KŪKULU MANAMANA:

RITUAL POWER AND RELIGIOUS EXPANSION IN HAWAIʻI

THE ETHNO-HISTORICAL AND ARCHAEOLOGICAL STUDY OF

MOKUMANAMANA AND NIHOA ISLANDS

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ABSTRACT

This dissertation examines a period in the late expansion phase (A.D. 1400-1650) of pre-contact Hawaiian society when formidable changes in ritual and social organization were underway which ultimately led to the emergence of Hawai‘i as a powerful complex chiefdom in East Polynesia. Remotely located towards the northwest were two geographically remote and ecologically marginal islands called Mokumanamana and Nihoa Islands. Though quite barren and seemingly inhospitable, these contain over 140 archaeological sites, including residential features, agricultural terraces, ceremonial structures, shelters, cairns, and burials that bear witness to an earlier occupation and settlement efforts on these islands. This research demonstrates that over a four hundred year period from approximately ca. A.D. 1400-1815, Mokumanamana became the central focus of chiefly elites in establishing this island as a ritual center of power for the Hawaiian system of heiau (temples). These efforts had long lasting implications which led to the centralization of chiefly management, an integration of chiefs and priests into a single social class, the development of a charter for institutional order, and ultimately a state sponsored religion that became widely established throughout the main Hawaiian Islands. The ideological beliefs that were developed centered on the concept of the cord (‘aha) as a symbolic connection between ancestors and descendants came to be a widespread organizing dimension of Hawaiian social life. Through commemorative rituals, the west was acknowledged and reaffirmed as a primary pathway of power where elite status, authority, and spiritual power originated and was continually legitimized.

This research utilizes an interdisciplinary approach in combining ethno-historical research with archeology as complimenting ways of understanding the Hawaiian past. Through these approaches ritual power is established as a strategic mechanism for social political development, one that leads to a unified set of social beliefs and level of integration across social units. Ethno-historical analysis of cosmogonic chants, mythologies, and oral accounts are looked at to understand ritualization as a historical process one that tracks important social transformations and ultimately led to the formation of the Hawaiian state religious system. Archaeological analysis of the material record is used to understand the nature of island settlement and the investments that went into developing a monument at the effective edge of their living universe. A strong regional chronology is created based on two independent chronometric dating techniques and a relative ordering technique called seriation applied to both habitation and ceremonial sites. An additional number of techniques will be used to track human movement as source of labor, and the transportation of necessary resources for survival such as timber resources through paleo-botanical identification, fine-grained basalt through x-ray fluorescence, and food inferred through the late development of agriculture.

The results of this study indicate that Mokumanamana and Nihoa islands were the focus of ritual use and human occupation in a continuous sequence from ca. A.D. 1400-1815, extending for intermittent periods well into the 19th century. The establishment and maintenance of Mokumanamana as a ritual center of power was a hallmark achievement of Hawaiian chiefs in establishing supporting use on these resource deficient islands and pushing towards greater expressions of their power. This island temple was perhaps one

of the most labor intensive examples of monumentality relying heavily on a voyaging interaction sphere for the import and transportation of necessary outside resources to sustain life. It highlights the importance of integration of ritual cycles centered on political competition (and/or integration) and agricultural surplus production through the calibration of the ritual calendar. The creation of this ritual center of power resulted in: (1) a strong ideological framework for social organization and order; (2) a process in which a growing class of ramified leaders could display their authority and power to rule; and increased predictability and stability in resource production through forecasting- all of which formed a strong foundation for the institutional power of Hawaiian chiefdoms.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

THE INCEPTION OF HAWAIIAN RITUAL POWER

He hikuhiku nā kini akua
The host of gods are many, many

There are none higher than the gods (Pukui 1983:67)

Anthropology has a long history of examining the power of ritual and religion in the context of social political development in Hawai‘i (Graves and Ladefoged 1995; Graves and Sweeney 1993; Kirch 1984; 1990, 1994; Kolb 1991, 1992, 1994a, 1994b, 1997, 1999a, 1999b, 2006; Kirch and Green 1987, 2001; Ladefoged and Graves 2000; Sahlins 1958, 1972; Peebles and Kus 1977; Valeri 1985). Ritual activity is central to the study of religion as it represents the manifestation of beliefs that are communicated, negotiated, and transmitted to all aspects of social life. It is reflected through a patterning of activity oriented towards the control of human affairs, primarily symbolic in character, and socially sanctioned (Verhoeven 2011: 116, 126). Hawaiian chiefdoms were generally structured and organized around religious beliefs pertaining to hereditary succession (primogeniture) as the basis for determining how leadership roles would be acquired and the ways in which power could be wielded. Ancestral Hawaiian (i.e., Polynesian) society was characterized as kin-based, where an individual's position in the kinship system determines his or her social status and rank in regards to religious and political authority (Earle 1997; Sahlins 1958; Goldman 1970). Status and rank were generally measured by genealogical proximity to founding ancestors who were directly linked to the ancestral gods. With population expansion local subgroups developed into a ramage-type system- a male-based ranked system of conical clans (Firth 1936; Earle 1978: 10). This system

had a strong ideological bias towards the patrilineal line and primogeniture (i.e. hereditary succession through first born sons). The senior male of each ramage would remain chief of the conical clan, as groups expanded in population and moved to occupy new territory. These rankings (from high to low status) determined sanctity and rights to political office and religious duties.

The term aliʻi (i.e. proto-Polynesian for ariki) derived from an original meaning for chief, head of lineage; first born in the senior line, who succeeds to the chieftainship of the lineage and has strongest personal "mana" (spiritual power) and "kapu" (sanctions that established the state of sacredness) (Kirch 1984: 63; Spriggs 1988: 58). These power relations and competition between siblings formed the underlying structure of socio-political organization, particularly that involving and status rivalry and social stratification (Sahlins 1958; Goldman 1970). At the time of European contact, Hawaiʻi was thought to be the most highly stratified society in Polynesia bordering on, if not already transformed into a "true" or "primary" state, or what was later termed "primitive state," "archaic state," or "state-analogue." (Sahlins 1972: 148; Service 1975; Hommon 1976, 1986; Kirch 2010; Grinin 2011). Chiefly lineages had been converted into one or more conical clans superimposed upon a truncated class of commoners (Kirch 1984:36). To many, ritual and ceremonies were seen as a playing a secondary role in reinforcing the hierarchical social structure, increasing the authority over labor, and widening the separation between the aliʻi and makaʻāinana classes. Others, such as Earle (1997b), posited a self-interested class of chiefs who used ritual to partly deify themselves and establish the cultural logic for their "right" to rule.

This hereditary Hawaiian chieftainship was legitimized by a religious ideology, and more specifically mana, which is defined here as ritual power. The concept of mana was of central importance to Hawai‘i’s religious system as a meta-physical medium of power that manifested in the sanctity and authority of chiefs (Blust 2007; Handy 1927; Keesing 1984, 1992). Mana was closely associated with hereditary rank and referred to as a type of “sacral aura conferred on chiefs” from their “god-inheritance” (Blust 2007: 409). The ali‘i (chief) class of Hawaiian society was further divided with at least seven or eight grades of chiefs competing at different geographic and social scales for authority and power. As the base of eligible chiefs with ascribed birthright grew, an important historical transformation occurred that established the ritual system as a means to help determine leadership preeminence.

The ‘aha ceremonies focused on competitive growth and the associated ritual became a part of a state sponsored religious system that ultimately sanctioned ad granted a level of power to chiefs that could not be fulfilled by an ascribed birthright alone. This new form of power and authority was obtained by joining with commoners to successfully complete arduous prescribed ceremonial activities. Through these practices they demonstrated their ability as true leaders and affirmed support through signs issued by ancestral gods and deities in the afterlife. This ancestor-descendant relationship became the basis for Hawaiian religion and ritual practice and is critical in understanding how power exists across the continuity of time and space. These practices, rituals, and relationships became important signatures of this complex religious system. Chiefs rose to the status of being “god-like” or “divine kings” and representatives of the people through ritual practice that reinforced and commemorated important events on places of

historical convergence. The earliest etymological definitions of mana describe it as an animistic spiritual energy, referring to powerful forces of nature that were conceived as expressions of an unseen supernatural agency (i.e., ancestors in nature) (Blust 2007: 406; Keesing 1984; 1992). The earliest notions of religion therefore represented an attempt to link power with the ancestral forces of nature (Blust 2007). Mana was conceived as ritual power, and the foundation of a coherent Hawaiian religion emerged based on this understanding of gods or ancestors in the universe or nature as sources of "power."

This research examines the elaboration of ritual power in pre-contact Hawai'i over a four hundred year period, ca. A.D. 1400-1815. This system of power complemented human activity and the circumstances of life amongst chiefdoms in Hawaiian society. The emergence of this ritual power was marked by an expansion of the voyaging elite to a relatively undocumented area in the Hawaiian Archipelago- the expansive region called the 'Northwestern Hawaiian Islands' (NWHI). It is here that two geographically remote and ecologically marginal islands called Nihoa and Mokumanamana were situated. Over a period of 110 years these islands were rapidly occupied and a number of structures constructed to serve complementary settlement functions- Mokumanamana was a hallmark achievement, established as the ritual center of power for a system of temples and ritual practices that spanned the archipelago; and Nihoa was developed into a remote elite outpost for recurrent staging and use of the ritual center. These efforts represent one of the earliest signs of the Hawaiian religion, expressed through the establishment of an astronomically-based calendar, and elaborate ritual ceremonies, increase in the monumentality of temple construction, expansion of voyaging, and integration across social and political territorial units. It had long lasting

effects, which led to the centralization of chiefly management, the integration of social classes of chiefs and priests, the development of a charter for institutional order, and ultimately a state sponsored religion that became widely established throughout the main Hawaiian Islands. Important ideological beliefs were developed around the concept of the cord (‘aha) as a symbolic connection between ancestors and descendants (represented in west and east divisions of the archipelago) as it came to be a widespread organizing dimension of Hawaiian social life. Through commemorative rituals, the west was acknowledged and reaffirmed as a primary pathway of power where elite status, authority, and spiritual power originated and was continually legitimized.

This research utilizes an interdisciplinary approach in combining ethno-historical research with archeology as complementary ways of understanding the Hawaiian past. Through these approaches ritual power is established as a strategic mechanism for social political development, one leading to a unified set of cultural beliefs that provide the basis for integration across social units. In this dissertation, ethno-historical analysis of cosmogonic chants, mythologies, and oral accounts will be examined to understand ritualization as a historical process one that tracks important social transformations and ultimately led to the formation of the Hawaiian religious system. In addition, archaeological analyses of the material records were used to understand the nature of island settlement and the investments that went into developing an island monument at the effective edge of the Hawaiian living universe. A reliable and precise regional chronology is created based on two chronometric dating techniques and the relative ordering technique, seriation. These are applied to both habitation and ceremonial sites. Additionally, a number of techniques are used to track human movement as a source of

labor, and the transportation of necessary resources for survival such as timber resources through paleo-botanical identification, fine-grained basalt through x-ray fluorescence, and food through agricultural terraces.

The results of these studies indicate that the Mokumanamana and Nihoa islands were the focus of ritual use and human occupation in a continuous sequence from ca. A.D. 1400-1815, extending for intermittent periods that continued well into the 19th century. The islands' chronology matches or exceeds the duration documented in other regional studies, such as Kohala, Hawai‘i Island, and Kahikinui, Maui Island. The establishment and maintenance of Mokumanamana as a ritual center of power was a hallmark achievement for Hawaiian chiefs in supporting use of these resource deficient islands and pushing towards greater expression of their power. This island temple was perhaps the most labor intensive case of monumentality in Hawai‘i relying heavily on a voyaging interaction sphere for the import and transportation of necessary outside resources to sustain life. It highlights the importance of an integration of ritual cycles centered on political competition (and/or integration) and agricultural surplus production through the calibration of the ritual calendar. The creation of this ritual center of power resulted in: (1) a strong ideological framework for social organization and order; (2) a process in which a growing class of ramified leaders could display their authority and power to rule; and (3) increased predictability and stability in resource production through forecasting- all of which formed a strong foundation for the institutional power of Hawaiian chiefdoms.

In this dissertation, the research confronts several established or stereotypical views about Hawaiian culture and history, and will demonstrate the following: 1) The

Northwestern Hawaiian Islands were not a cultural anomaly and played an integral role in the social political development of Hawaiian chiefdoms; 2) Hawaiian chiefdoms succeeded in sustaining the long-term use of Nihoa and Mokumanamana as remote satellites and were not forced into a scenario of island 'abandonment'; 3) Hawaiian long-distance maritime voyaging did not diminish post- A.D. 1300, and in fact expanded simultaneously with the development of terrestrial based economies; and 4) these Northwestern Hawaiian islands represent some of earliest and most evident forms of religious monumentality and their overall ritual investment matched or was comparable to the ritual complexes in the main Hawaiian Islands. The occupation and use of Mokumanamana and Nihoa were sustained over a 400 year period of time, involving energy investment, not just in building temples but in maintaining support for constructing habitation sites, rebuilding heiau, and periodic re-occupation in terms of resources, transport, labor, and energy. It will be demonstrated through this study that these 'peripheral' islands need to be reconsidered as they played a 'central' role in shaping and remembering the social political histories of Hawaiian chiefdoms.

Expanding the Setting for Hawaiian Chiefdoms

At the time of European contact traditional Hawaiian society had developed into one of the most advanced complex chiefdoms in Polynesia, diverging significantly from typical cultural signatures that were documented elsewhere in this region of the oceanic world. The Hawaiian archipelago provided a unique setting for this social-political development as it represented some of the most remote and ecologically diverse islands. The 'main' Hawaiian Islands became the backdrop and setting for complex social organizational patterns to emerge with ruling lineages established on each island. The

'main' Hawaiian Islands spanned a distance of approximately 4,594 km. and included the islands (from east to west): Hawai'i, Maui, Kaho'olawe, Lāna'i, Moloka'i, O'ahu, Kaua'i, and Ni'ihau. Together, these main islands covered an estimated total land area of 16,644 km^2. Absent from the prominent discussions were a number of remote, geographically isolated, and resource deficient islands located in the older western portion of the archipelago, called the 'Northwestern' Hawaiian Islands. These distant landfalls consisted of a series of smaller coral islands, seamounts, banks, and shoals extending an additional 1,760 km. in a northwestern direction past the 'main' islands covering a miniscule of 13.5 km^2 of emerged land; however their submerged coral reefs, landforms, and open waters expanded exponentially to cover an estimated total area of 14,165 km^2. The religious and cosmological significance of the Northwestern Hawaiian Islands was of primary importance in the social political development of Hawaiian society as this region that represented one half of a spiritual continuum between the living and spirits of the deceased. Located centrally on the axis between the two realms was the island of Mokumanamana (Necker) (23° 35' N latitude, 164° 42' W longitude), comprising only 0.20 km^2 of land reaching a maximum elevation of 82 masl. Approximately 290 km to the southeast was Nihoa (23^o 03' N latitude, 161^o 56' W longitude) the staging island, which comprised only 0.70 km^2 of land area, with a broad swale that extend between two ridge tops: Miller's Peak (269 masl) and Tanager Peak (256 masl) (Figures 1.1-1.4). Both islands were central to a complex ideological system that took into consideration the entire archipelago in order to understand the process of mana and acquisition of ritual power.

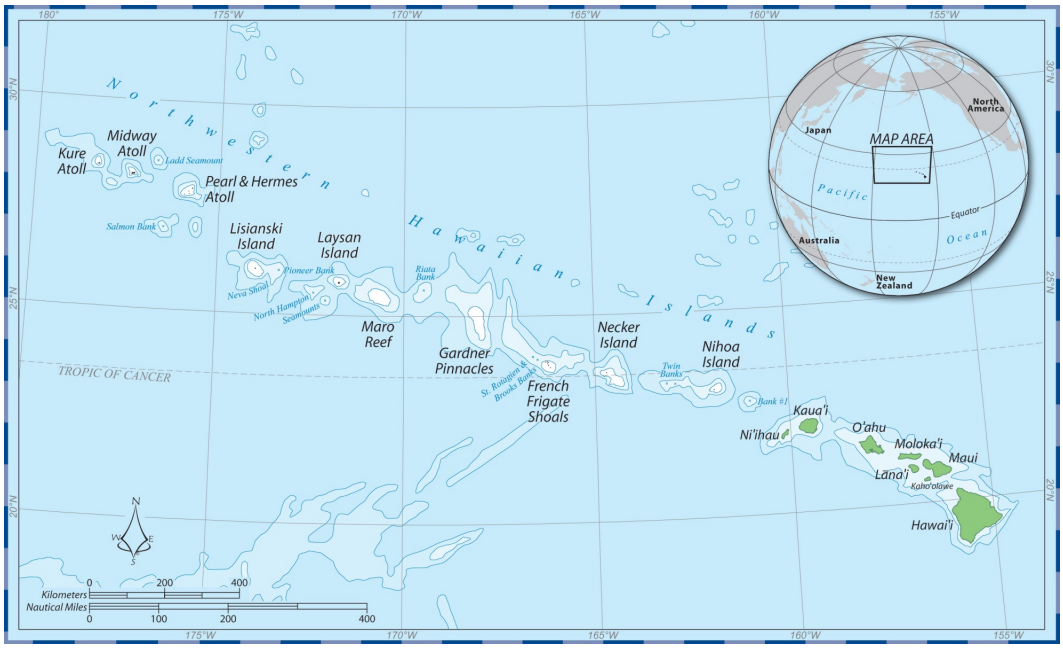

Figure 1.1. Map of the Entire Hawaiian Archipelago Including the 'Main Hawaiian Islands' and the 'Northwestern Hawaiian Islands'

Figure 1.2. Photo of Nihoa Island, Located a Distant 222 km NW of 'Main' Hawaiian Chain

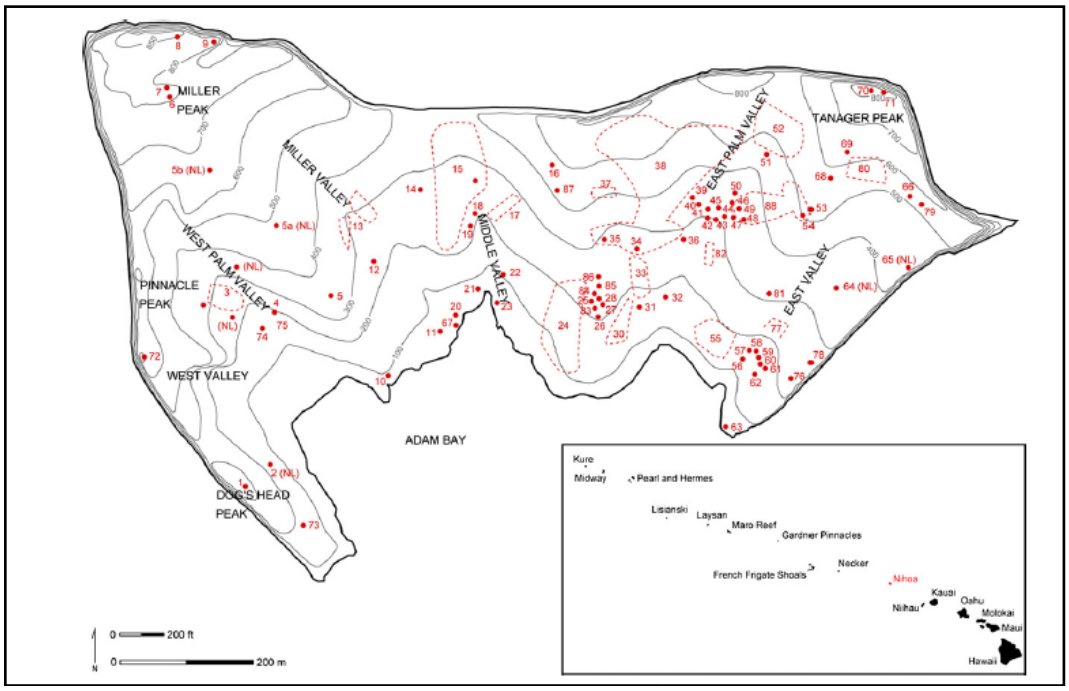

Figure 1.3. Map of Archaeological Sites on Nihoa Island

Figure 1.4. Photo of Mokumanamana (Necker) Island, Located a Distant 510 km NW of ‘Main Hawaiian Chain

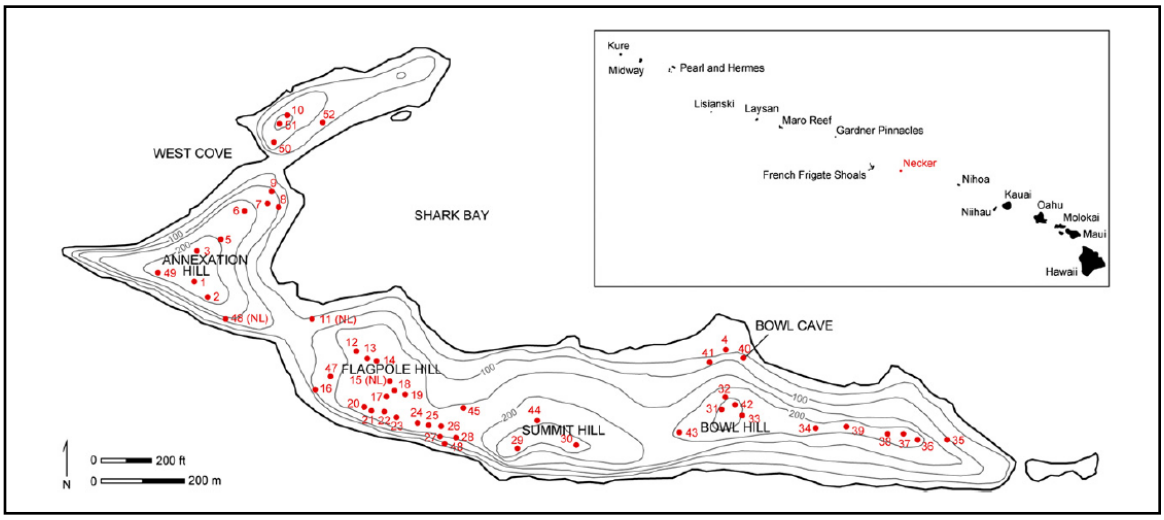

Figure 1.5. Map of Archaeological Sites on Mokumanamana (Necker) Island

The emergence of the Hawaiian "archaic" state derived its unique attributes of its economic, social and political structures from a much earlier transformation out of an ancient Polynesian chiefdom structure. From a cultural evolutionary perspective, Polynesian societies were considered to reflect an evolutionary continuum of social change and transformation. They were classified into stages of simple to complex chiefdoms of stratified and ranked societies from which archaic states and primary states emerge. Simple rank systems were marked primarily with one chiefly ranking (one distributive level) and composed a single kin group with hereditary power over a central community and possibly additional smaller subsidiary communities (Cordy 1974a, 1974b; Goldman 1955). In Hawai'i, this social structure changed into a complex ranked social system marked primarily by hierarchical ranking (two to three distributive levels) and larger socio-political territorial units (e.g. ahupua'a [smaller land unit], moku [district], mokupuni [island-wide]). The upper levels of elites and nobles (named ali'i)

lived in a manner that was relatively free from subsistence work; and they were supported by commoners, or makaʻāinana through tribute and surplus (Sahlins 1958). At the top of society were paramount chiefs who claimed rights of primogeniture from the gods and achieved further status through war and intermarriage. The social transformation in Hawaiʻi to this more complex form of chiefdom included additional differentiated practices involving housing, burials, sumptuary items, royal insignia (i.e. chiefly pendants, feathered capes and helmets, elaborate kapu [sanctions]), and monumental religious architecture (Cordy 1974a; 1974b).

Kirch (2010: 174) states that all the archaeological evidence points to the period from the late fifteenth to the mid-seventeenth centuries as the crucial phase during which the Hawaiian archaic states first emerged out of earlier sociopolitical formations of a more classic Polynesian chiefly form. This period is marked by the stabilization of population growth, the expansion of settlements into marginal leeward zones, and the formation of large-scale dry land agricultural field systems on Maui and Hawaiʻi. During this period, considerable investments were made in ritual and political power in the form of monumental architecture (Kirch 2010: 128). By proto historic to European contact periods, ca. A.D. 1650-1820 Hawaiian Society had reached its apex in terms of population growth, social stratification, and organizational complexity. At this apex, Hawaiian chiefdoms were continuously expanding and contracting in a cyclical pattern. Polities led by senior chiefs had a tendency for geographic expansion and contraction, as territorial domains enlarged, extending at times through alliances and conquest, only to be partitioned later through disputes, rebellions, and defeat in battle. These patterns were seen in their most extreme cases on the eastern islands of the archipelago (i.e. Maui and

Hawai‘i; Kirch 1994: 262; Graves et al. 2011) as fierce rivalries between leeward and windward chiefs were rooted in disparate resource potential and economic histories (Hommon 1986: 67). Expansion and reorganization of resource systems, as well as increased construction and utilization of temples and ritual shrines or heiau, are clearly demonstrated in the archaeological record suggesting greater centralized control of chiefs (Cordy 1974a, 1974b; Earle 1977, 1978, 1987, 1997b; Hommon 1986; Kirch 1990). During this late period competition and status rivalry between paramount leaders, as well as a growing class separation between the elites and commoners became institutionalized as inherent features of the social political structure of Hawai‘i.

The inception of ritual power and religious practices is believed to be one of the essential characteristics of the chiefdoms as it provided the foundation of institutional power of Hawaiian society. During this period, the paramount's status and power was legitimized by state cults involved a formalized temple system overseen by full time priests. The religious system played an important role in forming a vigorous ideological component to power that both reproduced and transformed society through replicated behaviors, or rituals. Rituals reinforced an ideology that was to be experienced and shared in common amongst the population. This research will show that in the early periods of the late expansion phase (ca. A.D. 1400), ritual played an important role of not only establishing authority, but providing a mechanism for social integration across social political divisions not previously documented in either ethno-historic or archaeological studies. During this time, the ali‘i became paramount rulers largely separated by genealogical pedigree and established as ruling lineages on the four main islands. Chiefs did rise in power and authority, but ritual processes that were put into place required them

to continually relate to the maka‘āinana as their representatives on the basis of a shared genealogy and ancestry.

Together, the chiefs worked with the priests to develop a complex religious system based on this ideology. It resulted in the creation of a temple system across the archipelago that operated in time with the rhythm of their natural universe and would commemorate genealogical authority and birthright in Hawaiian society.

