreign wealth objects” (Kristiansen 1998:261). Archaeologically, long-distance interaction and importing of status goods is evident through the transfer of stone adzes (Clark et al. 2014), and the historical record describes a complex system of exchange of mats, feathers, sailing vessels, and other objects throughout West Polynesia and the Fiji Islands (Davidson 1977). The degree to which these exchanges are characterized as either “tribute” or “market behaviour” (Kipp and Schortman 1989) is beyond the scope of this discussion. Clark et al. (2014) argue that state-level organization in Tonga was in part predicated on elite networks of exchange of status items and spouses, and highlight the central importance of long-distance canoe voyaging.

Economic exchange between lower-ranking Tongan chiefs is difficult to assess, as is their access to foreign goods and systems of long-distance exchange. We can presume that a similar system of status items and distribution of wealth would have occurred at a local level. There is little evidence of “craft specialization” in the sense that it is characterized in the context of primary states — that is, top-down organization of
specialized labour to produce craft surpluses for foreign markets. However, the historical record references artisans and specialists in activities such as masonry, building, and navigation, some of whom were *matapule* elevated to positions of relative eminence (Gifford 1929:148). Island groups are associated with traditional specializations; for example, Tongatapu was known for producing the best *ngatu*, Ha’apai for woven mats, and Vava’u for basketry (Burley pers. comm.). If we take *mala’e* to be sites of both ritual and economic activity, then they may be regarded as nodes of exchange on the landscape.

There are other alternatives to peer-polity interaction that explain similar types of archaeological evidence. For example, Colburn and Hughes (2010) have argued that the phenomenon of “itinerant kingship” has similar archaeological correlates to peer-polity interaction. The former describes a politically unified society in which a replication of structures (homologies) reflects the central ruler’s repeated presence throughout the domain, while the latter describes groups of independent, interacting polities. The Tongan data, under an itinerant kingship model, would be the result of the repeated presence and sustained influence of the Tu’i Tonga throughout the chiefly domain, implying top-down control of things like settlement pattern and land use even outside the elite precincts.

Alternatively, Rainbird (2006:313–315) showed how monumental centres can be interpreted as not representing centralized authority. He interprets the Micronesian monumental structures of Nan Madol and Leluh not as “… the apogee of sociopolitical systems in their social evolutionary march toward supposedly more complex levels of social hierarchy”. Rather, they represent sustained, long-term veneration of ancestors, conferring sacredness within a conical clan system that held ancestry as the “overriding ideal principle”. This perspective drastically downplays the role of elite decision-making in the spatial organization of a society, even in its construction and use of monuments exalting the kin-based social order. Political elites, in this view, perform obligatory roles that maintain this order; high status is both a privilege and a contract, or duty.

In emphasizing interaction between competing polities, Renfrew (1986:1) recognized that power relations and spatial relations went hand in hand. The
fundamental connection between land use, space, and power, is one that has long been recognized in archaeology. Adam Smith (2003), for example, argued that manipulation and perceptions of space and place are the basis for the constitution of authority in early complex societies. Earle (1997:7) noted that control over production and trade wealth forms an important plank of authority in chiefly societies, making land and labour for public works like irrigation the principle commodities.

Competition, emulation, and other forms of inter-polity interaction are linked fundamentally with landscape use, the delineation of boundaries, and the construction of monuments. Thus, while the application of a peer-polity interaction model to state emergence is aided using evidence of trade and other material forms of interaction, it is primarily through a study of landscape that significant patterns begin to emerge. As Falconer and Redman (2009:10) state, “… the archaeology of landscapes, more so than studies of cities and states abstracted from their settings, provides profoundly informative insights into the ecological and political coherence of early complex societies…”

Did late-prehistoric Tonga socio-politics, and the archaeological landscape they produced, arise as a result of peer-polity interaction? Again, it falls to the question of whether the social groupings (the hypothesized ha’a heuristic) on Tongatapu can be regarded as relatively autonomous groupings operating on equal terms. The documentation of monumental structures at Toloa, which probably dates to the early part of the second millennium AD, shows that at least one group, early on, was making strategic efforts to recruit members under a new ideological power structure. Perhaps individuals and groups were enticed by this prospect because of the intense nature of inter-group competition at the time.