Ritualization of Historic Processes

Religion is a universal and indispensable dimension of all social life and is often times recorded and documented in the ethno-historical record. It is the medium through which shared social life is experienced, expressed, and legitimated. Ritual—the practice of religious precepts is a primary component of religion, and it fundamentally serves the function of creating and maintaining common ideology and cultural principles (Bell 1997: 4; Valeri 1985: x-xi). Ritualistic practices reflect a process that is repetitive often referring to prototypical persons and events and through this repetition the practicioner maintains a sense of continuity with the past (Connerton 1989: 45). Rituals are dependent upon myth, since it provides the narrative assuring people what they are doing in the ritual is what was done in the primordial age when the gods, heroes, or ancestors ordered the cosmos, created the world and established divine models and moral codes for all subsequent activities. The process of reoccurrence is referred to as *ritualization*- “patterns that are imbedded in social dimensions that derive their significance from the interplay and contrasts of other practices” (i.e., aspects of Hawaiian social life that was indirectly tied into the ritual cycle) (Bell 1993). This historical pattern was an aspect of ideological production and indirectly shaped all aspects of social life, in particular the

stimulation of memory construction (Jones 2007: 47). Memory was important for people in the past because (1) it enabled them to preserve information and knowledge inwardly in the form of traditions and rituals as a means in sustaining key values of social life; and (2) it played a crucial role in one's own continuity in time, achieving some sense of ontological security, some sense of who one had been in the past and still was in the present. It made people aware of the temporal dimension of their existence and gave them a consistent sense of identity (Gross 2000: 2). These were significant ways of constructing authority, power, and ideology through re-enactments (i.e. commemorations) of deeds originally performed by gods in the primordial past and preserved through mythological accounts. It was this ritual power that was a driving mechanism that helped to maintain and transform the social political system- they were creative strategies by which human beings continually reproduced and reshaped their social environments (i.e., praxis or practical theory).

The idea of historical patterns and structured reoccurrence was introduced to Anthropology through a scholar named Le Roy Ladurie (1979: 111-31) regarding a cyclical pattern of event-structure-event. This social concept outlined how structures inspire action, with sometimes intended consequences, which in turn maybe alter the way in which we conceptualize the world. Sahlins (1981, 1983, 1985) built upon this idea based on patterns abstracted from chiefdom societies such as pre-contact Hawaiian society, where "heroic" polities often replicated the actions of great mythical heroes, in a process he termed mytho-praxis. In Mytho-praxis culture is historically reproduced from one generation to the next and is "altered in action" or even "transformed" by specific generations in a systems change. Metaphor, analogy, abstraction, specialization were all

seen as types of semantic meanings used to express a scheme of cultural categories and deployed as reference points in the relative "present" to experience and understand the past. Ladurie believed that reference to the world was an act of classification and from which reality is indexed to distinct concepts of relation or empirical understanding of meaning. Thus, in order to understand a culture and its history, one must be able to recall from a greater conceptual and referential extended archive of understanding. Hawaiian history was seen as a cultural ordering that was active historically and it reproduced, yet transformed itself simultaneously. Reproduction and transformation therefore were not mutually exclusive to stability and change (Sahlins 1985: 153). The principle of continuity is highlighted between past and present, as most societies are obligated to "stay true" to the past, yet grow and transcend the past. It is a synthesis of both stability and change in the continuation of culture and society.

The concept of mytho-praxis is important for understanding Hawaiian religion because ritual power in itself is an act of structured reoccurrence. The historical record is bound up in mytho-praxis as each generation of people were conscious actors that participated in enduring patterns of social organization and culturally symbolic systems that informed real events. In the course of this process, real situations were assessed and negotiated, in ways that transformed the traditional patterns of structures (Bell 2007:77). Sahlins (1972: 145) utilized this concept of replicated patterns to explain the cyclical expansion and contraction of chiefdom polities, a tendency for chiefs domains to enlarge and contract, extended at times by conquest only to be partitioned later in rebellion. Valeri (1985: 340-348) attempted to take these interpretations one step further by asserting that ritual represented a chain of sacrifices constituting the institutional

character of Hawaiian chiefdoms. Ritual symbolizes the linking of elites with the natural order of the universe, as well as to help mediate and control group relations. Both of these ritual explanations however do not capture the full magnitude of ritual power that was evident in Hawaiian society, and they represent only the latest patterns of society witnessed on the eve of and after European contact.

This dissertation research utilizes ethno-historical records to understand ritualization in the historical process through instances of mytho-praxis structured events and transformations. It is applied to cosmogonic chants, mythological stories, and historical accounts in an attempt to track ritual power back to its source. These records reveal the direct descent of chiefs from the gods whom mana ('spiritual power') and kapu ('state of sacredness') were derived and how these lessons become reified in Hawaiian society. It gives priority to Hawaiian language based ethno-historical accounts to map the complex relationships of ritual power that emerged in two important historical transformations: (1) the early cosmogonic period at the time of the emergence of the first Hawaiian man; and (2) at the late cosmogonic period at the time of a forefather for Hawaiian genealogies who establishes the dominant religious system. The first transformation marks an important story of Hawaiian genesis that provides divine models from which society structured itself by. The second transformation is described in an oral tradition that is rich with historic information of how mana is reconstituted, and a system of heiau temples are established in relation to Mokumanamana throughout the Hawaiian archipelago. The temporal scale of these events will be tracked using chiefly genealogies with conservative age estimates of 20-25 years per reign (Cachola-Abad 2000; Cordy 2002; Hommon 1976; Kirch 2010; Kolb 1991; 1994). Through the mytho-

praxis analysis of this historical reoccurrence it will be demonstrated that these events were critical junctures in history that: (1) helped to legitimize power and authority of chiefly elites in Hawaiian society; and (2) resulted in the formation of a state sponsored religious system. In the end, Mokumanamana will become clearly established as the site where this inception occurred.

Materialization of Ritual Ideology

Ritual ideology is a power expressed and materialized through the archaeological record. Earle (1997b: 151) defines this materialization of ritual ideology as the transformation of ideas, stories, myths, and the like into physical reality that can take the form of ceremonial events, symbolic objects, monuments, and writing. Materialization is thought to deliver two fundamental properties permitting the cultural dimension to be strategically created and manipulated as an ideology: (1) it creates common, shared experiences; and (2) it permits control over the production and use of ideology. Moku-manamana (also called "Necker"), or the 'island of ritual power' required large investments in order to construct its temples and maintain it as a ritual center of power for the archipelago. The massive size of this island temple required substantial planning and an enormous investment of labor. Its scale however exceeded normal measures of monumentality as not only was it an entire isolated unit of land dedicated for the sole purpose of ritual activities, but also: (1) it required an entire support network in order to sustain use over a prolonged period of time; and (2) it influenced a larger system of rituals that would occur in sequence across the entire archipelago.

The remote location of Mokumanamana provided an ideal space for the most sacred ritual activities to take place and undoubtedly only specific elites were designated

to participate. As a result Hawaiian oral traditions have been noticeably silent about the existence and use of these remote islands. For over a century now, archaeologists and ethno-historians have been unable to explain the archaeological remains on both Mokumanamana and Nihoa Islands and their seemingly enigmatic position with respect to known Hawaiian traditions (Graves and Erklen 1991). These islands have even been called 'mystery islands,' because they appeared to be uninhabited at the time of European contact, but had clear signs of evidence of former human occupation and settlement (Kirch 1988; Irwin 1992). This uncertainty led to speculation that the archaeological remains could have been vestigial linkages to places as far away as Central Eastern Polynesia (Emory 1928; Emory 1970). The Northwestern Hawaiian Islands represent histories of the past that were not forgotten or erased, but rather purposefully protected because of those histories (i.e., narratives) importance in accessing power. The chiefly elites who had the most power and control limited access and use of the island to small parties or groups. Only the most important chiefs and priests likely could have participated in the ceremonies that culminated there on an annual or periodic basis. The rituals associated with Mokumanama represented the root of socio-political power that required separation and concealment from much of the common population. Chiefly elites, along with their priests, placed a premium on secrecy and safely guarding this information concerning the construction and maintenance of a ritual center of power.

Ritual ideology often materialized publically and its display helped to form a strong ideological component to the entire population giving order to the institutional structure of society. The mass of population shared in these experiences through the 'aha ceremonies, which were commemorative events held at every heiau temple across the

entire archipelago. The repetition of these ceremonies and rites were valuable strategies for the enculturation of individuals. Rituals drew their power from following the repetition seen in natural cycles and the passing of time. These patterns helped to organize time in regards to social life. These types of invariant repetitive ritual patterns were deliberate and precise in their reoccurrence, as they were meant to separate sacred actions from the everyday (i.e., particular people, times, places, objects, and actions). Mana as ritual power therefore was a social strategy of distinguishing and highlighting certain places, people, actions, and objects as a process of shaping the direction of social evolution.

This dissertation research utilizes archaeological research as a means to understand the materialization of ritual ideology in the cultural record. Through this process a new understanding of these islands' histories of discovery, colonization, and continued settlement will begin to emerge. In order to accomplish this, chronologies are established using both chronometric dating and relative dating techniques for seriation. Through this research the chronology of these islands now include more than 62 chronometric dates 39 ^{230}Th dates from ritual corals, 23 ^{14}C from wood charcoals and unburnt nut shells, gourds, and woods. These dates come from a variety of contexts; both ritual and habitation sites, as well as agricultural terraces. Additionally, a geochemical analysis of nearly 20 basalt sources and more than 100 artifacts representing an array of forms were completed, including adzes and other utilitarian tools, 20 stone vessels, and 15 stone images. Settlement patterns are analyzed taking into account descriptions and data from a compiled database of more than 140 archaeological features, including 51 religious features (heiau and shrines), 48 habitation sites, and 23 dry land agricultural

complexes. These are examined in the context of mythologies and oral traditions, as well as astronomical implications and voyaging considerations.

Structure of the Research

In this section, I have introduced the research problem and the primary focus of the dissertation. I next present "Mythological Ancestors and Landscapes of Power," where the setting will shift to include the Northwestern Hawaiian Islands as the other half of a spiritual continuum. It will be established as a primary pathway where elite status, authority, and spiritual power originated. Mokumanamana which is centrally located will prove to be the primary site where historical interaction and convergence occurs in mytho-praxis transformations. Following this I present "Reconstituting Mana and the Establishment of the 'Aha," where the concepts of mana and 'aha are introduced as core aspects of Hawaiian religion and mechanisms for establishing Hawaiian leadership amongst ramified chiefs. Mokumanamana becomes established as a ritual center for chiefs to commemorate the origin of power. In the next chapter, I will examine the role of voyaging in "Voyaging Expansion of Hawaiian Maritime Chiefdoms," where geographical circumstances and maritime considerations will be outlined in regards to possible strategies for the colonization and settlement of these remote islands. I will demonstrate that there were only a few plausible scenarios for the settlement and use of these islands. Voyaging is established as a means through which chiefs could create a framework for their authority. After this chapter, I look at "Sustaining Ritual Use and Human Occupation," where the archaeological record is examined to understand contrasting yet complimentary settlement patterns between the islands. A settlement chronology is established through 14C AMS dates and seriations of open habitation sites.

Also, a number of analyses will be done including paleo-botanical identification of charcoal assemblages, x-ray fluorescence of basalt sources and tools, as well as nutrient analysis of agricultural soils to understand the nature of human settlement on these islands. In the final chapter, "Hawaiian Religious Formation and Monumentality," I present Monumentality as an expression of chiefly power. A ritual chronology will bedeveloped for the construction and use of temples. Also the true costs and investments associated with Monumentality and sustaining a voyaging support network for these islands will be measured. It will show a level of social integration and cooperative resource pooling that is demonstrated in the convergence of different social groups on these islands and the transportation of labor and resources needed to sustain life. In the concluding chapter, information from previous chapters will be synthesized. Also, a summary statement will be provided that outlines the broader significance of this research towards our understanding of Hawaiian history and sociopolitical processes.

CHAPTER 2

MYTHICAL ANCESTORS AND LANDSCAPES OF POWER

The Hawaiian religion and ritual practices, historically, were rooted in landscapes of power. The social political development of Hawaiian chiefdoms was dependent upon the leaders' ability to understand how the western portion of the archipelago was a primary pathway to power, where elite status, religious authority, and spiritual power originated. In the northwest of the Hawaiian archipelago were a series of smaller diminished islands called today the 'Northwestern Hawaiian Islands' that were considered a spiritual region facilitating the journey spirits took upon death and the process of deification in the afterlife. The configuration, directionality, and the age sequence of the Hawaiian archipelago is in a relatively straight line which encouraged early navigators to extend their voyaging exploration past the 'main' Hawaiian Islands, farther into the northwest with each new land fall discovered. This systematic exploration resulted in the formation of a complex knowledge system of religious beliefs that measured the extent of the Hawaiian universe and divided the archipelago into two worlds based on sequential patterns seen in their geological age and ecological structure. The success of the chiefs therefore was dependent upon their ability to negotiate between the world of the living and the world of the afterlife, as integrated landscapes of power. In the midst of this spectrum of islands was positioned one island in particular called Mokumanamana, which represented the intersection of both worlds, and was an important site of historical interactions as it pertained to the formation of Hawaiian religion. This island was the central focus of Hawaiian chiefs in the quest to

commemorate the source of their mana, birthright, and authority (lit. spiritual power derived by ancestral gods).

Myths played an important role in understanding the foundation of Hawaiian religious beliefs as they explained the chiefs' genealogical linkages to the gods (nā kini akua; literally the multitude of gods) and also provided a formulae for the successful transformation and reproduction of a stable society. In Hawai‘i, it was the duty of men, who were primarily employed to be the sources of ali‘i (chief) lore training, education, as a life occupation to archive and protect this information. Through a social class of priests' called kahuna this information was remembered and documented by their phenomenal memories as the storehouses of knowledge. These priests belonged to the chiefly houses that became dynasties relying upon the priestly knowledge to communicate with ancestors and legitimize the ruling family's reign. Through his process ruling lines were maintained, steeped with glory, and their genealogy built upon the reputation of mythical ancestors. Thus, genealogy provided an important continuum from the first life, which originated from primordial darkness, to the emergence of man and primary gods, to mythical heroes, and finally great chiefly rulers who developed Hawaiian society. This mythical past was not imaginary but rather a continual reality in the lives of chiefs as this past was re-enacted and re-adjusted at different times for the purposes of acquiring mana (Sahlins 1981: 9).

These earliest accounts outlined the highest goals and values there were strived for within the society. They provided a strong unified moral code that helped to keep continuity from one generation to the next. These ancient chants and stories outline the basis for religious beliefs in Hawaiian society and the complex relationship that emerged

between man and their ancestral gods. Their ancestral gods occupied all domains in nature and were the natural processes themselves. Thus man was interrelated and intertwined with nature in a reciprocal relationship of co-existence. Sahlins (1981: 13) states that Polynesian cosmology lends itself in a powerful way to stereotypical reproduction providing logical continuities linking the earliest elements of cosmological myths to chiefly heroes of the latest historical accounts. It was this cosmology that also highlighted strategic locations designated as places of important historical interactions that reoccurred at different periods in our history. These were not just random places of coincidence but rather ones where mana was known to be formed, built up, and concentrated. Through commemoration, that is the layering of important historical events on top of each other, the mana of these places, their historical events, and associated actors were doubled and glorified. It is through this cultural repetition between the past and present, ancestors and descendants, place upon place, that mana was continually established. This continuity was guaranteed by an unbroken succession of births between the historical actors and the mythical protagonists, giving rise to re-experience through analogous circumstances.[1]

The socio-political development of chiefdoms in Hawaii required knowledge of the totality of all the islands in the archipelago. In previous historical research efforts concerning Hawai‘i, the ‘Northwestern Hawaiian Islands’ have always been overlooked as playing any significant role in the social and political context. In this chapter however,

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[1] Sahlins (1981:9) believed that history often repeats itself, and that the first occurrence is considered a myth, while the second occurrence is a historical event. These patterned re-enactments with each occurrence reproducing itself, yet transforming by have its own unique signatures. Kame‘elehiwa (1992) utilizes a similar approach in her analysis of Traditional Hawaiian Metaphors and Kālai‘āina in Native Lands and Foreign Desires.

we look closer into mythological stories of Hawaiian creation for this remote region and draw upon important historical truths concerning the role of power and place in Hawaiian society and religion. The historical method will be used to look at the primary sources of Hawaiian mele koʻihonua (cosmogonic creation chants) and moʻolelo (histories, stories, narratives) that were uncovered by native informants, with preference given to sources in the Hawaiian language. This approach is used because it provides a more accurate method of understanding and reconstructing the Hawaiian past from a Hawaiian perspective. It also minimizes the problems of interpretation and accuracy from texts translated into English. Additionally, it will also draw upon Hawaiian language associations and semantic analyses as a means to interpret deeper cultural meanings and metaphors. Through this study, we will understand how islands represent the continuity principle of rank and status moving from east to west. Power therefore manifests in places such as the Northwestern Hawaiian Islands, which are located at the highest end of the rank spectrum. The unique location of the island of Mokumanamana allowed chiefs to access this northwest region, a world of gods and ancestral spirits, venturing to it and leaving material expressions of their visits behind. It represented a journey of returning back to the original site of Hawaiian social transformation, a place that first legitimized Hawaiian birth-right and authority.[2] The ability to access the pathways between these worlds was ultimately the basis for power and rank in Hawaiian society, and the impetus and means from which highborn chiefs were provided ascribed genealogical legitimacy.

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[2] The research acknowledges that there are layers of secrecy and protection concerning these complex knowledge systems of religious beliefs that requires researchers to adopt an insider (emic) approach to understand these deeper aspects of culture. This insider understanding that can only be gleamed through informed interpretations of cultural metaphor and language, as well drawing upon religious insight from being a spiritual practitioner.

Emergence of Life from Primordial Darkness

Mai ka pō mai ka ʻōiaiʻo
Truth comes from night

The Hawaiian ethno-historical record is rich with accounts of creation and of Hawaiian genesis recorded in chants called mele koʻihonua.[3] These dynastic chants carried important social myths that were considered sacred. They provided chiefs with important genealogical links back to the ancestral gods. It was believed that- "mai ka pō mai ka ʻoiaʻiʻo"- or that night gave truth (Pukui 1983: 225). It is this very truth that is revealed in this cosmogonic process that laid out the natural and social distinctions that our ancestors witnessed in the Hawaiian universe, highlighting the important relationship between mortal man and his supernatural ancestral gods. The Kumulipo genealogy (the 'source of deep darkness'), is widely recognized as the most comprehensive of all the mele koʻihonua encompassing most other ancient genealogies and stretching back farther to the beginning of the world, tracing Hawaiian genealogies from creation all the way into the seventeenth century to the chief ʻĪ-a-mamao. It was chanted at the birth of this famous son of Keawe-kekahi-aliʻi-o-ka-moku, at the time his umbilical cord was cut and the kapu (restrictions) were placed upon him (Liliuokalani 1978). There are five known accounts that provide the basis for understanding the Kumulipo as a comprehensive outline of Hawaiian history. The body of chants includes:

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[3] Kelsey (n.d. Hawaiʻi State Archives M-86) states "the earth, as a royal genealogy, was adzed open, as it were, by genealogical chant called mele koʻi honua (mele lit means chant; koʻi means adze; and honua means earth). In sum, it means to carve or shape the earth. Kelsey's notes were read extensively in this dissertation research to understand the Kumulipo. His informants were: Henry B. Kalimu, Mary Kaʻoulionalani Pahiʻo, William Kāmaʻu, Daniel Kaonoki Hoʻolapa, Philip Iokepa, Z. P. Kalokuokamaile, David Malo Kupihea, Akona Mika, Naluahine Kaʻōpua, Daniel Paea Hoe, George Pekelo Kalama, and the well known scholars Henry Kekahuna (1881-1969) and Fred Kahapula Beckley (1873-1943).

1. He pule hoʻolaʻa aliʻi. He Kumulipo no Ka-I-amamao a ia Alapai-wahine (Kalākaua in Beckwith 1951)[4]
2. He pule heiau. He Kumu Lipo no Alapai Wahine (Liliʻuokalani 1978)
3. He Kumulipo, he moolelo Hawaii (Kauakahi 1902)
4. Ka Mele Kuauhau Kumulipo/No Kumulipo nō (Kamokuiki n.d. L.1.3.#5)
5. He mele kuauhau Kumulipo (Poepoe 1906)

The Kumulipo creation describes the history of the world as it was divided into sixteen wā or time periods that move from past to present (i.e. forward in time). These sixteen wā were divided into two halves- pō (night, darkness, obscurity) and ao (day, light, clarity). Pō represented the spirit world, while ao was the world of living man (Beckwith 1951: 48). Thus, it is believed that pō was entirely divine- a source of creation, where ancestral spirits went to after death and were deified into gods.[5] Ao was its antithesis and a realm entirely compatible with man.[6] The Kumulipo chant opens with four wā (sections) of odes of identical patterns, each heralding the birth of a special class of animal or plants. Each class is governed by binary pairs[7] passing progressively from darkness towards light. Kumulipo and Pō-ʻele for the first class, Pō-uliuli and Pō-wehiwehi for the second class, Pō-ʻeleʻele and Pō-hāhā for the third class, and Pō-

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[4] The Kumulipo chant represents a broad framework of Hawaiian history from genesis to the seventeenth century. It encompasses a number of other well known creation chants such as Palikū, ʻOlolo, Kumuhonua, Kumuuli, and Puanue. Throughout the ethnohistorical sections in this dissertation I will utilize and reference lines from the Kalakaua version published in Beckwith's (1951) Kumulipo appendix as a primary guide.

[5] Pō means night, obscurity, darkness, and also "unseen" (Handy and Pukui 1972: 131), and "realm of the gods" (PE, 307).

[6] The Kumulipo chant uses repletion and mnemonic devices that play on binary opposites (i.e. pō and ao; or darkness and the light of day). It is said that during this period of pō (darkness) "ʻo ke akua ke komo, ʻaʻole komo kānaka,"or "the god [or the divine] enters, man cannot enter." (Liliʻuokalani 1878: 1-22).

[7] The demonstration of binary opposites is done through an oral technique of "countering" or classifying by opposites (e.g ʻAala ʻula [seaweed] in the sea and ʻAlaʻala-wai-nui [Peperomia plant] in the uplands); and also "metathesis (e.g. i kai [in the sea] and kiaʻi [guarded]) (Perkins 1990:26-27).

panopano and Pō-lalo-wehi for the fourth, Pō-kanokano and Pō-lalo-uli for the fifth class, Ka-pō-hiolo and Ka-pō-hāne‘e for the sixth, and Ka-pō-hane‘e-aku and Ka-pō-hāne‘e-mai for the seventh (Kamokuiki in Kalanianaole Collection n.d.). Each period from one to seven suggests the constant approach to “light” in successive stages of the world’s growth (Beckwith 1951: 68). In the beginning it was dark with the mists of night under the first faint light of the moon. It was in this darkness that the first life- the coral polyp was born. This origin was in remoteness, at the very roots where darkness began, far from the sun. The first period of pō (darkness) tells of the birth and evolution of the lower life forms (marine invertebrates) up through pairs of sea and land plants, birds, creeping crustaceans, reptiles, and creeping plants, to the mammals known to Hawaiians before European discovery (pig, bat, rat, dog). These allusions to plants and animals are full of connotative meanings regarding classes of migrants and competing lines of genealogies and possibly even social classes.[8]

The Dawn of Man in Ao

The second half of the Kumulipo chant marks the first major transformation in history between the periods of pō and ao- the breaking of light and the dawn of man.[9] This transition was an important aspect of Hawaiian religion as it helped to explain the world of spirits and gods as they were brought into relations with human descendants. It is here that the sun was first introduced as a vital element to man’s new beginning. This type of transformation in our past is termed here –“huliau”- (lit. overturning or complete

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[8] Beckwith (1951: 50) felt that the pairing of the species matching parent and child, plant and animal, or land and sea forms “has not apparent rational basis but rather depends upon world-play between names.” The pairings however reflects a complex level of understanding of Hawaiian associations and symbolism.
[9] Like the preceding periods, ao is also engendered by a pair of manifestations of po- Pōkinikini (k) and Pōhe‘enalumamao (line 596-597).

change) often times resulting in an overthrow of power and authority. In pō ancestral gods ruled, but in ao man took over and dominated. It is here that we see the appearance of four mythical protagonists- the first human woman La‘ila‘i (w) and first human man Ki‘i (k),[10] as well as their two other siblings- the male gods Kāne (a) and Kanaloa (a) (Figure 2.1).[11] La‘ila‘i represented the archetype Hawaiian female who was embodied in all human wives, mothers, daughters, and sisters reborn in every generation of Hawaiian females.[12] Likewise, Ki‘i became a symbol and model for Hawaiian male power, authority, and rank as the eldest born son. Kāne and Kanaloa represented the earliest primary gods, and also personified the divisions of space, representing the dualistic structures of life and the afterlife. It is in this first transformation from pō to ao, the relationship between these four mythical protagonists, which gave rise to the first and most enduring lessons on Hawaiian social reproduction concerning power: 1) the law of primogeniture as a means to determining the right of authority and rule; 2) the practice of royal endogamy, that is pi‘o[13] (incest) mating between siblings or half-siblings of the highest rank; and 3) the religious practice of using anthropomorphic images to control and petition gods.

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[10] In some references Ki‘i is descended from Ke-ali‘i-wahī-lani (lit. the chief who broke through the heavens) and La‘ila‘i (Malo 1951: 5). In the actual versions of the Kumulipo this husband of La‘ila‘i is not mentioned (Poepoe in Kamokuiki n.d. L.1. 3.#5).

[11] Kanaloa is called the akua hee haunawela (lit. the hot striking octopus). Kelsey (n.d. Box 1.4: 111) states Kanaloa’s name means: “Kana-loa, or Ka-loa (god), ka make loa (Ka ‘ana loa).”

[12] La’ila’i evolves into surrogate names of Haumea and Hina later. She represents the role and function of women in society. All females owe their origin to her and their roles in society. La‘ila‘i means calm (i.e. in regards to this conflict resolution between competing male claims). She ultimately chooses man over gods.

[13] Kelsey (n.d. Hawai‘i State Archives M-86) suggests that pi‘o mating or this metaphor of arching or bending the genealogy comes from the arching of the sun in the sky.

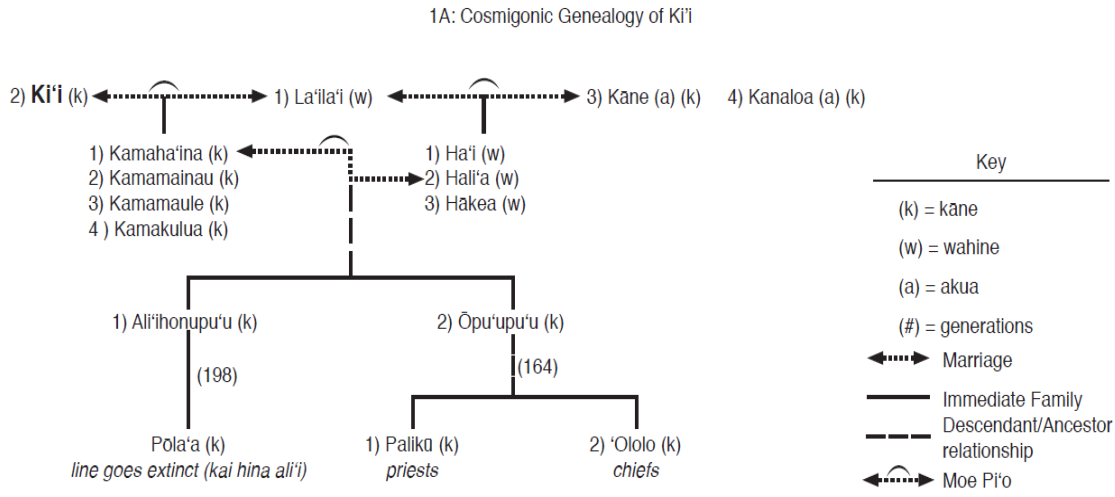

Figure 2.1. Cosmogonic Genealogy of Ki'i to Palikū and 'Ōlolo

The Triumph of Ki'i

Haku ai kama hānau mua	That is why first borns are always lords
Imua iā La'ila'i, Imua iā Ki'i	First through La'ila'i, next by Ki'i
Kalāua kama hānau lani lā	Their first born with sacred birth right
Puka	Emerge [through birth]

(Beckwith 1951: Lines 704-707) [Kikiloi translation]

The first lesson of the Hawaiian socio-political power is seen in the law of primogeniture (i.e., authority of rule that is passed down through first born sons). In this transformational period, Ki'i (k)[14] was the first-born son to emerge out of darkness. He mated first with La'ila'i (w), before his divine younger brothers Kāne (a) and Kanaloa

[14] Barrerre (1967: 111) states that "...in Hawai'i mankind descends through Hāloa rather than through Tii, or Kii, as "first man." However she does extend her examination sufficiently far back in the genealogies to realize that there are two Ki'i (k) in the Hawaiian genealogical sequence. Hāloa is a primary descendant of the first Ki'i (k) (and an ancestor to the second), the first man who emerges from pō (primordial darkness) in the earliest stories of creation.

(a).[15] Kiʻi (k) managed to win the right of authority and power of rule over the gods in the period of ao by securing this first mating and having his children become the senior line from which Hawaiian people descend. Kāne (a) mated with Laʻilaʻi second and his children were born junior to Kiʻi's (k) children and forced to marry into the senior line. Kanaloa (a) was denied the opportunity to mate and was left without children. The mating of Laʻilaʻi with Kiʻi secured the rights of men in their claim to chieftainship as primogeniture became the established model of hereditary succession in Hawaiʻi.

The second lesson of the Hawaiian socio-political power concerns mating practices between siblings and half-siblings. The practice of royal endogamy was called moe piʻo or incest relations and these affairs were not only acceptable, but encouraged as a means of creating divinity for Hawaiian chiefs (Kameeleihiwa 1992: 40). These were behaviors of god-like people that had no other suitable mates, so they mated siblings in order to raise the rank and status of the child, closer to that of the akua (gods) themselves. As mentioned before, the model for Hawaiian hereditary succession for rule is based on primogeniture. As the genealogical lines multiply and branch out and become competing pedigrees, moe piʻo becomes a means from which chiefs can elevate their status even further. The sibling mating of Laʻilaʻi with Kiʻi and then Kāne showed how this mating practice helped to push genealogies and rank of children closer to divine status.

The last lesson of Hawaiian socio-political power relates to the development of religious practices using idols. The myth of Kiʻi outlined an important ideological juxtaposition that "man's dependence on gods, in fact conceals the gods' dependence on

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[15] Kameʻeleihiwa (1992:24) and others use a culturally centered approach to gender identification that is adopted here: (w) indicates "wahine" (female) and (k) indicates "kāne" (male). Also (a) is added to this key for "akua" (god).

man" Valeri (1985: 7). Kiʻi (k) essentially represented and symbolized mans' ability to control gods by means of kiʻi (i.e. anthropomorphic images or 'fetching' gods). Also in at least one Kumulipo reference it states that Kiʻi and Kāne were not just brothers, but born twins (mahoe) with one being mortal, and the other divine (Kamokuiki n.d.). The meaning of their names reflects the desire of the other to be like their sibling brother. Kiʻi the name of the first man literally means "image of a god" (i.e. used as a medium to "fetch," petition, and control gods).[16] Likewise, Kāne, the name of the god creator, means man (essentially the "worshiper" of gods). Kiʻi (k) secured the right to rule through primogeniture, elevated the status of his children through moe piʻo, and taught them how to control the gods through religious practices using idols.

The myth of the struggle between Kiʻi and Kāne outlined lessons concerning power in terms of birth order and rank, mating practices, and religion. It explained the familial relationship between gods and man, as man strived to be divine and gods strived to be more mortal. Kiʻi, both literally and figuratively became the symbol of man's triumph. It was the "image" from which society was both transformed and reproduced from one generation to the next. Kiʻi's (k) senior genealogical line became the source of all Hawaiian genealogies. This genealogy had two major splits in the cosmogonic period, the first being at the sibling brothers Aliʻi-honu-puʻu (k) and ʻŌ-puʻu-puʻu (k) (line 1332 – 1333), and the second at the sibling brothers Pali-kū (k) and ʻO-lolo (k) (line 1710-1711) (Figure 2.1).

These major divisions in the genealogy of Hawaiʻi created an elaborate system of rank and succession as the split between high-born and low-born siblings with collateral

[16] The generic name attributed to the anthropomorphic images of the gods used in worship (Valeri 1985:6).

junior lines progressively being displaced downwards as the senior line grew higher. This was the basis for the development of social classes and stratification in Hawaiian society with religious ideology playing the increasingly important role of holding these divisions together. This summarizes the cosmogonic period of Hawaiian history ((Barrere 1961, 1967) that begins with Kiʻi at (Generation 1) and ends with a later descendant also named Kiʻi (i.e. father of Nanaulu & Ulu). The continuities of these mythologies in early Hawaiian society will be discussed further in the next chapter.

Pathways to Power and Rites of Passage

The ability of chiefs to gain mana and maintain socio-political power was dependent upon their understanding of how the worlds of pō and ao intersected and interacted. Mokumanamana was a central place and unique location in the archipelago that provided an axis between the worlds of the spirits of the dead (pō) and the living (ao) (Figure 3.4). Ala or alanui, were voyaging routes called "pathways" of navigational stars (i.e. nā alanui o nā hōkū hoʻokele; Johnson and Mahelona 1975: 81) that were tracked in the sky as it moved from east to west. These alanui were correlated and referenced with spatial locations on land and sea. Kaulainamoku (1865) describes in the story of Kepakaʻiliʻula how these routes were rites of passage and important pathways of power for chiefs. In order for chiefs to acquire greater mana and strengthen their legitimacy to rule they had to travel the path of Kanaloa (into the west). Most accounts are in agreement that the sun's path in the west was called ke ala maʻawe ʻula a Kanaloa (although Kaulainamoku incorrectly calls it ke ala ʻula a Kanaloa [the red path of Kanaloa]). There is also agreement that the sun's path in the east is called ke ala ʻula a Kāne (although Kaulainamoku incorrectly calls ke ala kīkeʻekeʻe a Kāne) (Gutmanis

1983:5; Johnson and Mahelona 1975: 81; Kaneakahoowaha in Kamakau 1965).[17] Kaulainamoku describes these sun pathways as beautiful and woven together with various colors of feathers (huluhulu) and braided cordage (‘aha) that twists and turn, bending crooked, and enfolding upon itself. He says that although many chiefs attempted this to travel Kanaloa’s path as a rite of passage, only a few could actually achieve this journey.[18]

> ua olelo ia ma ka moolelo o keia alii, ina e pii ma ke ala ula a Kanaloa, po ka la hiki iluna, a ina hoi ma ke ala kikeekee a Kane, ao ka po hiki ilalo
>
> (Kaulainamoku 1865)

> [It is said in this story of this chief, if you ascend on the red path of Kanaloa, day becomes night (ao ka po), [you are] able [to travel] above (northward), and if you return on the bending path of Kane, night becomes day (po ka ao), [you are] able [to travel] below (southward)]
>
> (Kikiloi translation)

The gods Kāne[19] and Kanaloa[20] were the earliest primary deities that emerged first from primordial darkness into the world of the living. These two gods were also important because they occupied positions that were dualistic and complementary in space, essentially governing over all domains of other gods. They were the oldest aspects of Hawaiian religion that likely originated from an earlier ancestral voyaging culture. These gods were thought to control the southern and northern hemispheres on the globe, but more importantly the directions of east and west (Kaneakahoowaha in Kamakau

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[17] The sun is figuratively called “ka lā kīke‘eke‘e a Kāne” for the way it bends and moves across the sky in an elliptical fashion.

[18] Barrere (1969: 13) states that “the sun (ka lā) was called “he alanui hele a Kāne” (the traveling path of Kāne), and the west called “he alanui a ka make” (the path to death [and afterlife]).

[19] Kāne has at least 70 body froms (Gutmanis 1983:5). These kinolau include: sunlight, wai (water), ‘ohe (bamboo), kalo (taro), kō (sugarcane), wauke (paper mulberry), popolo (black nightshade herb), and coral.

[20] Kanaloa bodyforms include: aweawe (plantain; also means tenacious, sticky threadlike, adhesive; Pukui & Elbert 1986:34), ‘awa hiwa (black ‘awa; Johnson 1983: 241), ‘uhaloa (*Waltheria ameicana; also called* ‘ala-‘ala-pū-loa; PE 1972: 387), species that are eight eyed or eight legged such as the he‘e20 (octopus), the wind compass, hīhīmanu (sting rays), koholā (whale), ivory, nai‘a (porpoise), ko‘a (coral), well as the kai hohonu (deep ocean).

1965). In the middle of the northern and southern hemisphere lies the tropic belt where the sun shines overhead (zenith) at various times and seasons throughout the year. In this tropic belt there were two types of stars that existed: 1) nā hōkū ʻai ʻāina (stars that rule the land), which were stars that stayed within the boundaries of the tropics and are used primarily for navigation (Figure 2.2); and 2) "nā hōkū paʻa i ka ʻāina" (stars that stick to land), which are stars that were fixed and at zenith, mark locations of islands in the ocean. Any stars outside the tropic sun-belt were considered "nā hōkū lewa," or stars that were suspended in the sky and irrelevant for navigation. These stars helped to give relational context to these islands in the ocean as the sea was explored systematically and island locations were documented for future reference and later use or settlement.

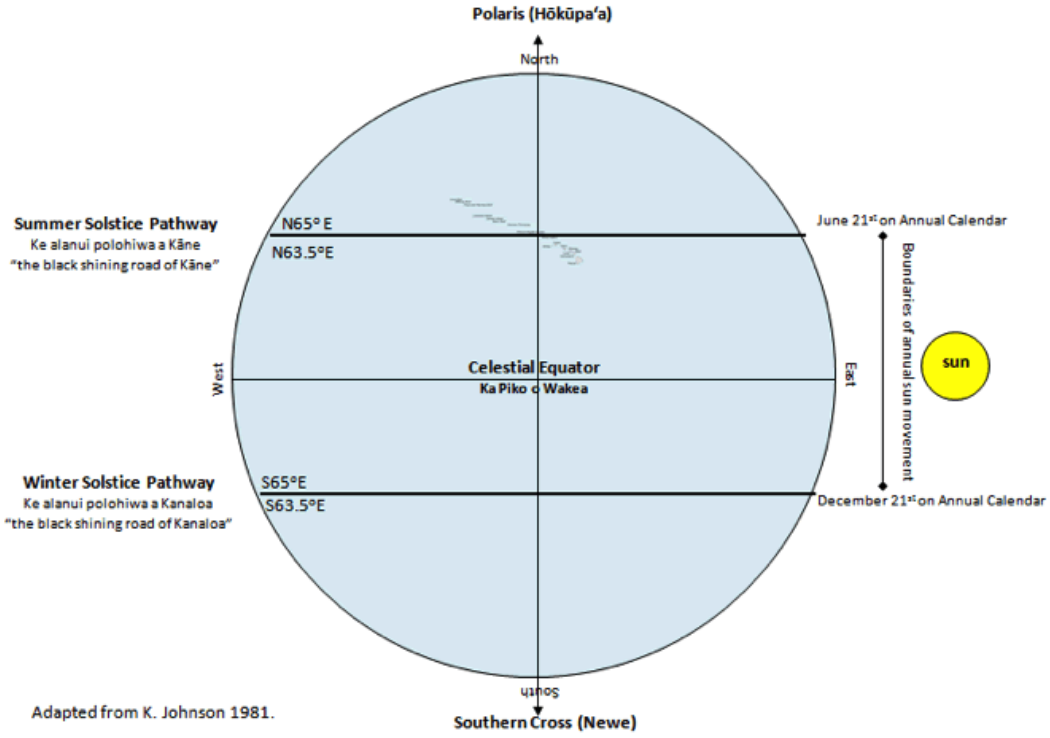

Figure 2.2. Traditional Divisions of Space & the Annual Cycle of the Sun Across the Earth

The direction of west was seen as a pathway to power because it offered chiefs an opportunity to maintain communication with their ancestors.[21] Since the migratory pattern in Oceania generally followed from west to east, the west was always seen as a direction of origin situated in a timeless past.[22] The Hawaiian archipelago was seen in the context of this continuum between east and west, as the islands laid in a sequenced order moving from southeast to northwest. The center of the archipelago was divided by the Tropic of Cancer, termed "ke ala nui polohiwa" a Kāne (Hooulumahiehie 2006: 201-204; Kamakau 1865; Pukui & Elbert 1986: 339; Johnson and Mahelona 1975: 72, 80-81). It was the most important cultural demarcation, a longitudinal pathway of the sun that separated the realms of Kāne (the living) and Kanaloa (the dead). This pathway to the afterlife existed directly over the island of Mokumanamana, which was situated centrally in the archipelago. These east and west distinctions not only outlined the process that the human spirit took from life to death, but also the analogous process that islands took in life and death.

On a relative east-west division, the east always represented Kāne and the pathway of the sun coming from the east was called "ke ala ʻula a Kāne" (the red road of

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[21] Hawaiian orientation of space followed a similar pattern to that of history (time), where the past was oriented to the front (from the perspective of a human body) and the future to the back (as described by Kameʻeleihiwa 1992: 22-23). Like temporal orientation, the position of the body was an important reference for understanding spatial orientation. Malo (1951: 9; 1987: 6-7) says that Hawaiian understanding of space (cardinal directions) was developed by following and tracking the course of the sun. The sun rises every day in the east (hikina) and sets in the west (komohana). The terminology used for Hawaiian cardinal directions (north, south, east, west) also gives us clues to this ideological orientation as the term for "north" is the same word for "right (side of the body)" (ʻākau), and the term for "south" is the same word for "left (side of the body)" (hema). So from this spatial perspective, Hawaiian orientation has a natural propensity to be situated facing west, the direction that gives us the strongest connection to our ancestral past- a place of origin and a place from which we return in the afterlife. The east and west are considered "timeless" spaces from which the human spirit and islands move on a continuum of aging.

[22] Kelsey (in Beckwith 1951: 47) believes that "darkness applies to distance in time rather than in space. The pit idea is absent and attention fixed upon a genealogical beginning of the chief stock in a time so remote as to be lost to memory."

Kāne), which symbolized new beginnings, emergence of new islands, and the rising sun. It also represented life as he kept his water of life in the east where the sun rose and the first light appeared in the beginning of each new day. This realm of Kāne and the living was called ao. It was a world of emergent islands and landforms, chiefs, and people all on the journey of life and aging with the passing of time. Kaulainamoku (1865) explains this world could be accessed by traveling the pathway called ke ala ʻula a Kāne (or called ke ala kikeʻekeʻe a Kāne in this description) that existed on the lower southeastern portion of the archipelago. As one travels southeast (i lalo), dark becomes light or "ao ka pō" because you move into the tropic belt where the sun shines overhead (Figures 2.3-2.4).

The west always represented Kanaloa, and the pathway of the sun going into the west direction was called "ke ala maʻawe ʻula a Kanaloa" (the much traveled path of Kanaloa). It represented death, and the idea of conclusions, endings, submergence of islands, open-ocean, and a place where the sun sets and the spirits journey to in death.[23] The realm of Kanaloa and the spirits of the dead was called pō. It was an underworld of ocean and submerged islands and landforms, full of ancestral gods, and spirits on their journey in death into stages of the afterlife. Kaulainamoku (1865) describes this afterlife of gods as accessible by traveling ke ala [maʻawe] ʻula a Kanaloa that existed on the upper northwestern portion of the archipelago. As one travels northwest (i luna), light becomes dark or "pō ka ao" because you move outside the tropic belt where the sun does not shine overhead (Figures 2.3-2.4).

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[23] "The portion to the right or east of this line is called "ke ala ʻula a Kāne (the dawning, or right road of Kāne); and that to the left or west is called "ke alanui maʻawe ʻula a Kanaloa" (the much travelled highway of Kanaloa) (Johnson and Mahelona 1975).

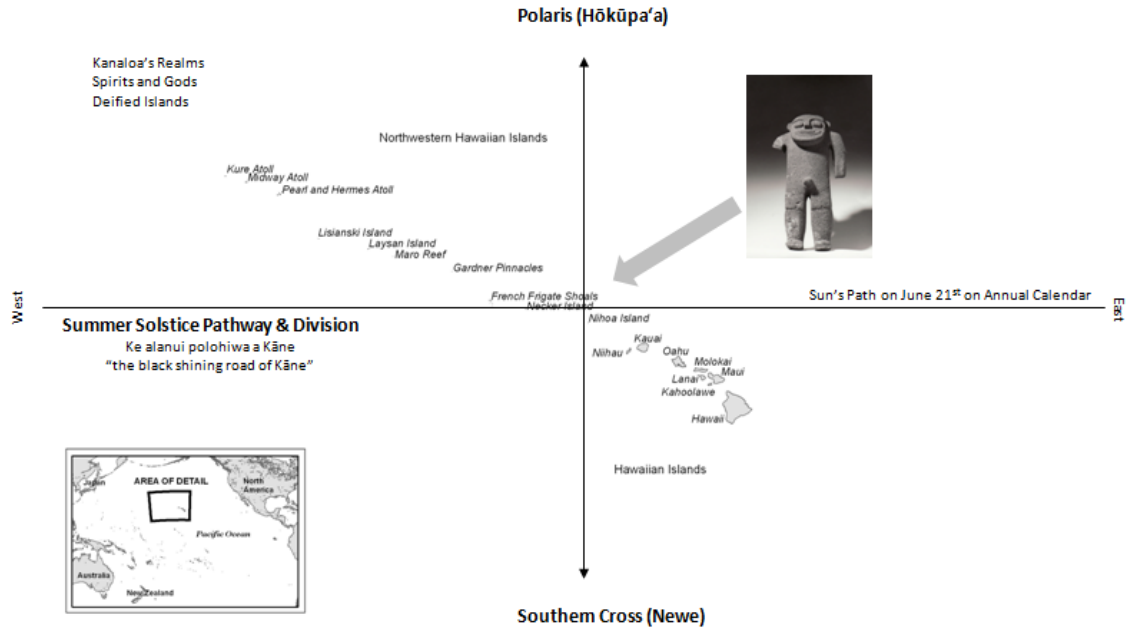

Figure 2.3. Traditional Divisions of Space for the Realm of Kanaloa & the Realm of Kāne (with Mokumanamana in the Center)

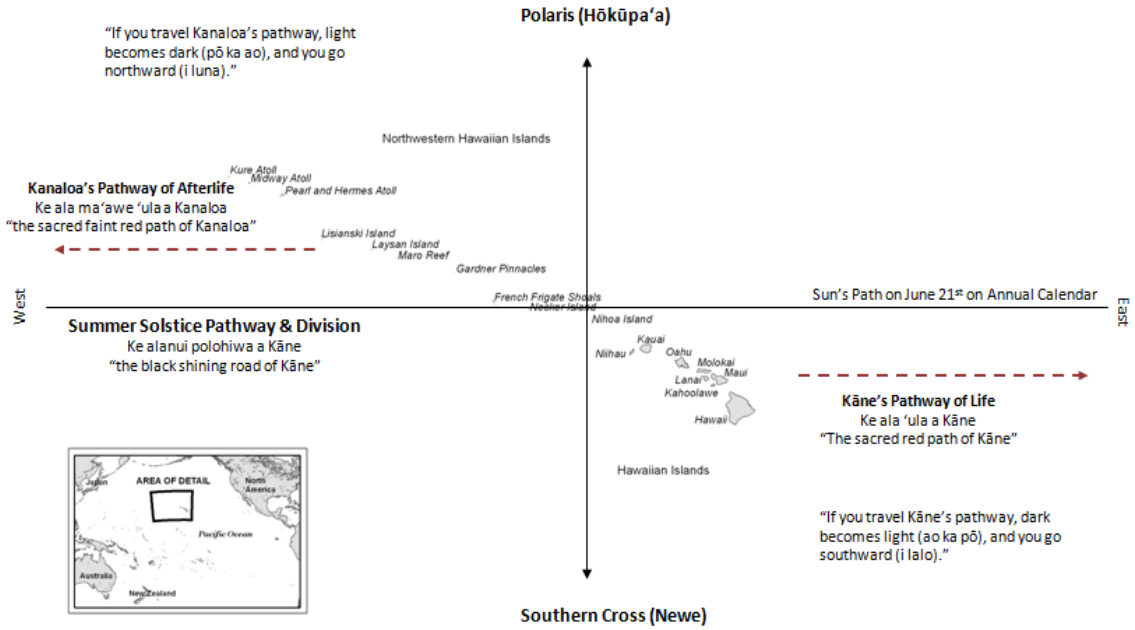

Figure 2.4. Traditional Divisions of Space and Ritual Pathways to Chiefly Power

The Kumulipo shows us the intersection of these two realms as it first happens with life emerging from primordial darkness into light. The two siblings La‘ila‘i (w) and Ki‘i (k) gave birth and established the senior line of Hawai‘i. Kāne (a) and Kanaloa (a) also emerged into light and represented this dichotomy of the two worlds--one for the spirits of dead and the other for the living. Mokumanamana was the central location where this transformation and reproduction occurred. This intersection between east and west and the use of pathways to power became a prevalent theme in Hawaiian narratives supporting the inherent relationship of gods wanting to become like men, and men wanting to become like gods. This pattern shows up in stories related to gods, demonstrated in their motivations to migrate from the Northwestern Hawaiian Islands (west to east) into the main Hawaiian Islands (where chiefs and people reside); and in the opposite direction a pattern occurs in stories of heroes, who are compelled to travel up the chain in the main Hawaiian Islands and venture into the Northwestern Hawaiian Islands as a rite of passage. Mokumanamana, therefore was situated in the axis between these worlds and represented an important gateway between life and afterlife. As Kaulainamoku (1865) states, chiefs needed to focus their attention western half of the chain in order to acquire the ability and authority to rule; and we can infer this island became of great importance for ceremonies and rituals directed towards the ancestral gods and spirits. This pathway of power rested in the ability of chiefs to retrace their “history” back to the first site of Hawaiian transformation and reproduction of society.

Rank and Status Across an Island Continuum

The Hawaiian archipelago played an important setting as a spatially specific framework for understanding the social political dimensions of rank, status, and power.

In Hawaiian traditions island landscapes and seascapes (in relation to sky) play a critical role in myth and ritual interconnecting the cosmological universe as a whole from one end of the archipelago to the other. Many of the patterns and divisions expressed in cosmogonic chants were based on early exploration and observations of these islands across spatial sequences, geological stages, and ecological systems that extend across this continuum from east to west. The 'main' Hawaiian Islands were seen as newly born, living islands that became the homeland for chiefly descendants of Kiʻi, through his main descendant lines. These islands were a powerful symbol of the living chiefs themselves. As the population of Hawaiian society grew, the genealogical branches of the elites continued to expand and senior lines occupied Kauaʻi and Oʻahu, while junior lines occupied Maui and Hawaiʻi. The Northwestern Hawaiian Islands represented the other half of the archipelago—dying islands in the final stages before their disappearance into the ocean. In this process of dying and moving into the afterlife, they became deified and god-like. The islands were a constant reminder of their gods and deified ancestors whom the chiefs hoped to transform into and become after death. Hawaiian society was to become predicated on these dynamics and patterns expressed in a complex ideological belief system. Thus, accounts show that both chiefs and islands were described similarly as analogous entities on a spiritual continuum. Both undertook the same course of aging, encapsulating the events of birth, growth, maturation, and eventually death and the afterlife.

The Birth of Islands for Chiefly Descendants

"Eia Hawai‘i, he moku, he kanaka..."
"Here is Hawai‘i, an island, a man..."

(Fornander Vol. II Ancient History of the Hawaiian people: 10)[24]

The main Hawaiian Islands were considered living islands and the homeland for the establishment of Hawaiian chiefdoms. These larger main islands are often described in the context of "birth" as some of the most famous accounts concerning the formation (and subsequent naming) of the Hawaiian archipelago focused on these main eight islands. This tradition of the "birthing of islands" centered on the genealogies and procreation of two important ancestors of the Hawaiian people who descend from Ki‘i and La‘ila‘i — Papahānaumoku (w) (who is personified in the earth) and Wākea (k) (who is personified in the expansive sky), and in some versions, the various partners with whom they mated. These events were thought to take place towards the end of the cosmogonic period of Hawaiian history. At this time, Papa and Wākea rose to prominence and their offspring survived to later become the royal dynasties of the Hawaiian Islands. It was during this time that the island names were reconstituted and a new archipelago was "birthed." Prior to this period there was an earlier set of island names were used for the archipelago. Only some of the earlier names for each of the main Hawaiian Islands have been historically documented including: Lono-nui-ākea for Hawai‘i; ‘Ihi-kapu-lau-māewa for Maui; Kanaloa for Kaho‘olawe; Olōlo-i-mehani for

[24] Fornander is cited extensively throughout this study as an appropriate source of Hawaiian oral traditions. The recording of the mo‘olelo for his publications was conducted by Native Hawaiian scholars including Samuel M. Kamakau, S. N. Hale‘ole, and Kepelino Keauokalani (Elbert 1956:1-4).

O‘ahu; Ka-māwae-lua-lani for Kaua‘i (Poepoe n.d.; Kamakau 1991: 129; Malo 1951; Malo 1987: 4); and Ka-unu for Ni‘ihau (Tava and Keale 1989:85).

Figure 2.5. Genealogy for the Birthing of the Islands Tradition from Papa & Wākea (Kikiloi 2010)

Papahānaumoku took on mythical powers and played the essential female role of “giving birth” to the Hawaiian archipelago as a place of residence for her royal offspring. It was here where the islands were conceived as living entities and afforded the same value and distinction as human life, capable of being siblings to people (Figure 2.5). This

particular union of Papa and Wākea represented the first moe pi‘o (incest mating or-literally, arch mating) of a marital couple, since the time of La‘ila‘i and Ki‘i (the first woman and man in the transition between pō and ao). In this account Wākea played an important guiding role in the transformation by symbolically using his right hand (lima ‘akau) to hold fast to the islands that were waving freely in the air and about to float away. Through this process a new archipelago was born and established across geographic space.

“Ua hānau ka moku	Born was the island—
A kupu a lau, a loa, a ao, a mu‘o	It budded, it leafed, it grew, it was green
Ka moku iluna o Hawai‘i	The island blossomed on tip, was Hawai‘i
‘O Hawai‘i nei nō ka moku	This Hawai‘i was an island
He pūlewa ka ‘āina, he naka Hawai‘i	Unstable was the land, tremulous was Hawai‘i
E lewa wale ana nō i ka lani,	Waving freely in the air
Lewa honua	Waved the earth
Mai i Ākea ua pāhono ‘ia	From Ākea it was fastened together
Mālie i ke a‘a o ka moku me ka honua	Quiet by the roots was the island and the land
Pa‘a ‘ia ka lewa ealani i ka lima ‘ākau o Ākea	It was fast in the air by the right hand of Akea
Pa‘a Hawai‘i lā a la‘a,	Fast was Hawai‘i, by itself—
Hawai‘i lā i kea he moku.”	Hawai‘i appeared an island.
	(Fornander Collection Vol. IV: 363)

There were six major accounts[25] that described the formation or “birth” of the archipelago from Papahānaumoku and Wākea. This body of chants included:

1. Eia Hawai‘i, he moku, he kanaka (Mele a Kamahualele Fornander IV: 20-21);
2. Ua Hānau ka Moku (Fornander IV: 363);
3. ‘O Wākea Noho Iā Papahānaumoku (Malo 1951: 243);

[25] Initial research on the “Birthing of the Archipelago” said there were five accounts, but since that time have located one more.