The validity of the peer-polity interaction model also hinges on whether this emergent centralized authority successfully “bureaucratized” the whole of Tongatapu, and the outer islands, fully centralizing decision-making processes and dictating the nature and layout of settlements and monuments. As discussed, absolute centralized authority precludes peer-polity interaction as an explanatory framework. I believe the answer to this, however, is probably no. Although the rapidly aggrandizing Tu’i Tonga
polity probably commanded island-wide respect and deference by the time it was moved to Heketa, I believe the internal politics of local corporate groups continued to play a central role in the day-to-day lives of both chiefs and commoners. I believe it likely that neighbouring socio-political groups remained partially autonomous for a significant period of time, and were brought to heel, so to speak, through the naming of new titles, bringing them fully into the ‘Aho’eitu genealogical structure. This political independence of Tongan ha’a is best reflected in the early origin and lasting maintenance of boundaries on the landscape, documented in this dissertation for the first time. Boundary maintenance, the evident antiquity of modern tofi’a estates, and structural homologies in the form of repeated architectural forms make peer-polity interaction one explanatory framework for Tongan landscape history, albeit one among competing frameworks.

7.6. Origin and development of Tongan settlement patterns ca. AD 950–1850

The patterns that have emerged in the previous sections support a general narrative for the development of settlement patterns in Tonga over the past millennium. In this section, I indulge the narrative quality of this data to provide a hypothetical and speculative model to explain those patterns. I stress at the outset that much of this narrative is based on assertion, but argue that it is necessary to begin with hypotheses such as these.

Sometime between 1,000 and 750 years ago, the kin-based corporate groups living throughout coastal and interior Tongatapu began burying their dead in earthen mounds. Most, if not all, productive agricultural land on Tongatapu was now occupied. Increased competition between neighbouring groups was changing the character of the landscape. Many of these groups had probably resided in certain areas for generations and were reinforcing their claims to land by constructing these permanent markers.

Perhaps as a means of deterring or fending off aggressive challengers, groups with real or fictive genealogical relationships organized themselves into larger socio-political units with more formalized hierarchies. Hereditary rights to land and labour were determined by one’s place in these new political hierarchies, which were but
institutionalized forms of social hierarchies that dated back centuries. Low-ranking people, who evenly occupied and farmed the ancestral land-holdings of their greater lineages, were interred in communal cemeteries, while chiefs were buried alone, or with select family members, in purpose-built mounds that signalled their exalted status.

At least one socio-political unit on Tongatapu attempted to consolidate authority among their neighbours, building large and elaborate monumental platforms as a demonstration of their persuasive, or coercive, capabilities. The formal layout of this and later chiefly precincts may have evoked cosmological concepts, but in any event, the formality and axiality of their layout conferred a sense of authority. Neighbouring chiefs may or may not have contested this consolidation with shows of force or status demonstrations of their own. A proliferation of elite forms of earthen architecture, including rectangular mounds and platforms that resembled those built at Toloa, suggests that local chiefs were concerned with legitimizing their authority within and outside of their own descent groups.

What eventually emerged was an all-encompassing social and political hierarchy with the descent group that built the Toloa platforms at the pinnacle. Local ancestral groups and permanent divisions of land on Tongatapu were now enshrined in the mythology of that paramount lineage. The increasingly influential descendants of that dynasty conferred hereditary titles on competing chiefs to bring them and their kainga into the fold. Despite this, interactions between chiefs likely remained competitive, with claims to land now more heavily reinforced through deliberate settlement of the backcountry and the continued maintenance of the ancient boundaries.

Perhaps in response to neighbourly aggression or attempts to challenge their authority, the preeminent socio-political group removed themselves to a coastal location in northeastern Tongatapu at Heketa, where they constructed for the first time the most exclusive and permanent form of monumental architecture using cut and dressed stone blocks. The labour and resources required for these projects were nearly unprecedented in Tonga — the low but extensive mounds at the first capital were perhaps more energy expensive overall. Elite use of resources in the form of labour and agricultural resources resulted in a concomitant expansion/intensification of dryland agriculture to meet the
needs of chiefs owing tribute to higher chiefs. An enormous quantity of foodstuffs was being channelled to the Tu’i Tonga and subsequently redistributed.

With a sharpening of the socio-political hierarchy came a complex system of social pre/proscriptions that governed how people travelled and conducted themselves on the landscape. The ‘hou eiki/tua divide became so clear that it was manifest in a separation of space. The highest chiefs were so tapu that the physical spaces they inhabited and visited became strictly off limits to commoners. Monumental tombs and ceremonial platforms placed in prominent areas served as permanent and unavoidable reminders of this strict social ranking. Pigeon-snaring mounds and arenas, built and used at the whim of the elite, required stillness and silence in order to attract wild birds with the use of decoys — they achieved this by using their privileged access to one of the rarest resources on this small and increasingly full island: secluded, uninhabited land.

The paramount dynasty moved once more, this time to the shoreline of the lagoon. Here they further cemented their authority on Tongatapu through the commissioning of massive stone tombs and pursued interests throughout the rest of Tonga and West Polynesia, employing immense sailing canoes built in Fiji and acquired through elite exchange networks. Extensive land reclamation and a monumental stone wharf are evidence of a sharpened maritime focus, as are the monumental structures located at the entrance to the lagoon that welcome visitors or returning voyagers.

Social relations at the apex of society remained tense, with assassination being a too-common cause of death for the male inheritors of the paramount title. Political machinations and lineage fissioning eventually resulted in a tripartite kingship. The last of these kings to be established moved to the extreme west of Tongatapu. Extant and novel chiefly titles in the west gained prominence in the shifting political landscape. The old pigeon-snaring mounds fell into disuse and disrepair, but some were refurbished and used to inter a new generation of hou ‘eiki.

Into this complex political situation came European visitors, first sporadically and then steadily. The influences of new material wealth, destructive weaponry, and enterprising proselytizers stoked existing tensions and inflamed all of Tonga in half a
century of brutal civil conflict. With war came a retrenching of individual territorial claims and, possibly, the fortification of boundary lines that had been marked by trees and fences for centuries. The paramount dynasty was challenged once more, becoming one of several confederacies vying for supremacy. Cross-island and inter-island raids were a common and violent response to the disintegrating social order.

These raids were the prime, but not sole motivation for the nucleation and fortification of the settlement pattern on Tongatapu. Once people began to live more densely in permanent towns, they could now better access the spiritual support of the very successful church denominations. Peace, and reunification of the Tongan archipelago as a constitutional kingdom, brought land reforms that reinforced this new settlement pattern through the distinction and allotment of “bush” 'api and “town” lots. However, the new order also preserved aspects of the old feudal system, granting parcels of land to the highest chiefs, now nopele, as hereditary estates, or tofita. Many of these estates followed the old boundaries. Some of the old mounds near towns saw continued use as cemeteries, while the majority of others became anonymous knolls that dotted fields planted in yam, taro, and coconut. The monuments of the old dynasty, while still venerated, became subordinate to the burial place of the new line of kings, engineered in concrete, in the new capital (Figure 86).

Figure 86. Mala'e Kula, the tombs of the modern Tongan royal family.
Chapter 8. Conclusion

The discussion in this chapter revolves around what I believe to be the most important themes in Tongan history on which the LiDAR dataset can be brought to bear. The first is the ancient and lasting connection between kin and land, embodied in terms like fonua. The second is the creation, expansion, and veneration of social difference in a profoundly hierarchical society. The third, perhaps overlooked, is the importance of inter-group dynamics in the shaping of the archaeological palimpsest we see today.

As a final point of discussion, I return to the research questions I posed in the introduction to the dissertation, which help to summarize the specific observations and general interpretations I have provided thus far.

8.1. Return to research questions

1. Characterization of monuments and their distribution. How do the new survey data compare with what we previously knew (or thought we knew) about mounds and the distribution of sites? Do they confirm or challenge previous typologies? Do the numbers or density of sites exceed what was known (or predicted) for unsurveyed portions of Tongatapu?