4. Kupuʻeu hou nā moku (Haumea ka lani in Gutmanis 1983: 10; BM Archives Ms Sc Roberts Box. 4.2);
5. ʻO Wākea, Kahiko-lua-mea (Mele a Pakuʻi in Fornander IV: 12-22; He Mele Hānau Moku in Bishop Museum Archives N.D.:171-174; He Hānau no ka Mōʻī Kalālaua in Bishop Museum Archives, N.D.:47-50);
6. He Mele (Kalama 1860; Fornander 6: 360-363)[26]

A general review of these chants has demonstrated some important commonalities that were consistently threaded between most of the accounts. First, all of these fixed texts focused primarily on the relationship of only the main Hawaiian Islands to Papa and Wākea. Many of the accounts provided a sequencing of names from east to west starting at Hawaiʻi and moving progressively to the last main Hawaiian islands, the Niʻihau group, and in some cases Nihoa Island, the first Northwestern Hawaiian Island. The first chant of Kamahualele stated, "Hawaiʻi is an island, and a man," making it clear that there was an implicit cultural correlation between the islands and man from a Hawaiian worldview. They could both be born from the same metaphoric source (mother) and also have similar characteristics and behavioral patterns throughout their life stages, as was mentioned earlier. It also stated that the Hawaiian islands originated from Kahiki (a distant ancestral homeland, or rather a figurative pathway of origin) and the archipelago consisted of "fragments of land grouped together in a row, placed evenly from east to west, arranged uniformly in sequence, and adjoined on to Hōlani." The place names

[26] Kalamas (1860) version of "He Mele" account for the birthing of the islands is an identical match to the reported transcription in Fornander (6: 360-363) entitled "A Wākea Creation Chant" composed by Kaleikuahulu. Kaleikuahulu was a native of Molokai, son of the ruling chief Kumukoa and grandson of Keawe whom Kamehameha appointed to teach some of the chiefs his knowledge of genealogies (Fornander 6: 360).

Kahiki and Hōlani are reoccurring names throughout many of the genealogical accounts of the islands. The association of this northwest region to Kahiki,[27] helped to identify this area as one of the routes leading to and from our place of spiritual origin, where souls are thought to return after death.

The main Hawaiian Islands become associated with ruling chiefdoms that trace their descent from Wākea and Papa. Each island represented a genealogical branch that stemmed from this reference point. Famous epithets were applied to each island in association to their most famous ruling chiefs. Hawai‘i became noted as “moku of Keawe” (island of Keawe) referring to Keawe-kekahi-ali‘i-o-ka-moku (G-20). Maui was often called “Maui a Kama” (Maui of Kama) for the famous ruling chief Kama-lālā-walu (Pukui 1983:234; G-16). O‘ahu was referred to as “ke one ‘ai ali‘i o Ka-kuhi-hewa” (the chief destroying sands of Kakuhihewa) linking the island to the famous chief Kakuhihewa (Pukui 1983:190; G-16). Kaua‘i was referred to as “Kaua‘i a Mano-ka-lani-pō” (Kaua‘i of Manokalanipō) associating it with the ancient chief Manokalani-pō (Pukui 1983: 168; G-9). The main Hawaiian Islands were considered “ao” or the realm of Kāne and became celebrated homes for growing populations within these Hawaiian chiefdoms. The islands of Kaua‘i and O‘ahu represented the senior genealogical lines, those islands thought to be occupied and settled earliest (descending from the Nanaulu branch). The islands of Maui and Hawai‘i represented the junior genealogical lines; islands occupied and settled later (descending from the Ulu branch) (Figure 2.2). The leaders of each of

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[27] The word “Ka-hiki can be broken down to mean “the arrival” or “the coming” (Pukui and Elbert 1986: 69) and interpreted as any source or pathway of origin. At various points in Hawaiian history this place name could have correlated to Tahiti in the South Pacific. This research will demonstrate however that there are clear linkages with this region being located to the west of the Hawaiian archipelago as a spiritual pathway or origin of life. These views are not mutually exclusive.

the chiefdoms however were interconnected in a web of relationships and marital ties, maneuvering for higher ascribed power through birthright (via arranged marriages) as well as seeking power and authority through achieved strategies of, alliances, competition, and aggression. The high chiefs who demonstrated the greatest leadership solidified their legacy in history, bringing honor to their genealogical branch and the islands themselves.

The Death of Islands for Deified Ancestors

The Northwestern Hawaiian Islands represented islands that were aging, subsiding, and disappearing back into the ocean on this life and death continuum. Regardless of their diminishing physical size and profile, their spiritual rank and status was seen as growing and increasing with age and death. These islands were often described in mythical narratives as deified islands, having supernatural attributes such as the ability to float in the sky and heavens, or appearing and disappearing upon their own volition. The restricted nature and difficulty in traveling to this portion of the archipelago likely resulted in few people of the general population actually seeing these islands firsthand in ancient times. These sparse direct accounts only heightened the human imagination, adding to their status and rank. The descriptions of the islands however were not entirely imaginary, as they were often based on naturally occurring phenomena witnessed by the few travelers who actually explored this region. Here myth intersected with reality in the lives of people in the past. These natural occurrences will be described in fuller detail in this section.

The Northwestern Hawaiian Islands are also part of the Papa and Wākea tradition that told of the formation of the archipelago. The original names of these islands were

recovered from the Kaiʻaikawaha "genealogy of island names" manuscript document from Lahainaluna School (Kikiloi 2010; Nogelmeir 1995). Following the birthing of the archipelago tradition, this list provided an additional sequential set of traditional names for islands beyond or past the 'main' Hawaiian Islands and towards the northwest. Additional islands names were also provided in "He Wahi Kaʻao no Mokulehua" (B.K.H 1862) and through Niʻihau traditions (Tava & Keale 1989). These names include: Nihoa, Hāʻena (an earlier name for Mokumanamana)[28], Lalo (French Frigate Shoals), ʻŌnūnui & ʻŌnūiki (Gardner Pinnacles), Ka Moku o Kamohoaliʻi (Maro Reef), Kamole (Laysan), Kapou (Lisianksi), Manawai (Pearl and Hermes), Kuaihelani (Midway), and Hōlani-kū (Kure) (Table 2.1; Figure 2.6).[29]

The Kaiʻaikawaha genealogy of island names supported this framework for the archipelago representing an arrangement of space, order, and structure from one end of the archipelago. These island names to the northwest illustrated the themes of afterlife and death in the Hawaiian culture.

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[28] It is important to point out that the Kaiʻaikawaha (1835) Genealogy of Island Names gives the original island name of Hāʻena to Necker Island. The name Mokumanamana is a much later name given to the island to commemorate historical events at the time of Wākea. This will be explained in greater detail in the next chapter.

[29] Two additional sources (B.K.H. 1862 Ka Hoku o ka Pakipika; Tava & Keale 1989) were used to find the names ʻŌnūnui & ʻŌnūiki and Ka Moku o Kamohoaliʻi (See Kikiloi 2010 for descriptions and explanations).

Table 2.1. Traditional Island Names for Northwestern Hawaiian Islands (Kikiloi 2010)

Island Names	Associated Island	Dictionary Definitions
Nihoa	Nihoa	**Nihoa**. pas/imp of niho. n. Toothed, serrated, notched, jagged, sharp; firmly imbedded and interlocked (Pukui and Elbert 1986:266).
Hāʻena **Hāʻena-kū** **Hā(ʻe)na-moe** **Hāʻena-ala** **Hāʻena-aʻe** **Hāʻena-mau-hoa-lālā-ia-(Ka)hiki**	Necker (Mokumanamana)	**Hāʻena**. nvs. Red-hot, burning red. A common place name on Hawaiʻi, Oʻahu, and Kauaʻi (Pukui and Elbert 1986:46). **Hāʻena**-kū. East (or Standing) Hāʻena **Hāʻena**-moe. West (or Prostrating) Hāʻena **Hāʻena**-ala. Rising Hāʻena **Hāʻena**-aʻe. Upward (or nearby) Hāʻena **Hāʻena**-mau-hoa-lālā-ia-(Ka)hiki. Hāʻena that secures the diverging branches to Kahiki
Lalo **Lalo-iho** **Lalo-aʻe** **Lalo-hele** **Lalo-kona** **Lalo-hoʻāniani**	French Frigate Shoals	**Lalo**. n. Leeward, lee southernly (PPN: Raro) (Pukui and Elbert 1986:192); the direction of being westward, southernly." (Handy 1927: 70). **Lalo**-iho. Lower Lalo **Lalo**-aʻe. Upper Lalo **Lalo**-hele. Continuous Lalo **Lalo**-kona. Leeward (or Southern) Lalo **Lalo**-hōʻāniani. Reflective Lalo
Ōnu-nui **Ōnu-iki**	Gardner Pinnacles	**Ōnū-nui** n."large protuberance" (Pukui et al., 1974, p. 171). It is also a variant of the name Unu-nui. Ununui means large altar, perhaps alluding to the role it plays in petitioning for northwest rains. **Ōnū-iki n.** "small protuberance" (Pukui et al., 1974, p. 171). Again it is a variant of Unu-iki. Unuiki means small altar, again alluding to the role both landforms play as altars in bringing forth northwest rains
Ka-moku-o-Kamohoaliʻi	Maro Reef	**Ka-moku-o-Kamohoaliʻi.** noun phrase defined as "island of Kamohoaliʻi" (B. K. H., 1862; Tava & Keale, 1989, p. 109). Kamohoaliʻi is known to be a major shark deity and brother of Pele.
Ka-mole	Laysan	**Ka-mole**. n. The taproot, main root; ancestral root, or foundation, source, or cause (Pukui and Elbert 1986:252).
Ka-pou **Pou-heʻe-ua** **Pou-heʻe-lani**	Lisianski	**Ka-pou**. n. The pillar, or post (PPN: Pou) (Pukui and Elbert 1986:343). **Pou**-heʻe-ua. Rain washed Kapou **Pou**-heʻe-lani. Heaven washed Kapou
Mana-wai **Mana-wai-nui** **Mana-wai-lani** **Mana-wai-hiki**	Pearl & Hermes	**Mana-wai**. n. Branching Water (Pukui and Elbert 1986: 238); nvs. Warped, depressed, bent in (Pukui and Elbert 1986:237). **Mana-wai**-nui**.** Greater Manawai **Mana-wai**-lani. Chiefly Manawai **Mana-wai**-hiki. Appearing Manawai
Kua-i-he-lani	Midway	**Kua-i-he-lani**. n. Backbone of heaven. It is said to be a mythical place (Pukui and Elbert 1986: 169).
Hōlani-kū	Kure	**Hōlani**. Bring forth heaven. It is said to be a mythical place, also a star name (Pukui and Elbert 1986: 77); Hōlani is a variant pronunciation of Helani (Johnson and Mahelona 1975: 5 **Hōlani**-kū. East Hōlani

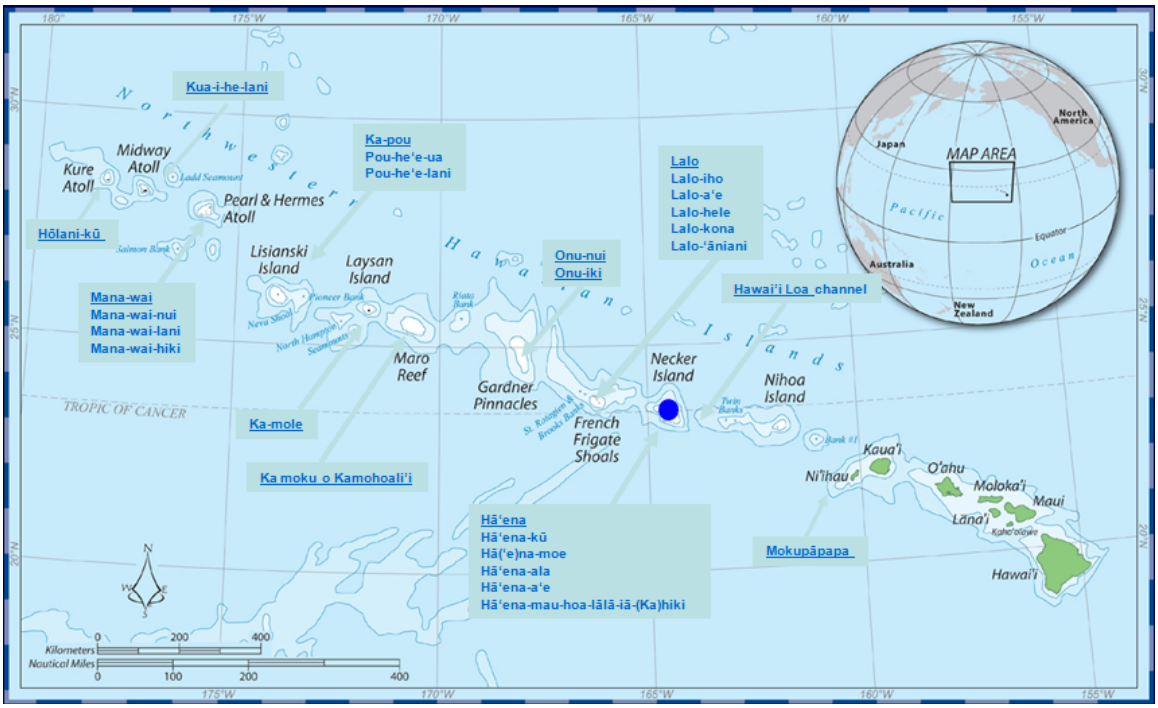

Figure 2.6. Map of the Hawaiian Archipelago with Proposed Correlations of Ancient Island Names and Place Names to Contemporary NWHI Locations. The northwest area represents a region of ‘aina akua (deified islands of gods) where Hawaiian souls return after they are dead, to reunite with their ancestors.

The island names and their associated stories demonstrate a number of convergent themes confirming the Northwestern Hawaiian Islands[30] as ‘āina akua, or ancestral islands where the souls of the deceased would travel to and lived in afterlife (also known as pō- darkness or creation). Pō or “darkness” is the realm of Kanaloa and represented a “vastness of time, and here our ancestors dwelled, transfigured into gods and deified spirits” (Pukui et al.: 1972: 35). The pattern of names assigned to the Islands describes a sequence of phenenomena and events that can be interpreted as islands undergoing stages

[30] This applies for islands in the Northwestern Hawaiian Islands past Mokumanamana (also known as Hā‘ena; Necker Island) as explained below.

of spiritual transformation. Basic words such as wai (water), lani (sky), ua (rain) describe in part the intrinsic and indispensible spiritual properties of an island. This represented a shift in naming patterns to include elemental words that alluded to a transitional process of islands losing their earthly form as they evolved towards an ethereal existence. This process of aging, death, and deification for islands paralleled the lifecycle of their human siblings, as both spiritually descended into the ocean, transforming into godly ancestors on their journey westward to the source (pō). It is for these reasons that these islands were often described as having supernatural abilities such as moving position upon their own volition; appearing or disappearing at the will of the gods; or in some cases being suspended in the sky and heavens (Tava and Keale 1989: 21-22; Johnson and Mahelona 1975: 5).

The Transformation of the Ancestral Homeland- Kahiki

The term Kahiki[31] was an important place name utilized in reference to the Northwestern Hawaiian Islands because of its link to the concept of an ancestral homeland. Kahiki has been generically used as a far and distant land of origin, prominently situated far away in the migratory history of our ancestors. It has often been assumed that it referred specifically to Tahiti (Society Islands, Central Polynesia) as it is a cognate of Kahiki. At some point in Hawaiian history however, this term was transformed to have cosmological linkages with the Northwestern Hawaiian Islands

[31] Across the larger Polynesia such famous names have been retained in traditions referring to ancient homelands that were once occupied by our seafaring ancestors in the remote past. Numerous names of ancestral homelands have been recounted in the stories of voyaging exploits of legendary navigators who sailed back and forth between distant lands. Some of the lands mentioned that are familiar to us from other parts of Polynesia are names such as Hawai‘i (or Hawaiki in Aotearoa, Avaiki in Cook Islands, Savai‘i in Sāmoa) Wāwa‘u (Vāva‘u), Polapola (or Borabora, Po‘apo‘a,), Upolu (also Upo‘u), and so forth. These names show up in multiple places as throughout Oceania, as they were appropriated affectionately in honor of the first homeland and place of origin.

(Kaiaikawaha 1835). This transformation of the concept of 'ancestral homeland' is supported by its usage interchangeably with pō, as a time and place where life began and to which spirits return always associated in the westerly direction. Kahiki[32] is mentioned as a place of origin for the Hawaiian archipelago, marked by the qualitative boundaries of Kahiki-kū and Kahiki moe. It was also believed however, that Kahiki was part of a definite route or path taken by souls of the departed on their way to the afterlife.

In Hawai'i, the northwest region of the archipelago included the routes leading to Kahiki and often took on mythological or deified characteristics, having the ability to either appear or disappear at the will of the gods, or in some cases levitate in the sky and heavens. Tava and Keale (1989) give the following statement: "These mirage-like islands were believed to be the path to Kahiki, or rather reference points in travel. If the gods permit the islands to move close, then it will take only an hour to reach them. If the gods don't see fit to let them to get close, one could sail the ocean and never find them."[33] One of the older names for Necker (i.e., Mokumanamana) is Hā'ena-mau-hoa-lālā-ia-(Ka)hiki. Translated, this means "Hā'ena that secures the diverging branches to

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[32] Malo (1987:143) says "It is thought that this race of people had come from the islands close to Kahiki and also from Kahiki, because the people of old in the Hawaiian Islands first remembered the name of Kahiki. Kahiki is recalled in songs, prayers and the stories of the people of old of the Hawaiian Islands."

[33] In the past, this Hawaiian term "Kahiki" has been a source of confusion for many scholars, who automatically assumed that it reflected how we are "intimately connected to a southern migratory period"-fitting neatly into Anthropological migration models for the Pacific. A closer analysis however shows that "Kahiki" does not necessarily translate to mean "Tahiti" of the Society Islands. In fact, once these ideas were put forth by early scholars such as Fornander, they were later reified by anthropological studies throughout the later part of the 20th century to fit contemporary ideas on the two way colonization and settlement of Hawai'i via Tahiti and the Marquesas. Undoubtedly, when Kahiki is referenced in historical stories of voyaging chiefs such as Mō'īkeha and La'amaikahiki (which is the later part of Hawaiian history) it is very likely they are referring to these islands in the south Pacific. However, in the early creation stories and the coming of gods, this research shows that "Kahiki" is actually referring to the source of creation and our spiritual connection to the pō, which is centered in the Northwestern Hawaiian Islands. Thus, later Hawaiian chiefs may have migrated to visit other lands, but in their world view their origins have always been tied to the Hawaiian Islands since creation.

Kahiki,"[34] again relating to the journey a soul takes to the afterlife. Another island name that refers to Kahiki is Kahiki-papa-ia-lewa (lit. Kahiki of the floating foundation) and is said to be one of three mythological floating islands on route to Kahiki; the others being Kuaihelani and Kānehunamoku (Tava and Keale 1989: 22). It is said in all of these accounts that the route taken by people to these islands was located west of Niʻihau (Kamakau 1991: 102-103).

Mythological Islands that Float in the Clouds

The Northwestern Hawaiian Islands have been described as having deified and supernatural attributes of floating in the clouds. These imaginative accounts of islands floating high in the sky were embellishments in stories that demonstrated the status and rank of these dying islands. Although they are small low flat islands, they had the ability to float in the air higher than that of the high mountains of the main Hawaiian Islands, which are often referred to as symbols of chiefly rank. There are natural phenomena that occur in the Northwestern Hawaiian Islands making it appear that islands are floating in the sky. Atoll lagoon reflections often create strong blue hues that appear in the white clouds (Figure 2.7).

[34] According to Kanahele and Wise, the word "Hāʻena" should be examined in conjunction with places bearing the same name. If the word is separated into its component parts, hā is breath and ʻena give the breath intensity. The Hāʻena locations are calculated to receive the very first and very last intense breath of the sun each and every day (Kanahele and Wise n.d. "Ka Honua Ola" – the living Earth: 69; Kanahele 2011).

Figure 2.7. Photo of Kure Atoll and the Appearance of the Floating Island Hōlani. The image shows the reflection of the lagoon in the sky. Photo credit: NOAA/LT Elizabeth Crapo.

These types of natural reflections in the sky were also indicators of land for navigators who voyaged over long distances searching and exploring new landfalls.

The islands of Kuaihelani, Nu‘umealani[35] and Hōlani were examples of these famous floating islands that were initially inhabited by ancestral gods and closed after the

[35] The name Nu‘umealani is the only island name that shows up in various accounts as an island in the Northwestern Hawaiian Islands but does not show up in the Kai‘aikawaha Genealogy of Island Names (1835). It typically always coincides with the name Kuaihelani and perhaps reflects only a mythological “floating” island that is not substantiated by an actual land form. In more recent times there has been some effort to link this name to actual islands in the Northwestern Hawaiian Islands as Kelsey (M-86) notes that it could be the “line of islands from Midway that are about 10 days sail northwest of Kaua‘i” referencing an unknown source- “people & probs of the Pacific.”

migration of their descendants to the main Hawaiian chain (Beckwith 1971: 78). This place has been described as containing high ranking islands part of a cloud bank adjoining earth but located somewhere in the heavens. These islands are mentioned in stories and chants associated with afterlife, where gods, spirits, and the deified ancestors dwell. The location of Kuaihelani has been identified in most sources to be in the northwest direction of the main Hawaiian archipelago. Throughout our traditional moʻolelo this land has been mentioned in a variety of contexts and described as: the place of birth of ʻAukelenuiaikū and his family (Fornander Collection 4, Part 1:32-108; Kaunamanō 1862); the place where the moʻo (lizard) deity Moʻoinanea originated; the place where Pele was born (in some versions), or where she resided for a period time after leaving Nuʻumealani; the land from which the grandparent's of Kamapuaʻa came;[36] the place where Kāne and Kanaloa drank ʻawa (*Piper methysticum*) with spirits (in the story of Kaulu) (Fornander Collection 5: 364; also in Fornander Collection 4: 522); the land in which Keānini'ulakalani was born and raised and from which he departed for the underworld (Fornander Collection 6: 345); the land visited by Kūalanakila, keeper of Mokulehua as he went off in a northwest direction (H.B.K 1861-62); place where Kaumaʻiliʻula was burned with fire (Kamakau 1991: 102-03); and finally in the dirge of Oʻahu high chief Kahāhana, it was the land of the deified dead (Fornander Collection 6:296.).[37]

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[36] Fornander Collection 6: 251; "Yet Kamapuaʻa's grandparents came from Kuaihelani (wherever that islands may have been), and he himself visited Kahiki and married there."

[37] Friend and colleague Keoni Kuoha noted seeing a reflection of the island of Midway (Kuaihelani) in the sky when he travelled up there on the voyaging canoe Hōkūleʻa in 2004. The "floating island" was the reflection of the atoll lagoon in the sky.

"…Hākoʻi o kona nui ko aloha e—	Weighed down under the greatness of his love
ʻAu wale ana au, he ake ka ʻike	I am looking around, desiring the sight
E ʻoe ʻike, ua nalo loa e—	I do not see him, for he has disappeared
Ua laʻa i ke kai ʻoki ʻia a Kāne	Made sacred in the sea cut off by Kāne
Aia i Kuaihelani ka hele ʻana ē	There in Kuaihelani you have gone
ʻO ka ʻōnohi ʻula o ka lani kō inoa…"	The red rainbow of the heaven is your name…

(Fornander Collection 6:296)

The most interesting account comes from the story of Kepakailiula published in *Ka Nupepa Kuokoa* in 1885 in which the hero of the story finds himself in a canoe near Lehua islet off Niʻihau. He falls asleep in the canoe and the currents take him northwest only to awaken to find he has arrived at this legendary island of Kuaihelani. The beautiful island has all the appearance of having people occupying it but during his 20-day stay there he only sees one other person. When he lands on the island there is a suspicious old woman, wrinkled and grey, who comes out to meet him. At this point the author reveals it is Kamoʻoinānea (a moʻo goddess and matriarch of moʻo lineages). She knows Kepakailiula is of aliʻi rank and asks him about the purpose of his voyage there. He responds that he has come there for adventure and battle. She takes him to a house and there is food already prepared and laid out for him. During his stay she gifts him a bird that helps him to communicate with the people of the island of Kuaihelani (poʻe o ka pō, lit. people of the afterlife) after he leaves to return to the main Hawaiian Islands. As he leaves he recognizes that this is a place of spirits and says, "*he ʻāina akua ʻo Kuaihelani nei, ʻakahi hoʻi a ʻike makaʻē nei*" (Kuaihelani is an island for gods, it is the first time seeing this place with my own eyes) (Kikiloi translation). This term used for Kuaihelani- "*ʻāina akua*" supports the distinction that these are deified islands and home

for the gods, and the main Hawaiian Islands were designated islands for the chiefs and people.

There were a number of sources that refer to Kuaihelani as a region or series of islands, rather than a specific location. In the story of Kepakailiula (1865), it is referred to as "*nā moku o Kuaihelani,*" or "the islands of Kuaihelani." David Kupihea Malo (D.K. Malo in Mahelona & Johnson 1975)[38] describes the use of the navigation gourd in the 1880's by fishermen at Sand Island (Kahakaʻaulana), Oʻahu. He goes on to state: "the old men used these navigation gourds for trips to Kuaihelani, which included Nihoa, Necker, and the islets beyond." This statement suggests that Kuaihelani was thought to be a number of islands, or region in the latter part of the 19th century. This account identifies extended trips lasting "six months at a time – from May to August was the special sailing season" associated with these islands. During this time they fished for ʻōpelu (mackrel scad; *Decapterus macarellus*) and aku (skipjack tuna; *Katsuwonus pelamis*) attracting some back to Kona, Hawaiʻi, and Kona, Oʻahu, perhaps by a Kūʻula, or stone fish-god" (D.K. Malo in Johnson and Mahelona 1975: 142). Regardless of these varying descriptions of Kuaihelani being a series of islands, or a single island location, it is clear it was thought to be a physical location of an actual place and not imaginary.

Mythological Islands that Disappear and Reappear

The Northwestern Hawaiian Islands have also been described as having additional deified and supernatural attributes of disappearing and reappearing. Kānehūnāmoku, which literally means "Kāne who hides islands" first appears in the third wā (of pō) in the

[38] David Kupihea Malo was the cousin of Hawaiian Historian David Malo (Johnson and Mahelona 1975:142).

Kumulipo, where it states that the birds were born and “they cover the land of Kānehūnāmoku.” This reflects the reality of this place as these northwest islands are nesting homes for millions of seabirds. This mirage event was tied to natural phenomena that occurred up there with the rising and setting of the sun as the back light on the clouds near the horizon created the silhouette image (Figure 2.8).