Prior to this research being conducted, there was a good general understanding of mound form and function, greatly informed by emic linguistic categories. There was broad consensus about the uses of mounds and their articulation with socio-political principles of the Tongan Classical Chiefdom as recorded by early explorers and traditional knowledge holders. Broadly parallel mound typologies were generally applicable to all the Tongan island groups as well as some other West Polynesian islands such as ‘Uvea.

From archaeological fieldwork conducted in Ha’apai and Niuatoputapu, it was clear that the spatial distribution of different monumental feature types related to
geopolitical factors and the divisions of land. For Tongatapu, previous work identified the Tu'i Tonga capitals of Heketa and Lapaha/Mu'a and identified the ubiquitous field monuments as proxies for settlement on the coast and in the interior of the island. Field survey on Tongatapu suggested an average density of mounds and suggested that the density decreased relative to distance from the lagoon and north shore. A small number of excavated mounds confirmed their use as burial places for occasionally large numbers of people.

What was lacking can be summarized into two broad categories: a) a good chronology of mound construction, and b) a sense of the overall distribution of mounds on Tongatapu and the specific distribution of mound types. The research presented in this dissertation primarily addresses the latter category, which had formerly been precluded by the size of the survey area and the poor visibility of smaller mounds on the landscape. The findings can be distilled down to these basic conclusions:

- Mounds are more numerous, and are constructed more densely, than previously thought. That mounds were common on the landscape of Tongatapu was no mystery, but the results of LiDAR survey and automated and manual feature extraction show that mounds are nearly ubiquitous in most areas. Low mounds, in some cases under 50 cm in height and nearly impossible to see on the ground, are easily recognizable in the LiDAR imagery.

- The mounds are, for the most part, spatially organized, suggestive of territoriality and/or boundary maintenance.

- There are distinct spatial distributions of specific mound types, most notably rectangular platforms and pigeon-snaring mounds.

Although no new dates were acquired, this full picture allows for some speculation in terms of relative age. The east–west dichotomy is suggestive of a population shift in the late-prehistoric period toward the western half of Tongatapu. The common monument types and spatial distributions characteristic of western Tongatapu may therefore indicate a change in land use and construction priorities in the centuries leading up to European contact.

This study employed a simplified survey typology for the purposes of automated and manual feature identification in the LiDAR data. It showed, on the basis of feature distribution, that form often correlates with physical location (i.e., a feature’s location on
the landscape is one of its diagnostic elements in a typological sense). The study introduced a new feature type, the “ceremonial platform”, and speculated on its use as a civic/ceremonial meeting space. Field checks of all feature types were crucial for verifying the morphology of various features and for assessing their position and proportions in relation to the surrounding landscape. Fieldwork showed that relatively few mounds outside the political centres have stone facing; exceptions tend to occur around other areas of importance such as Kanokupolu/Kolovai. Examination of numerous road-cut mounds confirmed the frequent presence of coral sand and/or beachrock cobbles that are indicative of burials. Although none were excavated, few if any mounds showed clear evidence of having been used as house mounds; I tend to side with the consensus that traditional Tongan houses were not typically located on mounds.

It is also worth noting that the record of monumental architecture on Tongatapu appears to be essentially intact; that is, apart from the built up areas of Nuku‘alofa, the airport, and to a lesser extent the towns of Pea, Vaini, Lapaha, and others around the lagoon, I do not see conspicuous gaps in the monumental record that can be attributed to recent destruction. The relative preservation of mounds of course depends on historical and current land uses; areas that are frequently machine-ploughed tend to have mounds with flattened appearances and deep furrows. Subsurface deposits such as burials stand a lesser chance of being preserved in these cases. However, in the relatively forested areas of Tongatapu, that do not appear to have been ploughed with any great intensity, mounds tend to preserve their original proportions. On the Nukuleka peninsula (Figure 87), for example, the agro-forest horticultural system practiced by owners of ‘api uta has resulted not only in the preservation of some exceedingly low, subtle mounds, but also midden deposits containing the earliest evidence of human habitation in Tonga (Burley et al. 2012). Mounds in and around the modern village are in some cases obscured by buildings or modern cemeteries.
This research was also concerned with monumental feature types apart from earthen mounds, primarily the linear ditch/embankment features that divide segments of land throughout Tongatapu. Field checks suggested their use as roads was possible but was likely not their primary use. Linear ditches with significant embankments on one or both sides may have been erected with the intention to defend occupants from raids during times of conflict; however, direct connections to actions and fortifications of the civil war period are non-existent or unclear. I have stressed in this dissertation the likelihood that in most cases they served as boundary markers and permanent, visible deterrents to both surreptitious and overt encroachment. They were the largest “fences” on an island repeatedly described by early explorers as well fenced. As such, they acted as both concrete and symbolic indicators of group membership in the context of competing ha’a, and, when necessary, signalled fighting strength (Carballo et al. 2012).

Whether linear ditches prove ancient or relatively recent in age, they clearly mark boundaries of significant time depth. Particularly in central and eastern Tongatapu, they frequently occur in the “empty” areas between clusters of mounds.
2. Late-prehistoric settlement patterns. What does the distribution of monuments say about settlement patterns more generally? Can we infer settlement nodes or concentrations based on the presence of mounds? How does this inferred pattern differ from earlier (or later) time periods in Tongan history?

The consensus view of Tongan settlement patterns is summarized by Burley (1994); it generally involves a gradual transition from coastal hamlets during the Lapita period to the inland portions of islands as the subsistence economy became more focused on terrestrial food production. By the Classical Chiefdom years, we expect to see the dispersed, plantation-style settlement pattern described by explorers like Cook, who famously said, “Here are no towns or villages”. The form of settlement is encapsulated in the phrase, *fanongonongo tokoto*, “making proclamation while reclining”, which refers to the purported ability of one homestead to shout news to the next and in so doing convey messages across great distances (Burley 1994:384).

According to Kirch (1984:221), this layout was primarily due to the geographical circumscription of islands, the absence of watercourses suitable for damming or irrigation (i.e., reliance on intensive dryland agriculture), and infrequent but recurrent natural stresses like cyclones and droughts. He goes on:

The unusual fertility of Tonga’s ash-rich soils, combined with intensive agronomic practices such as mulching made a short-fallow cycle possible. The emphasis on fencing of gardens, and indeed the degree to which the island was carved up into walled parcels, bespeaks a permanency of land division which further reveals the intensity of Tongan agriculture. Thus, at the time of European contact, the Tongan landscape was an intensely agrarian scene, and densely settled (Kirch 1984:222).

The “permanency of land division” is a theme I have stressed in this dissertation. Land tenure was evidently fundamental in the settlement layout, tied up as it was in kinship concepts like *fonua*. However, there is some question about how that would actually look and be reflected in the archaeological record. Burley (1994) showed that an assumption of dispersed, even settlement across the interiors of all Tongan islands was inappropriate for northern Ha’apai, where settlement pattern data indicate sustained occupation along a midden ridge on the leeward side of islands such as Lifuka. Even late-prehistoric chiefly sites appear to conform to the earlier template of “village-like aggregations”, although land division in the form of boundary ditches is apparent in
several cases. It is therefore worth asking whether the data presented here support or challenge the consensus view for Tongatapu, where many of the early observations were made and where the dispersed planation settlement system was apparently practiced to the greatest extent.

In Chapter 5 I examined the distribution of monumental feature types on Tongatapu, beginning with an overall look at mound distributions. The two measures of mound location relative to island geography (distribution by elevation and distance from coast) indicated a general trend toward lower-elevation and more coastal locations. In other words, mound density, and by extension settlement density, appears to have been greatest along the leeward coast and particularly around the lagoon. With greater mound density comes higher mounds on average, resulting in a general trend (with the notable exception of the Pelehake/Fua’amotu area) toward fewer and shorter mounds as one moves south and inland. From this pattern one can find support for Spennemann’s (1989:277) suggestion that settlement on Tongatapu is dispersed but occurs in three density bands, becoming more thinly settled toward the windward coast.