Figure 2.8. Photo Offshore of Lisianksi Island Showing Mirage Islands of Kānehūnāmoku. The image shows cloud formations and backlight on the horizon. Photo credit: Kekuewa Kikiloi

The descriptions from stories say that they appear “at sunrise or sunset [where] they may still be seen on the distant horizon, sometimes touched with reddish light” (Beckwith 1970: 67). According to Rice (1940) “they may lie under the sea or upon its

surface, approach close to land, or be raised and float in the air according to the will of the gods. These islands were believed to be sacred and must not be pointed at." This disappearing and reappearing set of islands were under the control of Kāne and Kanaloa and were thought to be located off the main group, carrying the souls of the deceased into the afterlife back into the afterlife or pō.[39]

An article by Kakelamaliuikeao (1915) in *Ka Nupepa Kuokoa* further describes this supernatural island of Kāne. Originally referred to in full as the "The fruitful land of Kāne at the Pillars of Kahiki" (ka ʻāina lauʻena a Kāne i ke kūkulu o Kahiki), this island was later termed Kānehunamoku. He describes, it "is a land that was rooted within the earth but there was power to move its boundary this way and that…"[40] this land is described as being a type of paradise and it was so bountiful that the gods knew it would one day be discovered and decided to hide the land away so that man could not get to it. Kānehūnāmoku is worshiped as an ʻaumakua (guardian spirit), who will take away the worshiper to the afterlife at the time of death. There have been sighting of this mirage island as far down the main Hawaiian Islands as Hana, Maui and Kaʻū, Hawaiʻi (Beckwith 1951: 68-69). It is said when the island passed offshore that the cocks started

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[39] In 2002, while in the Northwestern Hawaiian Islands, Bonnie Kahapeʻa and I saw these mirage islands of Kānehunamoku one morning while the ship vessel was anchored near Lisianski Island. This was probably one of the first documented sightings of these islands since the 1800's when Hawaiians published their own eyewitness accounts in the Hawaiian language newspapers. We photographed the mirages and wrote journal entries about them that are published on the NOWRAMP 2002 website.

[40] Kakelamaliuikeao (1915) states: "A oiai ua aina lauena ia a Kane e ku ana iloko o kona mahiehie nui, mawaena o ka moanakai akea, elike no hoi me ko kakou mau mokupuni pakahi e ku nei i keia wa, ua kahea aku la ua lehuakua la i ka inoa piha o ua aina la oia hoi, "Ka aina Lauena a Kane i Kukulu o Kahiki." O ua aina la nona ka inoa i hoike ia ae la maluna, he aina ia e ku ana kona mole iloko o ka hohonu, a i loaa ole nae hoi he mana hoonee i kona mau palena ia wa ma o a maanei, elike hoi me kona kulana heu mahope mai." [The fruitful land of Kane stood in its great beauty in the midst of a vast ocean, just as each of our islands now stands. The many gods called it by its full name of the "Fruitful Land of Kane at the Pillars of Kahiki" (Aina Lauena a Kane i ke Kukulu o Kahiki.) That land just mentioned is a land that was rooted within the earth but there was power to move its boundary this way and that as was done later.]

crowing, and the pigs grunted, and sometimes lights flickered, sugar cane swayed, and spirits moved about the island. Another account from Puʻuloa Oʻahu describes how two men out fishing were blown off by heavy winds and landed on an uninhabited island, save only gods. The land of Kānehūnāmoku in that account also positions it in Kahiki "a land not found by explorers who are endeavoring to discover." This source further states that "because this is a mythical land; if the land is seen by man, it is then submerged in the ocean, it can never be found, and so continues on. The things of that land are many; the living waters of Kāne and Kanaloa is found there; those who have died and their bodies turned into ash can be restored by that water" (Fornander 5: 678). As you can see although these islands were attributed to mythologies, they were considered real places that played important functional roles in the process of getting to the afterlife.

The Transition between Life and Afterlife

The transition between the world of the living and the world of the afterlife was only truly achieved in death. The area of the Northwestern Hawaiian Islands was considered a region that facilitated the process of afterlife and the journey spirits undertake. A fundamental Hawaiian religious belief was that a person's soul needed to complete its destiny by returning to the origins of his or her creation, or pō.[41] This procreative force called pō, or darkness, is the same concept introduced in the beginning of this chapter as it pertains to the cosmogonic accounts of creation and genesis. It was not however, limited to a universal state of darkness fixed in the beginning of creation, but also encompasses a timeless place where all life originates from and returns after

[41] Handy (1927:74) says, "to say that a soul ultimately reaches a state of being called darkness or oblivion (pō) is saying its ultimate destiny is extinction."

death.[42] According to Pukui (1972: 35-36, 131, 136-137), this darkness "represented the vastness of time, where our ancestors dwelled, transfigured into gods and deified spirits."

In Hawai'i, it is traditionally believed that death is symbolically tied to the setting of the sun in the west. A proverb that gives us deeper insight into this says, "mai hikina a ka lā i Kumukahi a ka welona a ka lā i Lehua," which literally means "from the sunrise at Kumukahi to the fading of sunlight at Lehua." This saying refers to the easternmost point of our 'main' Hawaiian chain, Kumukahi and the western most point, the islet of Lehua.[43] These boundaries were thought to be a poetic metaphor for the lifespan of a person from birth to death. The islands in the northwest however did not fall within the limits of these metaphorical boundaries. Rather, their importance resided in the second half of this overall journey, via the route to reunite with ancestors in the afterlife. It is during the afterlife that our souls travel to our ancestral islands in the northwest, and on into this procreative darkness.[44]

He moku Ka'ula i hoa me Ni'ihau	An island is Ka'ula connected with Ni'ihau,
I kaulua iā Kawaihoa a Kāne	On both are the waters brought forth by Kāne,
'O kaulana a ka lā i Halali'i lā	The sun shines over Halali'i there,
Hala ka lā nalo ma Lehua,	The sun passes on and vanishes at Lehua,
Hiki ka mōlehulehu o ke ahiahi	The dusk of evening comes,
Moe ē nō Kaua'i i luna ka lā	Kaua'i sleeps were the sun goes down,
E ao ana nō Lehua i ke kai	Lehua lies bright in the sea.

[42] After western contact, pō becomes negatively associated with it being a "realm of darkness" which connotes hell.

[43] The highest point of Lehua islet is called Kaunuokalā, meaning "the altar of the sun." Lehua was given the name "moku kā'ili lā," or 'sun snatching island" (Tava and Keale 1989:17).

[44] One of the major deities associated with the Northwestern Hawaiian Islands is Kānemilohai (Kāne-accepter-of-sacrifice). He is the younger brother of Pele who accompanies her from Kahiki. He was left on an islet in the northwestern end of the chain to guard this outpost and is represented as a catcher-of-souls and resuscitator, and is associated with healing and saving.

An example of this is in the mele "He moku Kaʻula i hoa me Niʻihau" chanted by paramount Hawaiʻi Island chief Alapaʻi during a battle against Kalaniʻōpuʻu on Hawaiʻi Island (Kamakau 1992). Alapaʻi used this chant to foretell the death of two men as he squeezed their necks holding one in his right hand, and the other in his left. The kaona, or concealed meaning, of this mele can be paraphrased as such: "These two men I am holding both have life from Kāne. They are men in full strength. They are soon to die. Early death comes to them. Glorious in battle am I." The setting of the sun past Lehua was used as poetic imagery to symbolize the death and a journey that these souls were about to face. It was thought in traditional times that when a person died, not only did the disembodied spirit retained the exact image of its former self, but any objects (moe pū- lit. to put to sleep with) that were buried with the dead body could be acquired by the soul for its journey through the afterlife. In fact, the soul required this assistance from its surviving relatives in its journey to and establishment in the afterlife (Handy 1927: 68).

A primary religious duty in traditional worship was to care for the remains of the dead and perform the prescribed rites. It was believed that the soul could not rest until all of the flesh had disappeared. Final internment of the bones required ensured safety so that the bones would not be harmed as the spirits' journey to pō. Handy (1927: 69) states that "the soul of one whose physical remains were neglected became a wandering, homeless, and usually malicious ghost." After death, the soul was believed to separate from the human body (Kaaie, J. W. 1862), and travel to specific points in the main Hawaiian islands called "leina ka ʻuhane" (souls leap; also called "reigna" in other places in Polynesia; Handy 1927:71). These areas are located on each main Hawaiian island

and were thought to be "jumping points"[45] from which the soul of the dead leaped in hopes of being caught by its ʻaumākua (ancestral family guardians) who would guide them through the process of traveling to the afterlife into the northwest. If individuals lived life honorably, their ancestors would assist them in their journey. In fact, according to Kamakau (1964: 50) people who fulfilled their kuleana (responsibility) and achieved during life did not fear death or have any misgivings about dying.

However, if a person behaved wrongly or dishonored their ancestors during their lifetime, then they would not be greeted by them at this transition and would be forced to wander the land in a purgatory state of unrest called kuewa (to wander).[46] The souls of people that achieved great mana in their lifetime might be immediately transfigured into embodiments of their gods, such as "a shark, thunder, a water spirit, a bird, or something else." Transfigured and deified male and female high chiefs became gods for future descendants (Luomala 1984). Leina functioned to facilitate this transitional process of getting souls to the afterlife so that they could continue on this path, accumulating rank and status. In several traditional moʻolelo they have been associated with the following places in the main Hawaiian Islands: on Niʻihau the soul's leap is on the islet of Lehua at a place called Mau-loku;[47] on Kauaʻi it is at Hana-pēpē; on Oʻahu it is near Kāʻena in

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[45] After western contact, this action of jumping into the sea becomes negatively associated with pō being an evil "underworld."

[46] The kuewa are said to be doomed to wander forever with no purpose. They were forced to chase moths, spiders, and grasshoppers in effort to appease their hunger, and were found at certain geographic locales in the 'main' Hawaiian Islands. According to Handy (1927: 66), "a soul that had been neglected and was constrained to wander on earth, retaining this form, might be seen by anyone, especially at night, but sometimes also by day."

[47] Mauloku is erroneously called the leina for the island of Nihoa (Pukui et al. 1974:148). Tava and Keale (1989: 99), as well as Kaaie (1862) clarifies that it is located on Lehua islet off of Niʻihau. Kapapakiʻikiʻi on Niʻihau is also mentioned by Kaaie (1862) as a place where souls congregate, however it is not clear whether it was a leina or a place for the kuewa.

Waialua;[48] on Moloka‘i the soul’s leap is at the boundary of Ko‘olau and Kona, at Ka-leina-a-ka-papio; on Lāna‘i the soul’s leaps are at Hōkūnui according to some people, and others thought it was at Kaunolū; on Maui the soul’s leap is at Keka‘a;[49] on Hawai‘i there are three places, one at Hilo, one at Waipi‘o, and the third at Palelua. According to Handy (1927:71), “at different points on the path there were supposed stopping or gathering places.” Thus, even in afterlife, the spirit of deceased ancestors could be worshiped and elevated to supernatural status and rank, eventually becoming ‘aumakua (family gods), and akua (gods).

Discussion

Socio-political power was built upon a metaphysical continuum in the Hawaiian archipelago. Mokumanamana was an island in a unique location centrally positioned between the worlds of the living and the world of the afterlife. In order to recognize the island patterns to put this knowledge system together, chiefs needed to have explored the full extent of the archipelago (up into the northwest) very early in the settlement history of the archipelago. This ritual knowledge of the spectrum of power across the east and west axis allowed them to conclude that ancestral power lay primarily in the west, and chiefs would need to access these pathways in both life and death. To what degree these voyages to the Northwestern Hawaiian Islands and particularly Mokumanamana were sustained has yet to be seen. When looking at these patterns closely however it becomes apparent that man-made structures were deliberately absent past Mokumanamana because the islands farther to the northwest represented ‘āina akua, or god islands. These

[48] On O‘ahu, the plain of Kaupe‘a is the name of the area where kuewa spirits wander, catching moths and spiders (Kamakau 1964: 92).
[49] On Maui ,the plain of Kama‘oma‘o, near Pu‘unēnē, is the name of the area where kuewa sprits wander (Kaaie 1862).

were places designated for their deified ancestors and the journey the spirits of the dead took on their way back to pō. The chiefly lineages descended from this ancient creation and represented branches of family lines that developed and occupied the main Hawaiian group. The senior lines occupied Kauaʻi and Oʻahu, while the junior lines inhabited the Maui group and Hawaiʻi. These junior lines had the most to gain from accessing the power of west and usurping the senior lines.

The mythologies outlined in this chapter provide a structure and framework for understanding the foundation for Hawaiian religion and the concept of mana. These ancient myths can be used in a historical manner to reveal lessons concerning power and rank and the role of humanity and divinity in Hawaiian society. Mana existed in landscapes of power as cosmological accounts document the first socio-political transformations in Hawaiʻi. This transformation set the world in motion, as man separated from darkness and emerged into light, helping to define the relationship between man and gods. The juxtaposition between the desires of men to become divine, and the desire of gods to become mortal played out here explicitly with the increasing appearance of gods (akua) involved in human affairs in through stories centered in the main Hawaiian islands as they departed from the mythical scene (pō) and migrated successively east (Beckwith 1951). Likewise chiefly heroes strived to be god-like and extraordinary, but did not have the full range of supernatural abilities of their ancestral predecessors. They sought to legitimize the source of their ascribed power and in the process achieved additional mana through skill, strength, and righteous rule. They demonstrated their spiritual prowess further by adventurous voyages to distant lands often times moving westward into the domain of gods. These lessons were passed on

through the collective memories maintained by elites and helped to cultivate a balance between cooperative and competitive behaviors among different genealogical branches. This balance of power was essential in the early phases of development for Hawaiian chiefdoms.

The Northwestern Hawaiian Islands played an important religious function in maintaining a world that was designated for the ancestral gods and spirits of the deceased. The west became the primary focus for the accession of ritual power in Hawaiian chiefdoms. Contenders for leadership in the main Hawaiian Islands need to petition the ancestral gods in the Northwestern Hawaiian Islands for legitimacy to rule. Also, chiefs understood that one's spirit did not end at death and in order to keep moving up the continuum of rank and power in both life and death, one needed to amass mana, not only for himself but also to elevate his ancestors who went before him (also relying on his/her descendants afterwards to continue this cycle). In this context, mana was a continued legacy that needed to be maintained. This could be achieved by building upon the reputation of mythical ancestors and also building upon the site of important social political transformations that were situated in the axis of these landscapes of power.

CHAPTER 3

RECONSTITUTING MANA AND ESTABLISHING THE ‘AHA

The rise of ritual power and the establishment of a state sponsored religious system represented an important phase in the socio-political development of Hawaiian chiefdoms. The island of Mokumanamana played a crucial role as the center of ritual power, helping to integrate a system of worship that spanned across all the main Hawaiian Islands. The strategic location of this island became an important site of historical interaction and reoccurrence, commemorating the dawn of man from primordial darkness and the furthering of his control over the spiritual realm. It is here that the concept of mana (i.e. divine religious authority and power) was reconstituted and integrated into a ceremony called the ‘aha (braided cord). This cord came to symbolize a historical record between the ancestors and their descendants, as mana no longer existed as a static presence of power and authority accumulated within a single individual, but rather one that was continually accrued (or lost) over the span of generations. The ‘aha ritual cycle ensured the continuation of this process and became the primary means for determining Hawaiian political leadership over time. The difficulty of the ‘aha gave rise to the strongest and most resilient chiefs by challenging them to demonstrate their ability to “braid” people towards a common purpose. Through this process mana was legitimized and sanctioned by the ancestors in the afterlife. This created the structure and framework of social order in traditional Hawaiian society while, at the same time, ensuring that it would be played out dynamically (and to some extent uncertainly) in the real world.

Rites and ritual behaviors are practices that are expressive acts by virtue of their conspicuous regularity. They are formalized and habituated actions that tend to be stylized, stereotyped, and repetitive. Rituals are not a product of random variation. They occur and reoccur at fixed times and specific places according to an annual and sometimes even longer calendar. This repletion was important because it aided in an ideological production and encouraged a sense of continuity between the past and the present. These acts reinforced social memory concerning their ancestors and of a remembered past or general links to a vague mythological antiquity. Knowledge of the past was rooted in a sense of collectivity as each person was aware of the degree in which they were immersed in a flow of tradition from past to present (Vansina 1985). Each person was an important link in the chain of transmission as a conscious actor in verifying, interpreting, and rationalizing these memories through his or her own sensory-emotional-mental experiences (Handy and Pukui 1998). Thus, these rites served the function of commemoration allowing the present day participants to recall an event, or ritually re-enact a narrative of the past. This was achieved at specific locales through sequences of ceremonies, offerings, embodied performances, feasts, and prayers. They helped to reinforce traditional values and the reproduction and transformation of a society from one generation to the next. They also often served a secondary role of helping to safe guard sacred knowledge through the use of indirect expressions. Rituals encoded information in hidden metaphors and practices that protected the integrity of the sacred information. It was this ritual knowledge, cloaked in secrecy, and held in prestige that helped to give structure to the social order from which people lived.

Ritual knowledge originated as part of a Hawaiian intellectual tradition that began from two major genealogical lines featured in the Kumulipo- the Palikū line and the ʻOlolo (Lolo) line (Kalakaua in Beckwith 1951: 230-31; lines 1711-1734; pp 231-232, lines 1735-1764). Hawaiian intellectualism (lololo)[50] (Barrerre 1961: 421; Malo 1951: 3; Kamakau 1992: 235) was developed as a process of gathering, managing, and protecting sacred knowledge. This depth of thought was firmly seated in the brain (lolo), while aspects of cognitive emotion and decision-making were largely based in the gut (naʻau). The word lololo comes from the root word lolo, which means brain, or bone marrow. The transfer and building of this knowledge was a process called "hānauna lolo" or generational intelligence (Kalakaua in Beckwith 1951: 233- line 1791).[51] This process of transfer still exists today in the form of ʻailolo or a ceremonial feasting of the brains of certain animals to attain knowledge and skills (Pukui 1983: 305). The term lolopua (lit. blossoming of the brain) represented the blossoming of this intellectualism, and an expression used in reference to when the sun reached its zenith overhead. This represented a major advancement in Hawaiian sacred knowledge as the sun began to play a greater role in establishing ways of calibrating the seasonal calendar and giving the elite the power of predictive ability. This was critical when trying to maximize resource productivity for an increasing population base. Understanding this space and time continuum was the ultimate form of mana and represented the height of Hawaiian

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[50] Lolo also refers to lolo ʻeleu – an active mind or intelligence; lololo- intelligence; and lolopua the blossoming of intellingence when the sun is at zenith.

[51] The concept of lololo and "hānau ma ka lolo" was first introduced to me through Kalei Nuʻuhiwa and the Papaku Makawalu group of the Edith Kanakaʻole Foundation. Acknowledgement should be given to them for re-introducing these concepts back into the Hawaiian community.

intellectual study. It helped them to forecast natural phenomenon and the units that represented divisions of time and space that became the foundation for Hawaiian religion.

The development of a state sponsored system of Hawaiian religion evolved over time through the concept of the ‘aha- a braided cord that connected the main Hawaiian group to the Northwestern Hawaiian Islands. The “braided cord’ became a pathway of power between ancestors in the afterlife and their chiefly living descendants. It represented the continuity across generations and a mechanism of ramifying male leaders through a complex web of genealogical birthrights. This process of cultivating leadership grew as a response to deal with problems associated with a growing competitive elite class in a stratified society. In this chapter we will examine the Hawaiian oral traditions as historical accounts and draw upon important historical truths concerning the transformation of ritual power in Hawaiian society. The historical method will be used to look at primary sources of Hawaiian mo‘olelo (histories, stories, narratives) that were linked to native informants, again giving preference to sources in the Hawaiian language. Similar to the last chapter, an approach is used that provides a more accurate method of understanding and reconstructing the Hawaiian past from a Hawaiian perspective. Hawaiian language associations and semantic analyses will be used as a means to interpret the deeper cultural meanings and metaphors. Through this study, we will understand how the concept of mana was built upon and transformed during the time of Wākea. The foundation of Hawaiian religion was established around the annual migration of the sun. This cycle became the bases for power and legitimacy for the four main chiefdoms competing for authority in late Hawaiian pre-contact history. Religious formation aids in ideological production by creating a stable and cohesive regional

identity for these developing chiefdoms. Chiefs began to invest more and more in ritual power though various means including: 1) the construction and reconstruction of temples across all of the islands; 2) the degree in which these rituals were timed and synchronized on an annual calendar; 3) the elaboration of ceremonies as embodied performances; 4) the mobilization of labor and the consumption of resources; and 5) the apparent desire to sustain the use of these two distant islands in the northwest Nihoa and Mokumanamana. This pathway to the west represented the ultimate expression and commitment in legitimizing the rule of chiefs over the people and territories that comprised their chiefdoms. This process of the ʻaha became vital process in achieving mana and maintaining the well-being of the nation.

Created By Wākea's Own Hands

> Then here again the story comes back. Hoʻi mai la ka noʻonoʻo i ka haʻi mai nā kūpuna o kākou i kēia ʻāina. Mana, manamana [holding up his hand], manamana lima, a ʻaha, moku ʻaha. So you put the two in place when you say manamana lima, we have our main islands over here, and these are the fingers [indicating the NWHI]. (Kaanana in Maly 2003a & b: 1218)

The Northwestern Hawaiian Islands were traditionally known as Nā Moku ʻAha (ʻIslands of the Cord')[52] and were the sites for important historical events leading to the formation of early Hawaiian chiefly society and the development of an integrated system of worship. These transformations were attributed to two ancestors, Wākea (k) and Papahānaumoku (w). In the previous chapter, it was mentioned that these two elites had

[52] Maly & Maly (2006) did a series of ethnographic interviews in the Hawaiian community to document fishing traditions throughout the main Hawaiian Islands. In one section of the study they interviewed knowledgeable kūpuna that had experiences going to the Northwestern Hawaiian Islands. Two of them were Uncle Eddie Kaʻanaana and Uncle Walter Paulo. These two men were raised like brothers in the tiny fishing village of Miloliʻi South Kona. In the interview Uncle Eddie recalls the name Nā Moku ʻAha as the old name for the Northwestern Hawaiian Islands.

descended from Kiʻi (k) and Laʻilaʻi (w). Later in Hawaiian traditions, these two individuals became positioned as central figures in the genealogy of Hawaiʻi as primary progenitors of all the chiefs from their time on, and ultimately all of the Hawaiian people. Wākea and Papa established a legacy for Hawaiʻi and were later personified in the mythologies of earth and sky. Despite being incorporated into mythologies, they were also thought to have been real people. Wākea (k) (who is later personified in the expansive sky)[53] was born at Waolani in Nuʻuanu, Oʻahu, of Kupu-lana-kēhau (w) and Kahiko-lua-mea (k). Papa (who is later personified in the earth) was born in the uplands of Hālawa, Oʻahu of Ka-haka-ua-koko (w) and Kūkalaniʻehu (k), the brother of Kupulanakēhau (w).[54] Their story documents an important socio-political transformation in Hawaiian society when the sovereignty and control of the islands is taken by Wākea from the senior line of the Kumu-honua genealogy[55] (See Kikiloi 2010; Fornander 1916—1920, Vol. IV; Kamakau, 1865b, 1991; Malo 1987; Poepoe 1906) (Figure 3.1).[56]

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[53] In the south seas, Wākea or his equivalent is the god of light and of the heavens who "opens the door to the sun." (Beckwith 1971: 294).

[54] Malo (1951) points out that "… Kahiko and Kupulanakehau resided at Kamawaelualani; and Loloimehani was the home land of Wākea and Papa, however there are no places in Hawaiʻi nei that are called by these names." Poepoe (1906) clarifies that these are names for Oʻahu and Kauaʻi.

[55] The person Kāneiakumuhonua (Kāne of Kumuhonua) is an obvious representative of the Kumuhonua Genealogy that in some way symbolizes the archetype character Kāne from the dawn of man in the Kumulipo. He has three sons Kāne, Kanaloa, and Ahukai. The Kumuhonua Genealogy has been the topic of much discussion (Barrere 1969) as there are many versions that do not achieve mutual agreement. In the Kumulipo (Kalakaua in Beckwith 1951: 230; line 1713) he is introduced as Kumuhonua and Haloiho. Kamakau gives two versions of the genealogy, one version (Kamakau 1992: 446) that focuses on the Paliku line down to Papa which calls them Hulihonua and Kaakahlilani; and the other version (Kamakau 1992: 446) that focuses on the Ololo line down to Wākea which calls them Kumuhonua and Halaiho. Fornander (1878: 181-183) is the most inconsistent version that calls them Kumuhonua and Lalohonua but has descendants listed that are exact names from the Liaikuhonua and Keakahulihonua (w) from the Paliku genealogy (Kalakaua in Beckwith 1951:line 1814-1842) either confusing the genealogical lines or implying that they are the same people.

[56] Poepoe (1906) also points out that the union of Papa & Wakea is important because it brings together the two main branches of genealogies that pre-date the genealogies of Laʻilaʻi- Ololo and Paliku. Ololo genealogy reflects the chiefly lines, while Paliku represents the supernatural kahuna lines.

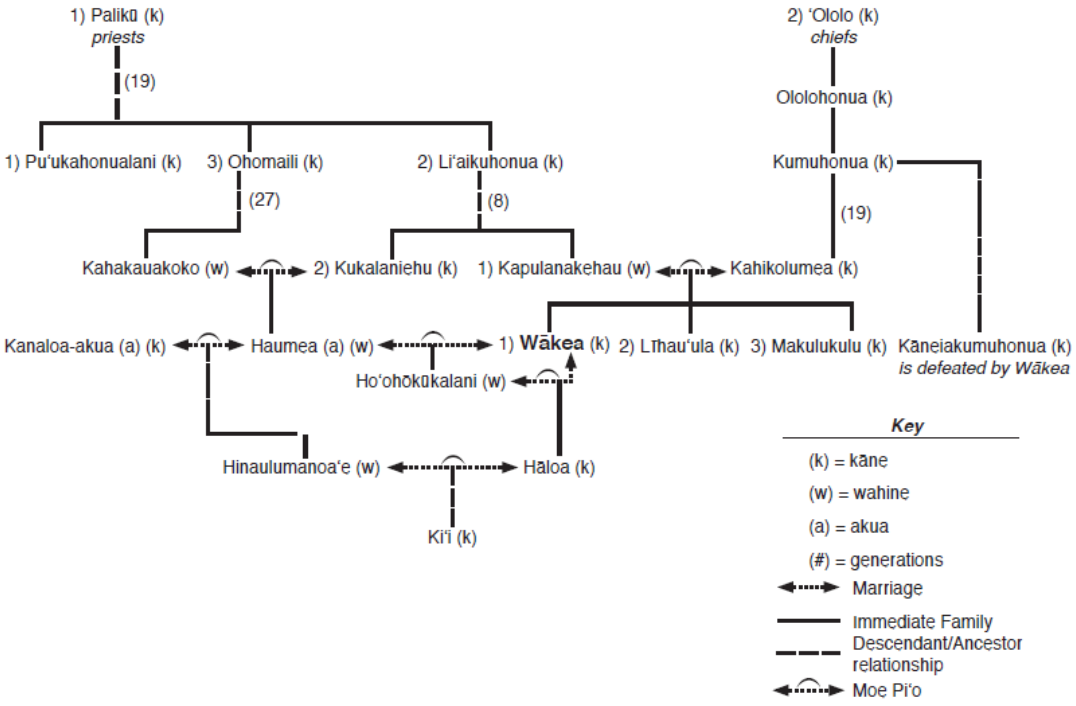

Figure 3.1. Genealogy of Wākea from Palikū & 'Ololo to Ki'i. Segmented lines represent the separation of more than one generation of time.