However, as I showed in Chapter 5, this is made more complicated by two factors. First, there is significant mound clustering, at least in central eastern Tongatapu, which suggests more radial bands of dense settlement with sharply defined borders. Between these clusters are areas without statistically significant clustering, or in some cases, areas with a statistically significant absence of clustering. One imagines relatively close living within each of these “hypothetical territories”, with closely spaced neighbouring ‘api divided by woven or living fences, and relatively thinner settlement, or larger ‘api, in the spaces in between. Second, the distribution of specific mound types shows that density may instead have occurred along an east–west travel corridor, with monumental rectangular platforms appearing at the front of territorial holdings.

A higher number and density of mounds has possible implications for demographic calculations. Burley’s (2007:186) calculated Tongatapu population estimate of 18,467 on the eve of European contact was based on the amount of arable land (36,930 acres, at 2 acres/person). This falls within the range of previous estimates and would likely hold up to future scrutiny. However, we now have a clearer idea of
where greater parts of this population were settled. Spacing between mounds in densely built areas could indicate the average space available for individual ‘api. Combined with a chronological sampling strategy, we may be able to arrive at a nuanced demographic history of Tongatapu in the near future.

The density of settlement, particularly in the eastern bay of the Fanga ‘Uta lagoon, was clearly high at certain points in history. This provokes the question of whether the concept of urbanism, properly defined, could help explain the settlement pattern. For example, Heckenberger et al. (2008:1214) argue that small, independent clusters of settlements in the pre-Columbian Amazon River basin constituted a “galactic” form of urbanism on the basis of settlement planning, supra-local integration, and a “self-organized anthropogenic landscape of late prehistoric towns, villages, and hamlets, with well-planned road networks across the region”. They argue for

the need to move beyond narrow typological approaches, which conflate early urban societies with full-blown cities or the state, and to focus instead of degrees and different kinds of urbanism, including dispersed, multicentric urban settlements (Heckenberger et al. 2008:1217).

Independent of questions of settlement density, approaching the settlement pattern of Tongatapu from the perspective of urbanism or urban planning could allow us to examine “interplay of top-down planning and bottom-up self organization” (Cowgill 2004:525), or, as Michael Smith (2007) argues, to move “beyond the traditional simplistic dichotomy of planned versus organic” settlements by examining the degree of coordination and standardization among settlements. Settlements need not have been as large or as dense as cities for these urban planning concepts to be applicable. Elite trade networks and craft specialization play a role here, particularly in defining a class of people in classical Tongan society who were not directly involved in food production and did not live “rurally”. Mu'a/Lapaha was said to be the only settlement resembling a “town”, but to what extent were there other dense settlement nodes, and therefore precursors to the settlement nucleation we typically associated with the civil war years?
3. **Landscape and socio-political organization.** How do patterns on the landscape confirm or challenge what we know about Tongan socio-political structure? What are the implications of a direct-historical approach (cf. Lyman and O’Brien 2001) to understanding Tongan prehistory?

This study of Tongan landscape history, like most others, was heavily informed by ethno-historical descriptions of the socio-political structure and land-use regime given at the time of European contact. As such, it is an example of the direct-historical approach in archaeology, or working back “from the known to the unknown” (Steward 1942:337). The historical record, therefore, becomes a source of both analogy and homology (Oxford 2018) from which to begin an interpretation of the deeper past. The chief criticisms of this logic come from areas of the world without direct cultural and/or biological continuity from the ancient past to the ethno-historical “present”.

Such an approach is relatively secure in this case in that there is no problem with assigning ethnic identity to archaeological phenomena, which bedevils such attempts in North America and elsewhere. The case for population continuity in Tonga and much of the southwestern Pacific is concrete; there is no evidence of major cultural or ethnic replacement at any time in history. Multiple lines of evidence for direct continuity (archaeological, linguistic, biological) put the approach on stable footing. Moreover, the archaeological record for this does not exist in a vacuum: strong evidence in the form of oral traditions bolsters our interpretations of the Tongan chiefdom.

A more effective critique of the direct-historical modelling employed here might begin by pointing to the circular reasoning inherent in looking for archaeological evidence of a cultural form. In other words, looking for evidence of an earlier evolutionary form and “finding it” in the messy and often contradictory archaeological record. One wants to avoid a situation “wherein sources are used to build on each other without foundation” (Rucker and Niemi 2010:97). Properly contextualized, however, oral traditions can form the basis of effective hypotheses for archaeological research, particularly concerning the “significant moments in history” (Martindale 2006:158). In the first professional archaeological study of Tonga, McKern (1929:3) began by acknowledging the strong alliance between datasets in this context:
In Tonga, as elsewhere in Polynesia, there is little break between prehistoric and historic culture. The archaeology and ethnology overlap and blend. The present work, therefore, is a study of archaeological remains which takes the fullest advantage of available traditions, ethnological evidence, and historical accounts that relate to ancient structures.

If anything, it is crucial that we develop and refine the alliance between Tongan archaeology and history so that it stands as an effective test case. The ethnographic template of the Polynesian chiefdom has long been exported to other prehistoric contexts around the world suspected to have functioned along similar socio-political principles (e.g., British and European chiefly societies). A historically contextualized archaeology of the Tongan chiefdom is therefore invaluable for assessing whether the classic chiefdom template is appropriate in those other cases.

8.2. LiDAR and the built environment

Aerial remote sensing techniques such as LiDAR are fundamentally changing the way archaeological survey is conducted. Combined with automated and manual classification techniques and other sophisticated GIS analyses, we can get from LiDAR point clouds to archaeological datasets in a very short period of time. Without undercutting the real challenges posed by this research project, it should be said that the survey presented here was relatively easy to conduct — crystal-clear imagery of an intact archaeological landscape made it simple to navigate to various features on the ground. No survey tracts or other sampling strategies were required, and no extrapolation needed to arrive at the full picture of monumental construction on Tongatapu.

Opitz (2017) and other contemporary thinkers in the subject of remote sensing in archaeology encourage us to develop and refine research and fieldwork practices employing big datasets like LiDAR. Better, more deliberate integration of LiDAR/remote sensing at the different stages of research — pre-field planning, fieldwork, and post-hoc analyses, will allow us to arrive at a more robust theory of practice. Field integration is a critical element — one imagines a near future in which small-scale, on-the-spot LiDAR data can be acquired via drone, processed in real time and used to make decisions.
while still in the field. McCoy (2018) demonstrates the uses, and necessity, of various remote sensing technologies, LiDAR included, for the documentation of cultural heritage at risk from rising sea levels. Rapid inventory could be applicable to a range of situations, such as war zones, contaminated zones or areas otherwise off-limits, and areas at risk of imminent natural disaster, such as active volcanic islands.

Johnson and Ouimet (2018:32) emphasize the palimpsest nature of LiDAR-derived imagery, and stress that at least one supporting (“supplementary”) dataset should be used to make interpretations:

While the concept of landscape as a palimpsest is well known, for the first time in hyper-realistic form we can see and physically interpret that palimpsest, along with the traces of data processing and visualization that we ourselves add to the digital landscape palimpsest in an effort to interpret it.

The present study is an example where at least two supporting datasets — previous archaeological field studies and the ethno-historical record, were brought to bear on LiDAR interpretation.

Archaeology and mounds go well together. The archaeology of mounds could almost be characterized as a sub-discipline based on the unique advantages and limitations one encounters when studying mounds on a landscape scale. Mounds are unique because they can be analyzed on a presence/absence basis, as they were in this dissertation. Of course, we wonder who built them, and when, and what might be contained within them, if anything. But they have geospatial value outside of intensive, site-by-site investigation. LiDAR is a crucial tool for the archaeology of mounds, as are other rapid, non-invasive remote sensing techniques like ground-penetrating radar. It is incumbent in cases like this one to develop a realistic way to sample a representative number of mounds to acquire dates and learn more about their uses/functions.

8.3. Reflection

From the beginning of this project, and throughout my time in the field and in the GIS lab, I have tried to maintain an awareness of the nature of what I was studying. The
picture emerging before me was endlessly fascinating — I could scroll through the LiDAR imagery and within minutes find a new, interesting feature to examine. In the field, I could wander down a bush road, past quiet farms and plantations, and explore any number of hulking mounds shrouded by trees and vines. I tried to keep in mind, despite my excitement and enchantment, that these features were in fact cemeteries, and many of them were not all that ancient. There were a number of poignant moments that reminded me not to let my interest become disrespectful, or morbid, two of which I will share briefly.