This places early Hawaiian society onto a trajectory towards the elaboration of religious practices and the rise in authority of a new type of chief, whose power is sustained and ordained through the religious system.

> "In the genealogy of Wākea, it is said that Papa gave birth to these islands. Another account has it that this group of islands were not begotten, but really made *by the hands* of Wākea himself" (italicized added; Malo 1951: 3; Malo 1987: 2).[57]

The concept of mana was central to understanding the dimensions of socio-political power, authority, and legitimacy to rule in Hawaiian chiefdoms. Mana could be

[57] The exact transcription goes: "Ma ka mookuauhau o Wakea, ua olelo ia main a Papa i hanau mai keia pae moku, o kekahi lohe mai, aole i hanau ia mai keia pae moku, aka i hana maoli ia e ko Wakea mau lima keia pae moku" (Malo 1987: 2).

loosely translated as "supernatural power," as well as "official power or authority." It was something that was acquired through one's genealogy and birthright or also achieved by one's spiritual merit and conduct within a lifetime. It was a power that continually "emanated and was confirmed by the spiritual realm and imbues all things animate and inanimate." From the human perspective it is a power that was physically felt, intellectually realized, and intuitively sensed. Those most closely connected to the gods and the spiritual realm possess a greater degree of mana and hence the authoritative position of being ali'i" (Abad 2000: 80; Beamer 2008: 57-58). This concept of spiritual power and authority was redefined by Wākea and took the form of a new religion called ho'o-mana-mana (worship).

Ho'omanamana[58] literally means to impart mana (power), as to idols or objects; to deify (Pukui and Elbert 1986). It represented spiritual worship that went beyond basic family practices and forms of communication between descendants and lesser family gods. It was the formalization of rituals, prayers, and rites in an attempt to connect high-born chiefs to the realm of the afterlife, and to the major gods cosmologically located in the northwest. When these formalized rituals were conducted at specific times and in exact locations the connection with ancestral gods was amplified and a transfer of power occurred. The word ho'omanamana is comprised of the root word mana (from mana-mana). Combined, it refers to the radiating branches and rays that fork out like those of the sun (i.e. lā manamana) or the way that fingers or toes (or the branching of digits) extended outward from the hands and feet of the human body. The closest English term

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[58] Mana.mana 1. Redup. of mana 1. ho'o.mana.mana- to impart mana, as to idols or objects; to deify; superstitious. (PPN manamana.). 2. Redup. of mana 2; appendages, claws, branches, rays, forks; to branch out. Lā manamana, sun with rays. (PPN mangamanga.). 3. n. Finger, toe (Pukui & Elbert 1986: 236).

equivalent to manamana is the term "radiating" and "transferring" (as in energy) as it refers to "radiated lines and divided splits" (Andrews 2003). These concepts involving the nature of religious worship, the way sunlight splits into rays, and extension of the fingers, although seemingly unrelated, will ultimately converge as a unified theme in this chapter.[59]

The hoʻomanamana system of religion was first mentioned in accounts associated with the sons of Kahikoluamea (k): Wākea (k) being the oldest, Līhauʻula (k) the second, and Mākulukuluokalani (k) the youngest.[60] These three brothers planned, developed, and implemented an integrated system of religious worship that centered on three dimensions: (1) construction of heiau (temples) of increasing scale and complexity as locations for worship; (2) linking the building locations and synchronizing ritual cycles (i.e., timing) to the migration pattern of the sun; and (3) the development of performance rituals and ceremonies that increased in investments as "sacrifices" over time. Wākea is remembered for his primary role as the progenitor of the chiefs and people (kuamoʻo kupuna aliʻi; literally the chiefly ancestral backbone) as his descendants populated the islands and were responsible for spreading this new type of temple and religious system. Lihauʻula became the developer of the priesthood class (ʻoihana kahuna) and created the intricate sacred rites and rituals for the ancestral gods. Mākulukulu became the developer

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[59] Hoʻomanamana later becomes synonymous with the word for religion and worship, but a closer look at all of the definitions helps us to understand it's totality in meaning. In the post contact period this word shifts to become hoʻomana kahiko (ancient religion) with the term ancient used in separating the old ways with the newly introduced religion- Christianity.

[60] Concerning the brothers, Poepoe (1906) states that "O Wakea ka mua, O Lihauulua ka waena, a o Makulu, i kapaia nohoi o Makulukulukalani, ke kanaka" [Wākea is first, Līhauʻula is the middle born, and Makulu, who was called Makulukuluokalani, is the man.] as cited in the Kumulipo (Liliuʻokalani, Kalākaua, Beckwith) before the chant goes on to helu (list) the names of stars and planets. Kamakau (1964) disagrees on the birth order and states that Kahikoluamea had two sons; Lihauʻula was the elder and Wākea the younger. In the Kumulipo (Kalakaua in Beckwith 1951) the term "pau-pani-ākea is used before listing the birth order of these sons, which means the "end of the closing up of light."

of the seer class (‘oihana kilo) who observed the celestial sky and tracked solar and celestial positions and movements (Poepoe 1906; Kalakaua in Beckwith 1951). Together these three traditions were brought together to create the foundation of this new religious system called ho‘omanamana. It became a system that spread and became more elaborate over time, requiring more and more investments to sustain an ideological production of power.

Heiau- Temples to Ensnare Time

The development of ho‘omanamana as a system of worship relied on the creation of temple sites called heiau (Pukui and Elbert 1986: 64). The word heiau literally means to “ensnare time.” The first word being hei, means to ensnare, and the second word being au, is defined in the dictionary as tide or current, but actually refers to the flow of time witnessed in the natural processes (i.e. a pantheon of ancestral deities that were personified in natural domains). The first heiau were purported to have been built by Wākea in Nu‘uanu, O‘ahu and was called Kawāluna (Kamakau 1976: 135, 1991: 129; Poepoe 1906).[61] The construction of these temples was an attempt to harness the power present in nature and develop a means of tracking calendrical time and the changing of seasons. Hawaiian intellectualism was based on this learning and retention of this sacred knowledge. Kekahuna writes the following description about the importance of heiau:

> Upon the profound concept of the word heiau light now dawns. We perceive the idea of ensnarement, of being held fast, of inescapable retention through the phenomenal memories of priests of the heiau, embracing many essential purposes, many fields of precious knowledge, all that was know of creation, all that should become known, especially of the life of man, through the period after period of ancient tradition, era after era of history, reign after reign of royal rulers. Thus

[61] Kawāluna lit. means the time period above. It is an appropriate name for the first heiau that possibly provides clues to the relationship between temples, time, and the movement of celestial bodies in the sky.

> should be denied to oblivion the inestimatable heritage bequeathed by the ages past, and to be yet bestowed by the ages to come, indelibly recorded in the storehouses of knowledge, the memory archives of the Hawaiian race. (Kekahuna n.d. Hawai‘i State Archives M-445 Folder 50)

Archaeological studies have shown that ritual sites throughout the Hawaiian archipelago have a remarkable degree of variation in their size, form, and function (Bennett 1930, McAllister 1933, Shimizu1980, Stokes 1991, Summers 1970). These ritual sites were often recorded in ethno-historical accounts as having a number of functional purposes, which ranged from simple shrines dedicated to family gods, to elaborate heiau that served different purposes for the state religion. The emergence of heiau temples symbolized a greater investment into ritual practices and the diversification of religious interest into other aspects of social development that fell outside the strict dimensions of power, including: productivity in fishing (heiau ho‘oulu i‘a), farming and horticulture (heiau ho‘oulu ‘ai), rain (ho‘oulu ua), increasing the population (ho‘oulu kānaka), increase in the health of the nation (ho‘oulu lāhui), peace (maluhia), long distance voyaging (ka holo ‘ana kahiki) and also war and governance (po‘o kānaka; luakini). The luakini (po‘o kānaka) temples were of particular importance because their construction reflects that the chiefly ambition was paramount ali‘i to increase their power (mana), authority, and governance. Construction of the massive temples could involve thousands of people and became public work projects (hana ‘aupuni) (Fornander 1878-80, 2:36). The need to mobilize labor in these construction efforts measured the king’s influence and ability to organize and command people and garner resources to support these massive undertakings. Labor requirements ranged from small scale “family” projects to large scale requirements of labor typically commissioned by chiefs for the building of large resource production systems and polity temples (Kolb 1997; Kolb and

Snead 1997). These were not just fixed construction costs but also required constant maintenance due to their increasing scale, periodic and synchronized use, and growing need for the display of "sacrifices" (i.e., investments in all forms whether it be labor, offerings, sacrifices, etc.) in order to make them effective.

All major or larger heiau temples were designed by the architect specialists called poʻe kuhikuhipuʻuone,[62] who combined the study of Hawaiian political history, especially the careers of successful chiefs, with the knowledge of various heiau plans through the ages (Dye in Stokes 1991: 3). Heiau temples conformed to a template of building components and were constructed as earth and stone infrastructure and wooden superstructures as outlined in the Wākea tradition.[63] These features listed in the chant included: (1) kūkalepa (inside row of images) that formed a line or semi-circle; (2) the paehumu (perimeter enclosure) comprised of a wooden (and sometimes rock) fence or wall that surrounds the sacred space delineating the heiau; (3) the ʻanuʻu or lananuʻumamao (oracle tower) that is a tall scaffolding behind the row of images; (4) the ʻiliʻili (pavement) or water worn stones used to pave the floor, and more specifically the place in front of the altar to temporarily hold offerings; (5) the hale mana (prayer house for the mōʻī principal idol) which held the priests most sacred images and was the focal point of the ceremonies to consecrate mōʻī (principal image) as the guardian of the nation; (6) the hale pahu (drum house) which sheltered the large drums used in the ceremonies; (7) the mōʻī (principal image) which was the wooden medium which housed

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[62] Lit. one who points out the sand heaps, since the design of heiau were first shown crudely in the sand (Malo 1951: 213)

[63] Poepoe (1906) and Kamakau (1976: 135) highlights a Wākea chant ("O Wakea la ko Waolani") that outlines all the principle components of a heiau that were developed for the first heiau ever constructed-Kawāluna at Waolani in Nuʻuanu, Oʻahu.

the spirit of the main god; and (8) the kuapala (offerings place) which could range from a stone kuahu or wooden framed lele (altar) where offerings and sacrifices were placed. These were the main components of a heiau. Other important additions that came later were: (1) the platform of paved pebbles called the papahola located outside the entrance; (2) the hale wai ea literally, "house of [the] sovereign, rising, life-giving waters"), which contained the ʻaha cord necessary for the consecration of the heiau; and (3) the hale o papa, and outside structure where high ranking women worshipped and where they participated in dedicatory ceremonies of the luakini; (4) the lua paʻū (pit) into which offerings are discarded after use (Kamakau 1976: 135) Furthermore, archaeological studies have shown that the complexity of temple design and overall scale in size generally increased over time with the largest heiau occurring at ca. A.D. 1600 (Kolb 1991, 1994a).

The location and placement of heiau played an important part in establishing ritual power. The placement of these temples determined the order in which they were consecrated on a ritual cycle based on the migration pattern of the sun. These locations were purposefully selected through celestial position and preserved through time in the ancient mandate of chiefs to to "kūkulu hou" (i.e. rebuild the foundation of their ancestors). Whenever a chief came into power they were required to consult with priests to determine whether it was necessary to rebuild to the temples (Valeri 1985: 234). Political success was thought to be dependent upon these temples as they were built and rebuilt on these specific site locations with each new generation (Fornander 1878-80 2: 102; cf Thrum 1908b: 60; Malo 1951: 161; Kamakau 1976: 132). Ancient forms of temples would therefore be used as the foundations when newer components were built

and thus merged into the old plans (Thrum 1910: 56). This represented the effort of the chiefs to rebuild the mana of the nation and to legitimize their own rule.[64]

The orientation of the heiau temples did not always follow strict patterns and were relatively flexible (Bennett 1930: 23; Valerie 1985: 236) as the astronomical function of monitoring the position of the sun was achieved through the innovation in Hawaii of towers placed within temple foundation perimeters. Bennett (1930: 130, 135) in his study of heiau across Hawai‘i says that “there are few Polynesian parallels to the Hawaiian anu‘u tower”, which supports this notion that towers are an independent development only found in heiau temples and religious worship in Hawaiian society (Linton 1925; McKern 1929; Routledge and Routledge 1921; Seurat 1905). All luakini heiau had a lana-nu‘u-mamao (or anu‘u for short- often interpreted as an “oracle tower”). The lana-nu‘u-mamao was a tall, framed wood tower (20-50 ft. or more in height) consisting of three levels. The lowest level where the offerings were placed was called the lana. The middle floor was called the nu‘u. The top floor was called the mamao and was the most sacred was the place from which the high priest and ali‘i nui (high chief) would conduct services (Kent 1986: 132; Malo 1951: 176; Valeri 1985: 238) (Figure 3.2).

[64] It is important to point out in the post-contact Kingdom period, chiefs also built the churches and government sites on the same heiau locations.

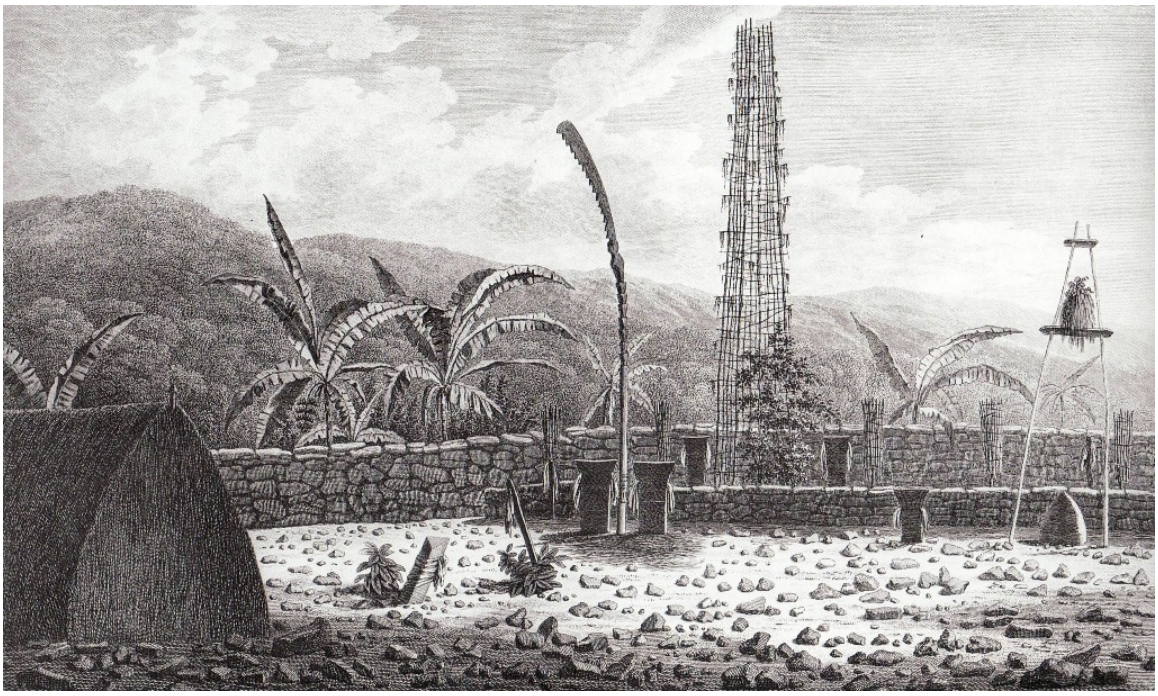

Figure 3.2. Drawings of Heiau by John Webber, from Cook and King 1784. The image shows the interior of a luakini heiau temple on Kauaʻi. Note the location of the images which are made of wood instead of stone, and also the presence of the anuʻu tower. Emory (1928) notes dyke prism in foreground and the presence of wooden uprights similar to that of the stone uprights of Nihoa and Mokumanamana.

In the planning for the construction of a heiau, the kuhikuhipuʻuone would exhibit and explain all the parts of the heiau and their internal locations and orientations as they pertain to "where the fence was to run, where the houses were to stand, and where was the place for the lana-nuʻu-mamao (tower) with the idols." Although the function of the anuʻu has never been explicitly expressed, its importance is clearly noted as: (1) it was the first thing built in a fixed position the interior after the paehumu (perimeter) was set (Kamakau 1976: 135; Malo 1951: 162; cf. Emory 1929: 92); (2) it was always built on one end of the heiau (Malo 1951: 61, 213-14) associated with the ahu; (3) all god images and interior house were oriented in relation to it; and (4) it was wrapped in kapa to

essentially create a funnel from which light could shine through from the top hole.[65] Thus having an unobstructed view plane (i.e., orientiation) was important, but the primary decision that went into determining the location of the anu‘u tower was in relation to the celestial sky. Events directly associated with the heiau temple needed to be calibrated with the celestial sky in order to determine their position and ritual order in the annual consecration cycle. Additionally, other types of dimensions of social life were also fixed in relation to the major heiau that were not directly associated with the ‘aha ritual (e.g., the timing of agricultural planting, the closures of resources through sanctions, etc.).

Offerings and sacrifices were important religious investments in the practice of worship at the heiau. Ethno-historical records show that earlier Hawaiian ritual practices typically included the offering (or “sacrifice”) of first-born animals, first fruits of the earth, and first caught fish (Kamakau 1964). It could be argued that human labor was a type of investment and “sacrifice” that was exchanged for religious power. Kolb (1997) suggests through archaeological evidence that labor and time invested into building heiau temples was also a form of sacrifice. Through his studies in Maui, he was able to demonstrate there was a shift from labor to goods as part of the sacrifice and worship. He makes this inference from his excavations, as the earliest heiau had few obvious offerings. Sacrificial offerings evolved and intensified over time to include living species

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[65] Early European visitors gave important descriptions of the anu‘u tower that further supports this notion of it being an important marker noting that is covered with a thin light grey cloth (‘oloa kapa), which seemed to be consecrated to religious and ceremonial purposes (Cook & King 1784, 2: 200). Ellis (1842: 97) gives another good description of the tower and its function (according to Valeri his informant is K. Kamakau) stating that an old Moloka‘i priest said it was a “kind of tube reaching to heaven, through which the god speaks to the high priest. (Brigham n.d.: 145). Valeri (1985) suggests that it could be used as “an observatory for noting position of stars and other heavenly signs of divine will.”

such as fish and wild birds eventually changing to domesticated animals such as pigs (Kolb 1994a, 1997). Coral is also a noted offering often found on ritual sites as it has been found in both coastal and upland mountain ritual contexts (Kirch & Sharp 2005, McCoy et al 2008; Weisler et al 2005; Weisler et al 2009. It is suggested here that this type of offering had direct cosmogonic associations with the emergence of first life in the time of creation. The offering of humans as sacrifice represented a much later historical development and intensified practice at the most far end of this continuum at the eve of European contact, as early Hawaiian rituals did not include this form of petitioning.[66]

All of these heiau descriptions from archaeological and ethno-historic studies support the idea that repetition and recurrence were the major reasons for their construction and use. The rebuilding or re-consecrating of heiau positioned in the same location was a commemorative act that had functional value in keeping the order of the ritual cycle. Thus, ritual time was not conceived as being built up of units, but rather as successive units in a set sequence. Time within this metaphysic is seen as cycles or intervals, with a series of repetitions of the same actions, the same enactments, and the same representations, which helped keep society in balance or in relation to the "natural" rhythm of the world. The intervals were framed annually and based on seasonal observations in the environment. Determining the celestial position of moving stars and the sun in the sky as it reaches its zenith (lolopua) overhead was one way of keeping track of the annual calendar and the shifting changes in the environment. These shifts

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[66] Kamakau (1964) notes that "in the period of Wākea, offering of fragrant things and human sacrifices were unknown. It was 700-1000 years later that men became burnt offerings, and were baked in an imu or broiled over a fire until the body grease (hinu) dripped, and then were placed on the lele altar." He also says that "the only offerings and sacrifices were of first born animals, the first fruits of the earth, and the first fishes caught. Men only gave these as offerings."

affected all aspects of survival as it relates to the production of food through agricultural expansion and intensification, the management of marine resources and fishponds, as well as periods of harvest and closures of forests. Ritual power revolved around all of these dimensions of society in which the sun played an ever larger role in religious practices.

Hānau ka Lā- the Sun is Born a Sacred Child to Wākea

Ke hakina mai la e ka Lā	Fragmenting by the sun
E ke keiki hele lani a Wākea	O the sky traveling child of Wākea
ʻO Wākea kai lalo, ʻo ka Lā ka iluna	Wākea is the one below, the Sun the one above
ʻO ke keiki Lā kēia a Wākea i ho‘okauhua ai	This is the sun child of Wākea in pregnancy
ʻOia ho‘i hā, o ka lā	Oh indeed, the sun
Hānau ka lā	The Sun is born

(Poepoe 1906; Kikiloi translation)

The sun (lā) was considered the most dominant and fiery force in nature as it had the ability to shine light, exert heat, and cast shadows. Its movement helped to track the passing of time and the changing of seasons on the earth. Although the earth rotates around the sun, our position on the ground gives the appearance that the sun moves in the sky around us, essentially "rising" (in the east), and "setting" (in the west). The sun brings forth light every day and heats the planet and gives life, energy, and vitality. Its movement back and forth between positions on the hemisphere are tied to the changing of seasons and weather patterns (and hence to climate). As the sun moves across the sky it rises and sets at different trajectories on the horizon from any given location on the planet. For Hawai‘i, it follows a circular track that moves from the northern hemisphere in the mid-year, to the southern hemisphere at year's end. Shifts in seasons based on the sun's location structure life cycles of various living organisms and wide range of

biological processes that occur in island environments. Seasonal patterns for which the sun is a measure includes important physical parameters such as: 1) cooler and warmer portions of the year; 2) variation in the length of daylight (important for vegetation growth); 3) correlated changes in wind direction and speed; 4) and variation in patterns of precipitation. These are broad parameters from which climate is estimated for any given region. The sun, therefore, becomes an essential guiding device that helps to predict the onset of shifting seasons.

In traditional Hawaiian society, this powerful burning star- the sun, became a metaphor for the fire and intensity (‘ena) of a chief and his influence over all variety of things and events. The prostrating kapu of the most sacred chiefs imitated the relation of sun to human; like the sun, they (paramount chiefs) were thought to have so much power that they could not be gazed upon directly. Hues of red and yellow ritual adornment became insignias of royalty.[67] During the time of Wākea the sun was “born” to him implying this fiery star played an important and newly defined role in the religious system he and his brothers were responsible for developing. The sun was important because it had an inverse relationship to shadows (aka),[68] as it casts shadows in the directions opposite from where it is located and shines. The shadow (aka) is thought to represent the initial stage of development of life forms- essentially ones spirit. When a

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[67] Examples of the relationship to the sun are names such as heiau sites (i.e. Papa‘ena‘ena), or chief names (Nahi‘ena‘ena), or place names (Hā‘ena- i.e Mokumanamana). There were also kapu (restrictions) such as the kapu ahi for being of such high rank that you have eternal torches being burned continuously. Kapu wela o nā ali‘i (Beckwith 1951:17), which was death by fire for breaking these restrictions. Ii (1969: 73) says regarding chiefs of high rank: Such chiefs could make one wilt by having one's back scorched by the sun.

[68] Aka means shadow or image- a person’s spiritual essence. It also refers to the embryo (spirit) in the early stages of human development. In traditional times, it was believed that a man’s shadow contained his mana (Pūku‘i et. al 1972:10). Kapu were created for high chiefs so that their shadow would not fall on anyone else. Thus, when the aka enters the head, people are at their highest level of spiritual strength.

shadow was cast, it was the spirit separating from the body.[69] This shadow had the ability to leave and return through the opening at the top of the head called the manawa into the lolo (brain). Thus there was a concept in Hawaiian spiritual beliefs reflected in the proverb- "kau ka lā i ka lolo, a hoʻi ke aka i ke kino" (the sun rests on the brain, and the shadow retreats into the body) reflecting a time of great mana when the shadow is no longer visible.

Wākea in the development of this religion becomes personified in the sun at high noon (a-wākea literally "of Wākea") when the sun was directly overhead (Pukui and Elbert 1984). Since the sun follows an elliptical path in the sky, it is only directly overhead in any given location twice a year when it reaches its zenith (lolopua; literally the blossoming of the brain). In the northern hemisphere this culminates only once a year at its highest northern latitude known as the Tropic of Cancer (ke ala nui polohiwa a Kāne) at the summer solstice. During this one day in the year the sun appears to stand still in the sky, representing the longest time of daylight for any location in the Hawaiian Islands. Once it reaches this point, the sun reverses its apparent movement in the sky and heads back towards the equator and then to the Tropic of Capricorn in the southern hemisphere at the winter solstice. The sun's zenith position represents only a small window of time in the annual calendar, and in Hawaiʻi represented the day that the sun is directly overhead so that one's spirit is entirely focused (Pukui et al. 1972a: 124) and knowledge and understanding (i.e. heightened intelligence from the ancestors) are granted. These Hawaiian concepts of the sun's movement, the rendering of shadows, and

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[69] "One's shadow could not fall on the chief's house, and one was required to prostrate oneself when "containers holding the ater for his bath, or when his clothing, his malo, his food, or anything that belonged to him was carried along" (Malo 1951: 56-57).

role of the sun in magnifying entreaties were most important in scheduling when to serve petitions to the gods and achieving mana.

Legitimizing Power through the ʻAha Ritual

The Northwestern Hawaiian Islands becomes the primary location for the earliest documented account of the ʻaha ceremony taking place.[70] The story of Papa and Wākea describe the ceremony first taking place as they are drifting in the ocean up the chain and that it coincides with the building of heiau temple in relation to the migration of the sun. There are three sources that describe this account: (1) "He mele hānau no Kauikeaouli (Pukui and Korn 1973; Hawaiian Historical Society 2001); (2) David Malo's text in Moʻolelo Hawaiʻi (Malo 1951; Malo 1987); and (3) Joseph Mokuʻōhai's Moʻolelo Hawaiʻi Kahiko unpublished in Ka Naʻi Aupuni (1906).

This account describes how Wākea and his entourage are swept out to sea from ahupuaʻa of Heʻeia on the island of Oʻahu (Heʻeia lit. meaning to be washed away, i.e. fleeing). Here Malo states: "After Wakea came to the government, he had war with Kāne-iā-kumu-hōnua, in which Wākea was routed and obliged to swim out into the ocean with all his people." (Malo 1951: 239). Both Malo (1951, 1987), and Poepoe agree that Wākea was defeated and Kāne-iā-kumu-honua[71] pursued him as far as Kaʻula (located 37 km. west-southwest of Niʻihau), where he and his entourage (ʻōhua) took to the ocean

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[70] The sun represents the god Kāne. Kepelino (1932: 58, 68) states "Kāne was originally the only god in Hawaiʻi" and that the heiau dedicated to him had no images, but when images worship was included then all heiau had image. Later religious changes happen and additional rites and practices are included into the ʻaha – including the insertion of Kū as the primary god who accepts human sacrifice.

[71] Barrerre (1967: 110) states "… any and all stories and theories originating from the "Kumuhonua legends" are not part of a true Hawaiian tradition, but are traceable to adulterations made in Hawaiian mythology in the mid-19th century." One thing that is clear however, the Kumuhonua genealogy represented a Kāne tradition that was competing with Wākea as a primary descendant of the senior line of Kiʻi from the dawn of man. This set the stage for a competition of genealogical lines once again for the right to rule.

(‘au ma ka moana). They would have found themselves fleeing into the direction of the Northwestern Hawaiian Islands. The mele hānau, firmly places Wākea and his entourage in the Northwestern Hawaiian Islands as they drift towards Hōlani-moe-moe (a loko o [Hō]lani-moe-moe) a named island in this region of the archipelago (Kikiloi 2010).[72]

He‘e Wākea, kālewa kona ‘ōhua	Wākea is washed out, his entourage floating
Kū-a-mū ‘ia e Kāne, Kū-a-wā ‘ia e Kāne	Silenced by Kane, Shouting by Kāne
Ho‘i mai ‘o Kāne a loko o [Hō]lani-moemoe	**Kāne returns, until inside of**
Moe Wākea moe iā Papa	**[Hō]lanimoemoe**
Hānau ka Lā na Wākea	Wākea mates, mates with Papa
He keiki kapu na Wākea	**The Sun is born from Wākea**
	A sacred child of Wākea
(Poepoe 1906; bold added for emphasis)	(Kikiloi translation)

It is in the Northwestern Hawaiian Islands that these seemingly unrelated concepts and views regarding religious temple building (ho‘omanamana), the sun (lā manamana), and hands (manamana lima) converge to reveal a deeper relationship in the descriptive narrative. Combined these accounts describe how at that moment in the Northwestern Hawaiian Islands the Sun is born “as sacred child to Wākea” (hānau ka lā nā Wākea, he keiki kapu nā Wākea). During the climax of this story, Wākea is also with Papa (i.e. Haumea), his brothers Līhau‘ula (later progenitor of the priest class) and Mākulukulu (later progenitor of the kilokilo, divination astronomers), as well as his kahuna Komo‘awa and others in his entourage (‘ōhua). It is here, with his priests and star seers that Wākea makes this revelation about the sun and gives new birth and meaning to it.

[72] Lani-moemoe is a ellipse that refers to [Hō]lani-moemoe. Hōlani is an island name or region in the NWHI that is cross referenced in the Kai‘aikawaha (1835) “Genealogy of Island names.”

In their darkest moment of despair, Wākea desperately turns to a ritual process called the ʻaha (braided sennit cord) and petitions his ancestral gods for their favor. While stranded at sea in the Northwestern Hawaiian Islands, he consults with his kahuna Komoʻawa and asks him, "What can we do to save our lives? (pehea lā ua nei kākou, e hana aku ai i kēia lā i ola kākou?)"

ʻĪ mai lā ʻo Komoʻawa, e **kūkulu i heiau no ke akua**, ʻī mai ʻo Wākea, ʻaʻole he lāʻau o ka hale e kūkulu ai i heiau, ʻaʻole nō he puaʻa e pono ai ke mōhai aku i ke akua, ʻī mai ʻo Komoʻawa he lāʻau nō, he puaʻa nō

ʻĪ mai lā ʻo Komoʻawa iā Wākea, e **kūkulu aʻe ʻoe i kou lima ʻakau i luna, e hoʻoʻapu aʻe i kou poholima, e hoʻokūkulu mai kou manamanalima lima,** hana aʻe la ʻo Wākea pēlā, ʻī mai ʻo Komoʻawa, ua paʻa ka hale

ʻĪ hou mai ʻo Komoʻawa iā Wākea, **e ʻopiki ʻoe i kou manamana ma ka lima hema** a **hoʻoiʻoi i nā wēlau o nā manamana**, a e kau iho maluna o ka poho o kou lima ʻākau hana iho lā ʻo Wākea pēlā, i mai Komoēawa, ua mākaukau ka heiau, o ka pule koe. (Malo 1951; 239; Malo 1987: 121, 293; bold added for emphasis).

"**Build a heiau to the deity**," answered Komoʻawa. "There is no wood here with which to build a heiau, nor a pig with which to make a suitable offering to the god," answered Wākea. "There is wood and there is a pig," said Komoʻawa (Malo).

Komoawa said to Wakea, "**You must build it with placing your right hand up. Cup the palm of your hand must and build it from your fingers**. "Wakea did so and Komoawa said "the house is secured."

Komoawa said again to Wakea, "**Your left hand is to be pinched together (ʻupiki)** and **the fingertips are to be pointed down** and placed in the hollow of the palm of your right hand." Wakea did this and Komoawa said, "the heiau is ready. The prayer remains (to be said). (Kikiloi translation)

This section of the story provided by Malo (1951) and Poepoe (1906) describes the dialogue between Wākea and Komoʻawa results in the building of a heiau temple with his *hands and fingers* in order to conduct the first ʻaha ceremony. This heiau is secured by building the foundation with the right hand (lima ʻakau)[73] by forming it in a cup-like fashion (ʻapu/poho), and building manamana uprights- then the heiau is done.

[73] Earlier in the birth chant for Kauikeaouli (Mele Hānau nō Kauikeaouli) there is a line that says "Paʻa ʻia lewa lani i ka lima ʻākau o Wākea ("the sky was secured by Wākea's right hand"), again referencing the importance of Wākea's hands in securing a new destiny for Hawaiʻi (Pukui and Korn 1973: 16, 22; Hawaiian Historical Society 2001: 292).

The heiau is made ready for the ‘aha by using the left (hema) hand and closing the finger tips together and placing on the right hand- then the prayer is then recited.[74]

This account describes how Wākea builds this “temple of fingers,” placing his pinched left fingers on top of his cupped right hand to erect the heiau of fingers (manamana) (Figure 3.3).

Figure 3.3. Photo Demonstrating a Hand Gesture Relating to Building a Heiau with Your Hand. This gesture is described by Poepoe (1906) and Malo (1951; 1987) as being done in first ‘aha ceremony and the building of the temple of fingers.

[74] Poepoe (1906) gives this description: “A laila, olelo mai la ua kahuna nei: “E o ae ko lima akau Huna, piao ae oe i ou manamana lima a ku ka upoho i ka poli o ko lima, o ke ku no ia o ka heiau o ke akua.” Wahi a ke kahuna. [Then, the kahuna said: “thrust forward your right hidden right hand, fold your fingers until it is a cuplike fashion in the palm of your hand, then the temple of the gods stands.” Said the kahuna.]. He goes on to say “E like me nei mau olelo a ke kahuna, pela o Wakea i hooko ai. O ae la oi i kona lima akau, piao ae la na manamana lima a ku nohoi ka upoho i ka poli o ka lima a ia wa i olelo mai ai ke kahuna ia ia [Just as the kahuna said, that is what Wakea did. He put out his right hand, and curled the fingers until it formed a dip in the palm of the hand and at this time the kahuna spoke to him.] (Kikiloi translation).

Komoʻawa gathers all the ʻōhua and leads them in the ʻaha ceremony. They sit in total focus and silence as the ceremony is completed with perfection. This single act turns the political tide and secures Wākea's right to rule and control the ʻaupuni. This ceremony that is done in silence and specifically these hand gestures described were ritualized throughout the ʻaha ceremonies from this period forward. Poepoe's (1906) version explains that a humu-humu-nuku-nuku-a-puaʻa fish is substituted for the pig sacrifice and laid into his palm, and then the prayers are done.[75] The Komoʻawa says "Ano, e kuʻu haku, ua kū ka ʻaha, a e mōhai aʻe au i ka ʻalana o ka hale o ke akua, i kū ʻo Wākea i ka moku." [Indeed, my lord, the ʻaha ceremony stands, and I sacrificed the offering of the temple of the god so that Wākea has been given the ultimate authority to be ruler] (Kikiloi translation). After the first ʻaha was completed Wākea and his party returned to Oʻahu and mounted a successful campaign against Kāneiākumuhonua, unifying the archipelago, and forever changing the course of Hawaiian history in favor of Wākea and his descendants.

A Temple of Fingers on the Path of the Sun

The Island of Mokumanamana was the realization of Wākea's "temple of fingers," as a thousand years ago it was directly in line (23^{o} 34.5' N) with the rising and the setting of the equinoctial sun (23^{o} 34.1' N) on the path called the Tropic of Cancer ("ke ala polohiwa a Kāne," or the black shining road of Kāne).[76] The name

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[75] Ua olelo ia ma kekahi mana o keia moolelo, o ka puaa alana ia ai keia heiau pulima o Wakea, oia no ka piao manamana o kona lima hema, i hookomoia aku ma ka upoho o kona lima akau. [It is said in some divisions of this story, the pig offering that Wākea's clasped hand temple consumed, it was indeed the curling of his left hand that entered in the cup of his right hand.] (Kikiloi translation).

[76] A reference to the Tropic of Cancer (Kamakau 1865; Johnson and Mahelona 1975: 72, 80-81), the path souls of the deceased take into the afterlife and a passage in which souls can be brought back to life through

Mokumanamana (literally "island [temple] of fingers") exists today as a clue that marks the commemoration of this first ʻaha event. Visually, the island has five major crests emerging out of the water giving it the appearance of an open right hand facing upwards with its fingers sticking out of the water (Figure 3.4). The natural contours and features of this island were an uncanny representation of Wākea's right hand and fingers building the heiau temple and a powerful reminder of this important historical event. The actual construction of the heiau temple structures were likely a commemoration of this Wākea tradition. The chiefs that descended from this newly established senior line would have been primarily responsible for the initial impetus to build and construct this island "temple." While the story exists in a mythological period, the investment towards making this a reality likely occurred at a point in history when there was a division of labor already established amongst the different classes of chiefs, priests, and seers within the traditional social structure.

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sorcery (Hooulumahiehie 2006: 201-204; Pukui and Elbert 1986: 339). The path of the Tropic of Cancer has been moving south 1' every 128 years (Almanac in Liller 2000).

Figure 3.4. Aerial Photo of Mokumanamana. The contour of the island gives the appearance of a right hand, palm facing upwards sticking out of the water. The four hills represent the tips of the fingers and the northwest cape represents the thumb.

The Wākea tradition gave new "birth" to the sun, making it an essential element within an integrated ritual process that tracked time and increased the elite's predictive ability in anticipating the annual shifts in climate and weather. Each island had correlative environments that were tied into this process by virtue of their position of latitude in the northern hemisphere. Mokumanamana was positioned in the ideal location as it was centrally placed in the middle of the archipelago, and also was situated on the northern end of the sun's migration route. This position allowed the island to be used to demarcate the year on the equinoxes (when the sun crossed the equator) and more importantly the summer solstice (when the sun arrived at this northern limit overhead). The summer solstice the longest day of the year and an important shadowless moment as the sun was directly overhead at its zenith. As it reached its apex in the celestial sky the sun gave the illusion of having "stood still" before turning and beginning its slow journey to return to the southern hemisphere.[77] This narrative concerning Wākea's dilemma of being out at sea and stranded in the northwestern region of Hawai'i is the only tradition known that combines these concepts of heiau building and religion (ho'omanamana lit. worship), the sun (lā manamana lit. sun's rays), and fingers (manamana lima lit. fingers) in a single religious dimension. This is in fact the earliest story explaining the creation of Hawaiian religion as we know it (i.e. ho'omanamana).

The unique location of Mokumanamana made it ideal for the construction of numerous heiau temple structures because it is the only landfall in the archipelago that intersected with this northern hemispheric summer solstice pathway. It truly was an island dedicated to ancestral worship as the summer solstice provided a exclusive

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[77] Solstice comes from Latin word *sōlstitium* meaning the (apparent) "standing still" of the sun.

ceremonial opportunity for the phenomenon of "kau ka lā i ka lolo, hoʻi ke aka i ke kino," allowing the sun to "rest on the brain and the shadow will retreat into the body"[78] for the longest duration possible as it essentially "stood still." The island is also positioned on the axis between the realm of the living- ao (light, day, free) and the realm designated for the spirits and gods- pō (darkness, night, divine); and its central location allowed clearer spiritual communication between the realms. These are likely to be the primary factors contributing to the investment into the construction of ceremonial sites on such a small and remote island. The strategic concentration of ceremonial sites on this island is revealing of its important spiritual role that it played in facilitating the creation of new life and the passing of our ancestors. This story of the "temple of hands" did not end here rather it became part of a ritualized ceremonial performance generation after generation by Wākea and Papa's royal offspring. Wākea had established the social template for how to petition the ancestral gods to achieve power past what was genealogically ascribed. The ʻaha ceremonies would come to represent the level of sacrifice chiefs were willing to undergo to obtain power and legitimacy amongst the people. Over time, the ʻaha would grow in scale and complexity, creating a much stronger connection between the spirits of the ancestors and gods in the afterlife with the living chiefs in the main Hawaiian Islands. This was accomplished through Nā Moku ʻAha, the islands of the cord that served as a communication pathway between these two worlds.

[78] Pūkuʻi 1983: 174; Pūkuʻi et. al 1972:123; Pūkuʻi and Elbert 1986:211.

Braiding a Cord to Bind Descendants to Ancestors

ʻAha kau i ka moʻo o Hāloa
Set cord in the succession [lineage] of Hāloa (Kamakau 1960)

The ʻaha ceremony was the primary ritual (or set of rituals) of consecrating the heiau and chief from the time of Wākea on. It represented an important development for Hawaiian society in its ability to develop leadership that could coordinate and mobilize people towards a common purpose and effort. Cooperation and integration appear to be defining sociopolitical characteristics of this ritual mechanism as both aliʻi elites and makaʻāinana needed to work together across social classes and between territorial units to accomplish these rituals. The ʻaha was situated within the Hawaiian ritual calendar which was divided into two parts (or seasons) based on climatic variations between wet and dry cycles. According the lunar calendar, four months were appropriated to Makahiki (a time of peace, non-conflict, harvest, redistribution), while eight months were dedicated to Kau wela (a time of governance, competitive growth, industry, production). While Makahiki activities have been of primary focus of much archaeological research, the ethnohistorical record points to Kau wela being an equal if not more important in helping to shape sociopolitical development over time. Both of these seasonal periods were situated within a larger solar calendar from which all dimensions of Hawaiian social life and rituals were calibrated annually. As the sun moved into the northern hemisphere (spring equinox), it marked the beginning of the spring and summer seasons, two important times for resource production, food cultivation, and labor mobilization.

The ʻaha ceremonies started within a window of time typically between May and June (often May 15th – June 21st) at which time the constellation Pleiades (Nā huihui o

Makali‘i) sets at sunrise. During this time the stars known as Regulus and Leo are rising with the morning sun and the Pleiades cannot be seen. Their appearance marked the beginning of the dry season of Kau wela, literally when “the sun (heat) was placed directly overhead” and the days of this period were the longest. It marked an annual time when the sun was moving back into the northern hemisphere (vernal equinoxes) which were ideal times for resource production, food cultivation, and labor mobilization. Preparations on the heiau were done (in the months of March to May) to anticipate the arrival of the sun in this ritual cycle (May through June) (K. Kamakau 1919-20:8). This ritual cycle was important because it represented the culmination of annual events, but also provided the best time to calibrate the annual calendar for the following year. These months from May to June also coincided with the interval for voyaging to the Northwestern Hawaiian Islands, as recalled by some within the modern era (May through August outlined by D.K. Malo 1879-1880 in Johnson and Mahelona 1975: 142). The ‘aha was the most important ritual process in Hawai‘i as it represented a window of time to petition the ancestral gods and reaffirm mana, requiring a great deal of cooperation and cohesion in an otherwise competitive ali‘i social system. This process culminated on the first day of summer called the summer solstice when the sun stood in the sky the longest and passed directly overhead at Mokumanamana.

According to the dictionary, ‘aha is physically described as cordage braided from coconut-husk fiber, human hair, or intestines (Pukui & Elbert 1971: 5; Andrews 2003: 35; Stokes 1906: 147). This type of coconut-husk fiber was known to be very strong when braided together from strings (aho). Buck however considered the Hawaiian usage to encompass twisting as well as braiding, adding that in the rest of Polynesia. He stated,

"the dialectic words forms- ʻaha, ʻafa, and kaha- are usually restricted to coir braid" (Buck 1957: 60-61). The ritual ʻaha referred to a series of prayers or services whose efficacy depended on the recitation under kapu without any interruption or error (Pukui and Elbert 1986: 5). The ʻaha cord metaphorically represented the ritual performance and process as the chiefs would actually consecrate these sennit braids called ʻaha kapu (sacred cords). These series of rituals were very strict requiring the audience to sit without moving for hours on end. No one could interfere with the prayers and if anyone made a sound or moved the offender would be put to death. The ʻaha was essentially a series of petitions to the ancestral gods to save the land from sickness and death, and also rebellion. At various stages of the different aha the priest would question the aliʻi nui whether all the requirements for the ʻaha had been met. It was only if the chief responded affirmatively that the kahuna would affirm the validity of the ʻaha- "the ʻaha was good, and you, your land, the chiefs and all the people shall live" (Kameʻeleihiwa 1992: 37-39). The finalization of the ceremony was the public proclamation that the gods approved of the particular chief and would support him in the face of any rebellion.

This ceremony occurred for each generation where the Wākea's chiefly descendants would have to demonstrate their leadership abilities by successfully completing these arduous set of rituals in order to prove their right to rule. The ritual would be employed in a number of contexts including the passing of inheritance or after the conquest of a rival chief. It would also be done more than once depending on the particular ambition of chiefs who hoped to expand their rule (e.g. Kamehameha). Thus, the twisting coir braided cord was a powerful symbol that evoked the imagery of "binding," "connecting," and "linking" people and ancestors and focusing them in

common purpose- essentially increasing their strength through collective and cohesive action. The cord was the genealogical connection between past, present, and future and reflected the enormous effort of the chief to garner the support needed towards accomplishing these rituals. If the rituals were done in unison and perfection the success of the people would be acknowledged and confirmed from the ancestral gods. As we noted in the last section, the very first ʻaha was established by Wākea while he was in the Northwestern Hawaiian Islands building the temple of fingers and giving new meaning to the sun. This became a re-occurring historical pattern in stories in chiefs efforts to secure the right and authority to rule (i.e., kū i ka moku)[79] from the time of Wākea until the time of Kamehameha I (ca. A.D. 1758-1819). All leaders were tasked on an annual basis to refurbish the heiau and to perform some version of these rites.

The ʻaha aliʻi or "sacred assembly' of chiefs (Pukui and Elbert 1986: 6) played an important role in addressing problems associated with the transformation of Hawaiian society to a more hierarchical structure and social order.[80] This council was "a key group in maintaining the well being of the nation" and was a means of cultivating leadership (Cachola Abad 2000: 159). The ʻaha aliʻi helped sort out distinctions between senior and junior genealogical lines and created a much clearer system of authority and rule. It became a process of determining rank and establishing what kapu (privileges) were associated with those ranks. Established by the chief Haho (G-2; est. A.D. 1225-1330), who was the son of the famous Maui chief Paumakua, the ʻaha aliʻi represented a social

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[79] "Kū i ka moku" represented the authority from the gods to rule. Literally meaning to "stand on the island," it was said that the chief stood on his district or island (Pukui 1983:202).
[80] Fornander states that the ʻaha aliʻi was created at the time of Haho on Hawaii Island. It was marked by genealogical rank and insignias such as ahuʻula (feather capes), palaoa (whales tooth pendants), and canoe sails were painted red and he wore a pennon at the masthead (Fornander 1996: 29).

group of high ranking genealogical peers who had the authority to rule. This rank was entirely dependent upon birth order as genealogies were socially remembered and memorized in order to establish order of succession, formal marriages, and relationships to high chiefs (Handy and Pukui 1998: 197). This entry to the ʻaha aliʻi came with privileges and kapus (restricted privileges) that could not be infringed upon by other chiefs (Fornander 1996: 28-30; Beamer 2008: 64-66). Once fully established on Maui, the ʻaha aliʻi model was adopted across the archipelago and became the standard internal governance structure among the aliʻi class to balance the power of the paramount.

ʻAha rites were incidental to the actual ʻaha kapu or ʻaha ʻula ʻenaʻena (sacred sennit cords) that represented the king's genealogical link to the gods. The symbolic relationship between the high chief and his/her ancestral deities was expressed through this very concept of the braided cord in the term ʻaha kapu (sacred coconut-husk cord), ʻahaʻula kapu (lit. sacred red coconut-husk cord), and ʻaha ʻula kapu ʻenaʻena (fiery sacred red coconut-husk cord) (Desha 2000: 316-319).[81] It was a symbol of the chiefs' mana as they were put on the masts of canoes (Kamakau 1992: 43).[82] In practice, this kapu (restriction) served to distinguish aliʻi (chiefs), especially aliʻi kapu (sacred chiefs of high lineage), from commoners. This segregation for instance was demonstrated by using ropes to demarcate kapu (sacred & restricted) sections of chiefly compounds (Pukui n.d. in HEN; Kamakau 1869 & n.d. b: 102-103; Valerie 1985: 296). As Kamakau

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[81] The descriptive term ʻula refers not only to the red color of the cord but the sacredness and royalty as it relates to the fiery sun.

[82] Kekahuna (n.d. M-445 Religion) gives another definition of ʻaha- n. a small piece of wood, around which was wound a piece of tapa, held in the hand of the priest while offering sacrifices. The wood was made of mamane or kauila wrapped in a dark kapa as a symbol of authority. Also described as a type of prayer and that "ina walaau ke kanaka i ka aha, make no ia" (if a man should make a noise during the prayer, he would die).

explains, "the outer sacred kapu cord was the long twisted rope placed between the kapu sticks outside the chief's house. The inner cord was placed between the kapu signs at the entrance to the chief's house. Only the ruling chief had a right to the sacred cord (n.d.: 37). Pukui and Elbert (1971: 6) also provide a similar description of how the sacred sennit cord belonging to the high chief was kept on a high place before his house; trespassers entering the house were killed if the cord remained in place, but if it fell down and the stranger stepped over it, this was a token of the strangers high rank or kinship with the owner of the cord. Some chiefs had several such cords, each given a name, and some were used after the owner's death in making kā'ai, containers for his bones (Pukui and Elbert 1971: 6).[83]

Over time, the 'aha rituals became more frequent, elaborated, and intensified as the role of the physical cord itself became significant in aspects of divination and a symbol of chiefly power. During the reign of Hawai'i Island high chief, Liloa,[84] (G-13; est. A.D. 1500- 1550) there was a noted transformation of the role of the 'aha cord into one that was called 'aha kapu 'ena'ena- that is a fiery red (sacred) cord [of omens]. The purpose of these cords was not only to confirm, secure, and acknowledge ali'i status and the right to rule, but also to predict and help in divination. In some accounts (Desha 2000: 317), the cord had individual names and also appeared to act on its own volition, having the ability to predict the outcomes of events before they occurred. This 'fiery kapu cord' was set up upon two posts (pou kapu) by high ranking ali'i, set to be straight

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[83] A chant recorded by Kamakau (1960) goes over all the names of the 'aha cords (and ceremonies) done by Hawai'i Island chiefs can be found in Ka Hae Hawaii April 11, 18, and May 2, called "He Mele (A Chant)."

[84] Stokes places Liloa's death at A.D. 1575. Barrerre using a genealogical count of 25 years per generations places Liloa's death at A. D 1475. How this coincides with the settlement dates for Nihoa and Mokumanamana will be discussed in later chapters.

and taut. Questions would be asked of the cord and if it fell, then it gave its consent. This type of inquiry was done later during the time of Kamehameha, when the cord was asked who would fetch his cousin Keoua-kū-ʻahu-ʻula from Kaʻū to be the sacrifice for Puʻu Kohola heiau (Desha 2000: 317-319).

Emory (1986: 106) explains that during the life of a chief, these consecrated ʻaha sennit braids, ʻwould continually be extended and were given names. At the death of the chief these ʻaha were incorporated in their kāʻai. The strands for the kāʻai were obtained from the undoing of the cords from the ʻaha, as they were used to create the caskets that acted as final resting places for the bones of chiefs (Buck 1957: 575-77). These coconut-husk coir fibers where plaited into shape over long bones and skull, encasing them in a torso-like, semi-naturalistic position (Rose 1992: 2). Interestingly, the plaiting of both examples formerly in the Bishop Museum shows signs of radiating patterns (manamana) that "starts at the bottom center and radiates outward in counterclockwise direction to form the flat base, advancing up the sides to terminate at the apex of the skull (i.e. manawa)." Chants tell of famous names for these cords, for instance high paramount chief Liloa of Hawaiʻi Island had a ʻaha cord named ʻKamakilakū,' and in the binding of this kāʻai the lashing cord was renamed ''Ahaʻula.' Liloa's famous son ʻUmi had a cord named ʻKapākiʻio[a]hema' and the lashing cord that secured his kāʻai was renamed ʻNeʻeneihonua.' These are a few examples of the increasing elaboration of the ʻaha, often times extending to all aspects of chiefly religious life. It grew to be a symbolic connection that extended even into death, as the cords from the ʻaha were used to create the kāʻai, a casket for the bones of the dead chiefs that were hidden away in secret burial

caves or placed in a house in the heiau called the hale poki.[85] This dissolution of the sacred cord into the casket helped to carry these chiefs into their spiritual journey into the afterlife in the northwest direction via Nā Moku ʻAha (the Northwestern Hawaiian Islands) onwards into pō (darkness, source) towards deification.

Kapu o Kānehonokapaʻa – Commemorating the Temple of Fingers

Ua kaʻi ka ʻaha, loaʻa kā kākou ʻaha (Pukui and Elbert 1986)
The cord ceremony is led, our prayer is rendered successfully

The series of ʻaha rites culminated in the final ʻaha that represented the "ultimate in ritual discipline"- the kapu o Kāne-hono-ka-paʻa (Kāne-who-unites-the-people) (Ii 1963: 43-44; K. Kamakau 1919-20:26-27; S. Kamakau 1976: 142-144; Pukui et al. 1972b: 125; Thrum 1910: 65-66; Valeries 1985: 318-324). The kapu o Kāne-hono-ka-paʻa represented a ritual focused on "great sacrifice and sacred solemnity" (Thrum 1910: 65-66), marking the final transformation of the chief into the embodiment of godly protector of the nation. The performance ritual was done on "a sacred day dedicated to the god Kāne," who embodied the sun, and honored his ability to hono or "to stitch, sew, mend, patch," essentially join the men together in unison (PE 74).[86] It was a service essentially timed with the sun and that actively included commoners (makaʻāinana) in embodied performances. Participants "needed to hold a particular posture and position with his hands during prayer" (Thrum 65; Kelsey M-86 Heiau). Each person had to sit perfectly still with "his seat firmly fixed, the body in a bending attitude, with the left foot

[85] Also involves the deification process of dead kings- his successor would build a new heiau for the reception of his bones and call it a hale poki. He was enshrined in the heiau as a god (Malo 1951: 105-6).
[86] Hono refers to bay, light, harbor, or lagoon formed by the coming together of lands, particularly elevations. The basic through of hono is that of joining. It also means to mend a net, to patch, or to come together as many men (Kelsey Manuscript M-86 Place names; Pukui et. al 1972: 125)

over the right foot, that being the position for a great length of time. Also, the palm of his left hand is placed over the palm of the right hand."[87] Again, the hands and fingers play a role in linking together this concept of manamana (i.e. manamana lima).[88]

The description of the Kāne-hono-ka-paʻa ritual appears to be a commemorative reenactment of a combined hand gesture originally done by Wākea in the first ʻaha ceremony- or the building of the temple of the hand (i.e., Mokumanamana), a rite dedicated and timed to the sun. By the time of Western contact, temple rituals became very elaborate, strict, the services arduous, and its priests held in the highest rank. The dedication of a luakini heiau occupied from ten to fourteen days of protracted rites of the severest kind, whereas other lower heiau forms required three days if no delays occurred (Thrum 1910: 54). This ritual rigor came to represent a form of investment or behavioral sacrifice that added to the cost of maintaining the heiau (and supporting chiefs). It thus became a form of advertisement- a demonstration of the number of disciplined individuals who could meet the requirements to participate and devote themselves for these lengths of time.