I was hot on the trail of pigeon-snaring mounds on the west and south coasts of Tongatapu. I had noticed a pattern of disc- or donut-shaped mounds, alone or in small groups, all along the rocky windward coast from Kolovai to ‘Utulau. One day I rode up to as many of them as I could on my rented 50-cc gas scooter (perhaps the most efficient survey vehicle available for Tonga). After visiting nearly a half-dozen of these sia heu lupe I arrived at the mound pictured in Figure 84.

The bright, whitish-yellow coral sand eroding from the surface of the mound told me right away that there was at least one burial here. Small piles and shallow depressions suggested more. On the cusp of the mound’s characteristic flat top, on its eastern edge, a gap in the sand revealed the edge of a stone slab, which I immediately recognized as the lid of a prehistoric (i.e., pre-concrete) burial vault. Common in the political centres, especially in the langi at Lapaha, these vaults are a less anticipated find in the quiet countryside. They are a clear indicator of elevated status, requiring great skill to cut and shape the stone (in this case, a granular sandstone) and fit the components together snugly. This vault appeared well made, around 4 feet long. The lid was cracked. I peered inside.

A beam of daylight shone through spider webs to the bottom of the vault, which I judged to be around 3 feet deep. Twigs, leaves, and germinating seedpods on the bottom told me the crack in the lid was not too recent. Among the debris, however, were human bones — minimally, a skull and several other elements, which had the appearance of being disturbed or at least not in anatomical position. Amid the thrill of the discovery, it took me several moments to register the diminutive size of the skull, and to
step back and reconsider the 4-foot length of the crypt. This was the type of adrenaline-inducing Indiana Jones moment that many archaeologists can relate to, but finding the remains of a child made the occasion more solemn. I did not linger.

Three days later, on July 21, 2015, the revered and celebrated geologist William R. Dickinson passed away in his sleep in Nuku'alofa. Bill had joined Dr. Burley and I in Tonga to re-examine paleoshorelines in light of the new LiDAR data, among other things. Curious and energetic at 83, Bill was on another of his innumerable journeys to the Pacific islands to unlock the secrets of their geological and human pasts. His sudden death left us, and members of his family in the United States, scrambling to make arrangements. It was finally decided that Bill would be buried in the village of Nukuleka, the site of the first human settlement in Tonga and in all of Polynesia approximately 2,850 years ago. Bill was instrumental in establishing Nukuleka as the founder settlement through his examination of exotic ceramic sherds recovered by Dr. Burley at the site.

News of Bill’s death had spread throughout Tongatapu. The local media picked up on his significance in the story of first Polynesian landfall. When we arrived at the cemetery, “Sia Ko Veiongo”, recently cleaned and prepared by the people of Nukuleka, we witnessed a large procession of people from all around, including several dignitaries and a marching band and choir. These were demonstrations of respect for a greatly admired person. Under a gentle rain, great speeches and a sermon were given; a hymn was sung. A group of men, including ha’atufunga (undertakers), lowered Bill’s body into a whitewashed concrete vault, specially built in the days leading up to the ceremony.

The vault was covered with tightly fitting concrete slabs and cemented shut. During the lengthy process of sealing the vault, my mind wandered to the burial I had discovered only days before. The parallels between what I was witnessing now and what must have occurred on that mound centuries ago were too strong to ignore.

Every burial mound is a community. At least, each one represents the values and actions of a community in mourning. There is more to this than pragmatic decisions about how to care for the dead, and certainly more to it than establishing archaeological clusters in space and time. A mound is more than a data point. My treatment of mounds as such in this dissertation reflects an unfortunate but necessary reduction, or abbreviation of detail, in an overwhelming number of individual features. If there is an “archaeology of mounds”, as I alluded to in the preceding section, it will perhaps benefit from an acknowledgment that when we analyze a landscape dotted with anthropogenic hills, we gaze upon centuries of accumulated ritual, honour, and it must be said, grief. There are many intellectual temptations that come with viewing mortuary practices writ large, on a landscape scale — may we always engage with such datasets with the respect required of our fellow citizens in history.
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