The kapu o Kāne-hono-ka-paʻa began by the king, priest and participants cleansing themselves prior to entering the temple. Once inside, the participants would essentially be arranged in eight rows before the altar, as though sitting in a canoe. The kahuna (na waʻa lālani kahuna) were in rows below the lele, and the hono service participants (nā waʻa lālani hono) were in rows below the anuʻu tower. Their arrangement

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[87] Exact descriptions of the hand gestures tend to vary as it is overlooked by many of the authors as being unimportant. Thrum (1910) and Kamakau (1976) both say that the left hand holds a position over the right hand. Ii (1963: 44) says they had the option of either raising one hand or the other, or both.
[88] Hono ceremony is refered to as kapu o Kānehonohokapaʻa, when every man must hold hands in a particular posture (Kelsey M-86 Heiau).

takes the form of rays that eradiated from the hale mana (mana house) towards each of the images in the heiau (Figure 3.5) (Kamakau 1976: 142; Thrum 1910: 65).

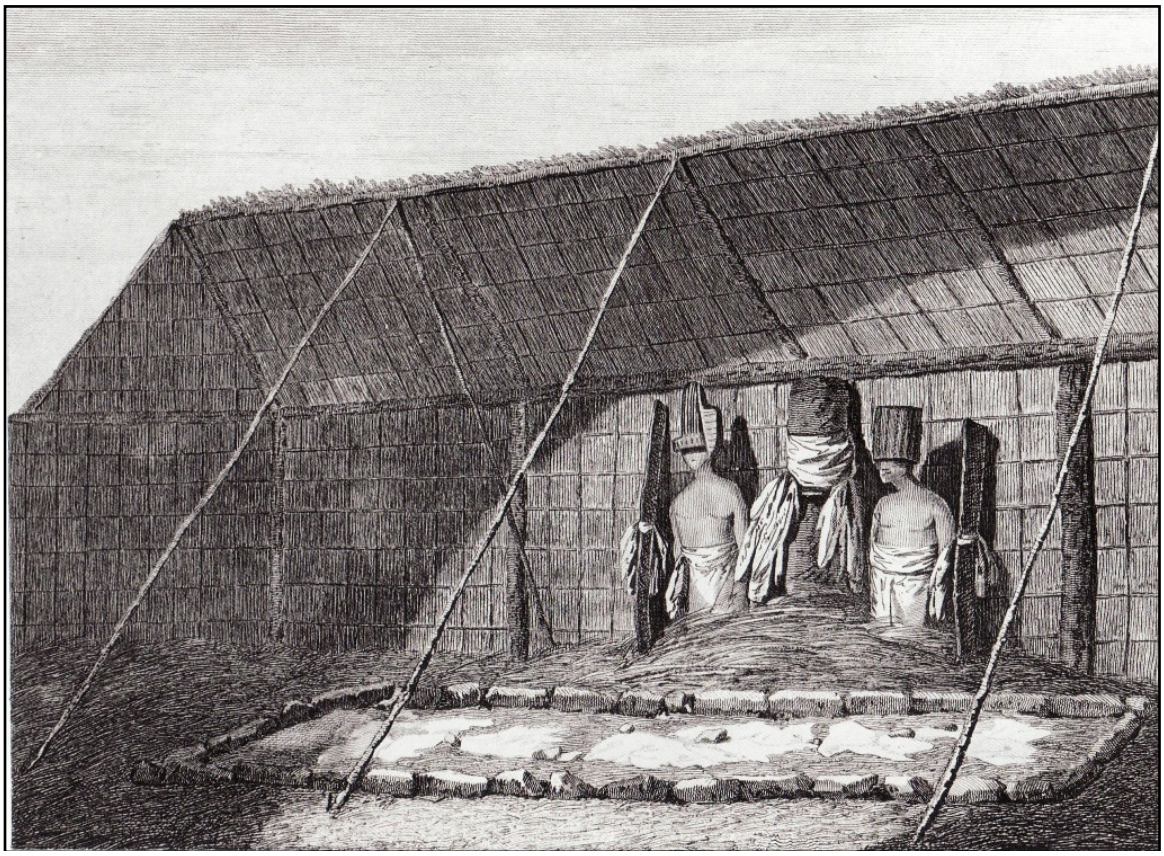

Figure 3.5. Drawings of Hale Mana by John Webber, from Cook and King 1784. Show sthe interior of the Hale Mana and the principle images. It is noted that the graves of seven chiefs lay entombed in the front.

The priest would then say “"remain quiet, all of you. Do not make a noise. Do not move. Steady your posture. Make the knees uniform and keep your seats down, so the deity may be favorably impressed” (Ii 1963: 43-44; K. Kamakau 1919-20: 26). The description of the hand position is left hand over right hand and is called ne‘epu. A later description shows the position as “i ke kuhi lima i ke kunou po‘o”, meaning that they

were using their hands in a pointing manner (perhaps referring to the left hand coming to a point in the cupped right hand) and had a bowed head (Kamakau 1976:143) as a expression of embodied memory. He would then give the direction "O hoaka o ka lima aia iluna" or "place the palm of the hand, and turn it upward."[89]

Throughout the ritual, each person sat perfectly still as the punishment for movement or noise was to be death. The focus of the ceremony was on the Hale Mana and the principal idol the Mōʻī. All of the outside images on the kukalepa were faced in a semicircle towards the Hale Mana, while all the participants sat in rows directed to it; also in the later intervals of pre-contact history the heads of the sacrifices at the lele also was directed there. They would make the following chant:

E Kū, e Kūnuiākea, e Lononuiākea, e Kānenuiākea me Kanaloa	O Kū, O Kū-nui-ākea, O Lono-nui-ākea, O Kāne-nui-ākea, and Kanaloa
Eia ka ʻalana, ka mōhai, he ʻahu koʻokea, he palaoa pae	Here is a gift, a sacrifice, a cape of white tail feathers,
He kipiʻāina, he lawe ʻāina	a whale ivory cast ashore
E mōlia aku i kipi o waho me loko	A rebel, a grabber of land
I ke kunou poʻo me ke kuhilima	Curse the rebels outside and inside,
A i ka laweʻāina hoʻi	Who with bowed head and pointing finger,
E ola iaʻu, i ka pouhana o ke aupuni	plot to take the land
A me nā liʻi a pau, i ka hū, i ka makaʻāinana,	Grant life to me, the ridgepost of the government
I ke aupuni mai ʻō a ʻō,	And to all the chiefs, to the masses, to the people
Amama, ua noa	To the domain, from one end to another.
Lele wale aku lā hoʻi	The prayer is lifted, it is free
	The prayer has gone on its way.

[89] John Keola Lake states: "In Hawaiian circles they only used an open hand in several instances. When there is a ritual that calls upon Kū, when priests are convening . . . and asking for the powers above. That is the only time the hand gesture is done with the hand facing up, [*huli ka lima i lalo, hana ka poʻe, o hana ka noke*], when the hand is turned downwards, he is prepared to work. When the hand is turned upwards, he rests, he has nothing to do. So it would be very un-Hawaiian for him to greet people beckoning with the hand up. To beckon is with the hand down. This gesture is offensive. Hawaiians would never greet people the way the sculpture is gesturing. That is an expression between the *aliʻi* and his god." (Lake in Wharton 2011: 28; brackets are corrections by the author of what might have been intended by the obvious errors in Hawaiian transcription-"the hands are flipped downward, the people work, or else the work persists.").

The earliest versions of the ʻaha (from the time of Wākea) required only a single rite, however by the time of European contact the ʻaha rites had expanded to 9 elaborate rituals (Valeri 1985: 334). These rituals were designed to sort through and test the leadership abilities of the growing base of high chiefs all of whom could make genealogical claims to power. Hence it became part of the "achievement" basis to power. Through this consecration process the primary deity (which was typically Kū in later times, but could have been other gods prior) was established as the ancestral guardian relegated to protecting the sovereignty of the government.[90] This concept of a supreme ruler was given the term "mōʻī" and was solely designated to the principal heiau image in the Hale Mana (i.e., as a vessel for the godly protector of the nation). This term evolves as the aliʻi nui becomes the living embodiment this guardian and eventually synonymous with the western term "king" in the Kingdom period.[91] The aliʻi was compared to the ridge post (pouhana) that holds up the house (i.e. the government and nation). Successfully completing the ʻaha was a difficult and challenging task that required enormous investments and sacrifices. In some cases the chiefs spent their entire lifetime attempting to achieve this elusive goal without ever accomplishing it. It represented the legitimization of their mana and the authority from the ancestral gods to rule, or "kū i ka moku."

The ʻaha evolved from single ritual to a series of arduous rituals formally institutionalized within a temple system. Through time, the frequency of the ʻaha

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[90] Kamakau (1976: 135) states that the concept of mōʻī as a living chief is develop much later than Wākea's period, closer to the time of Keoloewanui-a-kamauaua a contemporary of Hakalanileo.

[91] Stokes (1932: 1-10) says the word moʻī is of recent origin, however it is only the application of the term as a correlate to "king" that is recent. Beamer (2008: 58) says it is a concept that originates from the time of Haho and the ʻaha aliʻi, but it exists prior to this very early on from the time of Wākea in the chants regarding heiau.

increased and intensified eventually influencing of all aspects of social life both directly and indirectly (i.e., ritualization). Hawaiian religion and ritual power became the primary mechanism to establish chiefly leadership, one that became widely practiced throughout the archipelago. It represented the integration and sequencing of ritual timing on all the main Hawaiian Islands as the sun progressed incrementally northward to Hawaii, Maui, Kahoolawe, Molokai and Lāna‘i, O‘ahu, Kaua‘i and Ni‘ihau, Nihoa, finally culminating at its climax at Mokumanamana- the island temple (Figure 3.6).[92]

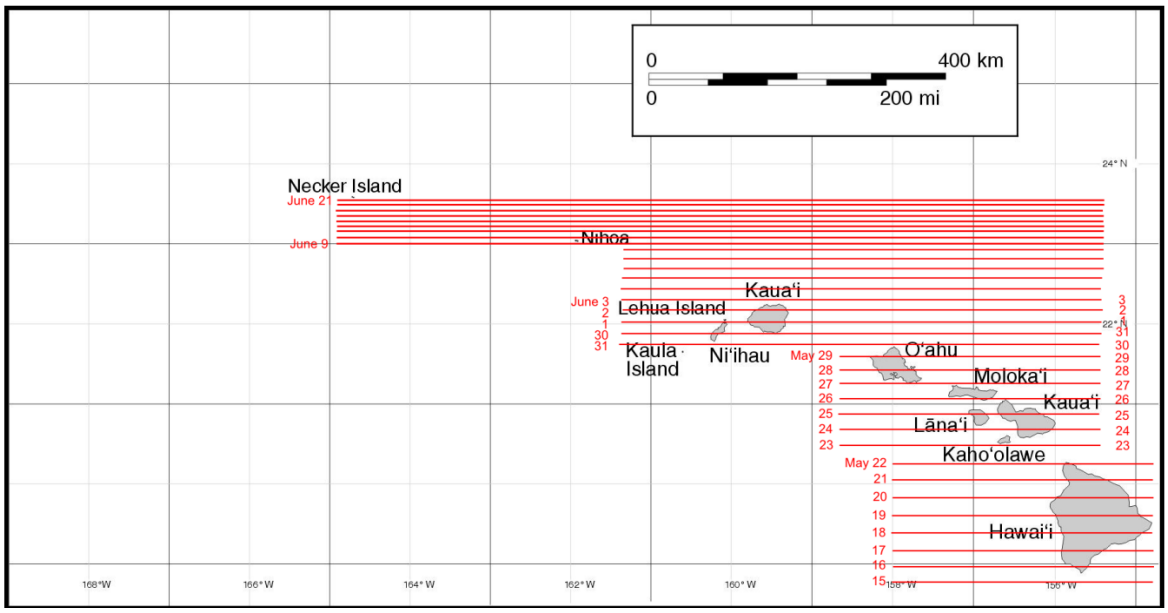

Figure 3.6 The Latitudinal Path of the Sun as it Moves into the Northern Hemisphere (generally from May 15-June 21st). These are the approximate dates the sun reaches zenith overhead for each island, as it moves its way north culminating at Mokumanamana on the Summer Solstice. Notice that the latitudinal degrees get incrementally smaller as the sun moves more north giving the appearance of slowing down and eventually standing still.

[92] The sun also reaches its zenith on the journey southward after reaching the solstice. The estimated dates for its zenith southward are as follows: Kaua‘i (July 11-14), O‘ahu (July 15-18), Molokai (July 19), Maui (July 20-22), Hawai‘i (July 23-29) (Bryan 1955).

The extent to which these ritual practices crossed seemingly divided socio-political boundaries and distances of open-ocean demonstrated that this was clearly a state-wide effort towards religious formation and a unified Hawaiian belief system in pre-contact times. The idea that these competing chiefdoms were ultimately linked to a common ancestor and the important historical event concerning the formation of ritual power (i.e. creation of hoʻomanamana) was reinforced with each annual performance and commemoration. The timing and sequential nature of this process suggests that all chiefdoms in the main islands had a vested interest in this ʻaha process and the culmination of the event at Mokumanamana. This long and difficult journey might have been the ultimate determinant of how far high chiefs would go to legitimize their rank, authority, and power. With this understanding, chiefs from the most eastern islands (Maui and Hawaiʻi) had the most difficult time to gain access to this island, but also had the most to gain as knowledge of seasons and the environment could greatly enhance their ability to produce resources and support their growing population base.

The Triumph of Wākea- A Mythological Reoccurrence

The traditional account of Wākea taking control of the sovereignty of the Hawaiian Islands from Kaneiākumuhonua is part of a mytho-praxis historical reoccurrence patterned from the earlier myth of Laʻilaʻi and Kiʻi, who were introduced to us in the Kumulipo at the dawn of man. This inference is based on the appearance of four main characters (Haumea, Wakea, Kāne, and Kanaloa) that represent the same four mythical protagonists introduced in the last chapter in the beginning of ao (Laʻilaʻi, Kiʻi, Kāne, and Kanaloa). It was not coincidence then that Mokumanamana which represented the original location outlined in the dawn of man, was the same location that Wākea

chose to strategically build his island temple. Informed from the past, he builds his ritual system on the pre-existing pathway of power to the west. The account of Wākea furthers the lessons of the cosmogonic period concerning: (1) the law of primogeniture (i.e. first born sons are given the right to rule) with mechanisms developed for establishing leadership amongst a growing base of elites; 2) pi‘o mating with elites reserving for themselves the right to practice marriage of siblings and half siblings and royal endogamy; and 3) kapu becomes firmly established as a set of strict sanction that heightened the divine nature of chiefs and added an element of secrecy and protection of sacred knowledge concerning celestial patterns and predictive forecasting of nature. During this period, the use of anthropomorphic images to control gods (i.e. ki‘i) evolved past individual ritual practices to permeate all aspects of sociopolitical development through the formalized ritual system occurring on all islands.

Primogeniture continued to play a primary role in determining rank, status, and power in Hawaiian society through ascribed birthright given to elder senior males. The ‘aha however became the primary mechanism that evolved out of response to this growing base of chiefs competing within a single stratified class. It became a means to help determine leadership through the ritual system. Together, both Kāneiākumuhonua and Wākea represent the continual cycle of struggle between senior and junior lines within the same family branch. In this account however, Kāneiakumuhonua becomes appropriated as a representation of the god Kāne, while Wākea takes on the mortal form of Ki‘i. The outcomes of this story teach us that any junior line (i.e., Wākea) is able to usurp the senior line of elites through successfully completing ‘aha ceremonies and obtaining ritual power. This is why paramount chiefs would be careful of junior chiefs

building luakini heiau because it was a sign of rebellion as they were seeking confirmation to usurp the existing ruling structure. In this historical reoccurrence, once the ʻaha was achieved, warfare and aggression became the primary means to defeat Kāne (again), and eventually his younger brother Līhauʻula, the priest line, who posed a viable threat to his title.[93] Through these actions, Wākea secured his spot as supreme and his genealogy was established as the new order for Hawaiʻi.

Royal endogamy became re-established as a practice of sibling and half-sibling marriages during this period. This was an important transition towards chiefs and commoners separating into individual endogamous classes. Rank, status, and power was reified through this practice as the chiefs continued to climb closer and closer towards divine status. Kamakau (1964: 4) states "the sister marrying her brother, and the brother his sister, this wondrous marriage (hoʻāo) of theirs was called hoʻāo piʻo, an arched marriage… the children born of these were gods, fire, heat, and raging blazes, and they conversed with chiefs and retainers only at night." Chiefs began to understand the power of these marriage practices and as a result a greater range of elite mating practices emerged for collateral genealogical lines to merge back into the senior line including: the "arching back" (piʼo), "the return" (hoʼi), "the curving" (naha) of midribs of coconut leaves (nīʻau) onto each other (Davenport 1994:48). During the period of Wākea, Haumea (who represented Laʻilaʻi) re-introduces these concepts of moe piʻo (incest

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[93] Wakea defeats his brother Lihauʻula in battle after he plots to rebel against him despite warnings he should not do so. This defeat of his brother represents a temporary split between the chief and priestly lines. Kamakau states "…in the settling down of (hoʻonohonoho) of the ancestors after Wākea and his wife Papa, the kahuna orders were made separate, to be over the familes. The separation began with the priesthood order of Lihauʻula, the first child of Kahikoluamea and older brother of Wākea. This order, the papa kahuna pule, was the first to be selected out (Wae) and so the kahuna orders were kept separate throughout the entire race in the following generations" (Kamakau 1964: 4).

mating).[94] In fact, prior to this generation there is only one other example of moe pi‘o of at the generation of their parents who were also half-siblings. Through their mating, Haumea and Wākea produced only daughter (instead of a son), and her name was Ho‘ohōkūkalani (w).[95] In need of a first born son, Haumea then mated with Kanaloa-akua and had a son Kū-kaua-kahi (k) creating a problematic scenario for Wākea as his offspring who would effectively lose rights of primogeniture.

In order to protect his legacy and to create viable offspring who could be a legitimate heir to his rule, Wākea finds himself in a situation where his only option is to moe pi‘o with his daughter, Ho‘ohōkūkalani (w). Based on the historical patterns that occurred prior at the dawn of man, Wākea knew that his future offspring were now on a trajectory to become the junior line. In order to avoid this, he attempts to conceive out of necessity a first born son through his daughter. This father-daughter relationship was exposed as Wākea secretly went out to have this affair on certain nights as she reached adulthood. A moe pi‘o was the only type of mating that could raise (or figuratively “arch”) the genealogy of offspring above that of either parent, giving them divine status (Kepelino in Beckwith 1932: 195-198; Kamakau 1870). Ho‘o-hōkū-ka-lani (w) mated upwards with her father and gave birth to two sons, first to Hāloa-naka-lau-kapa-lili (lit. the long breath in the quivering leaf) a premature child who was planted and emerged the first kalo plant (*Colocasia esculata*) an important staple crop for the people. The second son, also named Hāloa (lit. the long breath) survived and became the direct ancestor for all Hawaiian people. The Haumea- Kanaloa-akua line eventually bears no more sons, and

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[94] This moe pi‘o represents the first incest mating since the time of La‘ila‘i and Ki‘i, the first woman and man to emerge out of pō in the chant Kumulipo.
[95] Wākea and Papa have a daughter, Ho‘ohōkūkalani (w) whose name means the “starring of heaven.”

only daughters. Thus, Hāloa is established as the senior line of Hawai‘i. This becomes a standard practice of divinity amongst elites, and further refining man's ability to conceive godly children, who become god like chiefs.

Finally, the last important innovation that arose during this period was the establishment of restrictions and laws called kapu wela or 'fiery divine sanctions.'[96] Since Wākea was forced to defeat and kill his rival priestly brother who held the knowledge of stars, he rebuilt and refined the system of tracking celestial time through his relationship with his daughter (who was a metaphor for the stars). As a result he established lunar months and anahulu (weeks comprised of 10 days) and created kapu nights dedicated to four main principal gods (Kamakau 1976: 13-18; Kepelino in Beckwith 1932: 22-23; Malo 1951: 32-33). These four main official state gods- Kanaloa, Kāne, Lono, and Kū organized calendrical time and space into finer units. It became part of the ritualization that influenced all aspects of social life. The 'kapu system' (which it becomes commonly termed) not only created a further distinction between 'ali‘i and maka‘āinana,[97] it also outlined important gender distinctions between men and women,[98] as certain foods became kapu for women to eat such as the pig, shark, ulua fish, redfish, most banana varieties, yellow coconuts, and certain dark and pink poi (i.e., 'ai kapu- sacred eating). Also there was a separation of sleeping between men and women on

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[96] Beckwith (1951: 47) states: "Life on earth is engendered by the heat of the sun. As the sun symbolizes procreative power whence life proceeds, whose source is the god of generation in the spirit world, so a chief descended from the god and "hot with fiercest taboo" carries on through procreation to ensure the continuity of the family lines.

[97] Kamakau (1964) states "the first laws were made to establish the ritual periods (kapu) of the year. These days, kapu to the gods were established in the time of Wākea, and they were very sacred days. At the time of Luhaukapawa, the first prophet, and the priestly order of Lihau‘ula, and in the time of the later prophets, the laws of the kapu days became very strict and enforced."

[98] For individuals it referred mainly to eating restrictions of 'aumakua (Kamakau 1964: 89).

certain nights (Kameelehiwa 1992: 33-34; Kamakau 1964: 65). Kapu wela or "fiery divine sanctions" were chiefly attributes that derived its symbolic meaning from the sun as powerful solar body that subjected and regulated all aspects of life (i.e. space, materials, food, and even the chiefs' bodies) to complex set of prescriptions and prohibitions that was designed to protect and enhance their mana. These sanctions and laws represented some of the earliest origins of Hawaiian social stratification as these social norms were created to protect and elevate mana of the chiefs towards a divine status.[99]

Rise of the Divine Priest Chief

Ke li‘i o Hāloa, ke kahuna nui o Hāloa (Kepelino in Beckwith 1932: 62)
Hāloa is the chief, Hāloa is the high priest

The priesthood or kahuna were experts of specialized sacred knowledge in traditional times, and the elaboration of their power was unique to Hawai‘i that went beyond Polynesian counterparts (Handy 1927; Kirch 2010). The chiefs and priests became intertwined within this ritual system of power as leaders evolved to have the attributes of both classes. Hāloa (k) who was the son born of Wākea and Ho‘ohōkūkalani becomes the first priest chief in history. After his birth, Haumea (Papa) exacted her revenge on Wākea for mating with Ho‘ohōkūkalani by being reborn into the next six generations of female offspring from the Kanaloa-akua line first through Kauahulihonua

[99] Note the 1819 abolition of the "kapu system" (‘ainoa or free eating) in the time of Ka‘ahumanu, refers to her convincing Kamehameha I's successor and son Liholiho to agree to abolish the traditional norms of separation of eating between men and women. This also leads to the destruction of the temples. It should be noted however that Liholiho fails twice to achieve his ‘aha to successfully petition the ancestral gods for the right to rule, showing his own spiritual disqualification for power. This eventually leads to this demise and breaking of the kapu (Kameeleihiwa 1992: 76). This failure set off the chain of historical events that led to a shift towards Christianity as a new means to legitimize this rule.

(w). The next five generations of daughters mate with her grandson, Hāloa and his descendants taking the form of, Hina-mano-ulu-aʻe (w), Huhune (w), Hau-nuʻu (w), Hau-lani (w), Hi-ko-puanea (w).[100] Incredibly, this moe piʻo continues to bend the family genealogy upwards elevating their descendants to a level of divine chiefly status (Kalakaua in Beckwith 1951: 232- lines 1765-1771; 236- lines 1948-1957.). The continuity of genealogical lines from Kiʻi (k) to Wakea to Haloa, finally closes some generations later with the birth of a second Kiʻi (k).[101] This marked the closing of the cosmogonic period and mythical cycle of the first man in his effort to establish dominance over the gods.

Kepelino (Beckwith 1932: 62) noted that Hāloa was the first priest-chief of Hawaiʻi as he had descended from both the branches of chiefs and the branches of priests. His birth marked an important transition to a new type of ruler, as Hāloa became the archetype for all later chiefs to emulate in order to achieve mana and chiefly success. He represented the first born Hawaiian man and there is a saying "ʻiliʻili o Hāloa," referring to how all the chiefs genealogies were descended from Hāloa and ultimately descended from gods. The ʻiliʻili (stone pavement) therefore represented a new foundation based on the alliance and merging of two aforementioned genealogical lines- Ololo (chief's lines) and Palikū (supernatural kahuna) genealogies. Kepelino says "it was at that time that the chiefs became chiefs with divine tapus and were regarded as gods. Hence the power of this class of chiefs increased because they assumed three characteristics- of a god, of a

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[100] In my Hūlili article (Kikiloi 2011) I made an error of one generation for the reincarnations of Haumea, stating that it started with Hinamanouluaʻe (w) and ended with Kamole (w). This error is corrected here to accurately reflect it started with Kauahulihonua (w) and ends with Hikopuanea (w).

[101] Kiʻi (k) and Hina koʻula (Hina-the sacred red) give birth to the twins Nanaulu and Ulu, which marks the major genealogical break that separates Kauai-Oʻahu genealogies from Maui-Hawaiʻi ones. This marks the end of the cosmogonic period and the completion of the Kiʻi mythical cycle.

kahuna, of a chief- in the one chief class." (Kepelino in Beckwith 1932:66). This concept of the divine priest chief becomes a prevalent theme in Hawaiian mo‘olelo as a template for political success from this period until the time of Kamehameha, and well into the time of the Kingdom (post-contact). This new type of leadership integrates sacred ritual power into all aspects of chiefly governance.

Discussion

This chapter demonstrates the important role that ritual power and religious ideology played in the practice and service of the state. Ritual power took on a pervasive role in society with the formation of an institutionalized temple system, with the rising role of priest specialists who managed sacred knowledge. It helped to create an ideological system that was synchronized with the annual cycle of the sun which shapes all aspects of Hawaiian social life. Through an analysis of oral traditions and other Hawaiian accounts it is established that Mokumanamana was conceived as a primary ritual center from which the state sponsored ho‘omanamana religion emerged. The historical events that took place in this period created the foundation for pre-contact Hawaiian history that is rich with stories of chiefly political alliances, marriages, times of peace and prosperity, warfare and aggression, as well as revolution. Throughout all of this the elite descendants of Wākea attempt to link back to these original stories of their forefathers through ritual form and reenactment that strengthened a sense of group identity between chiefs derived from a sole familial line. The ‘aha ceremonies were a celebrated annual commemoration of this ancient myth of their forefather and the building of a ‘temple of fingers’ on the path of the sun during solstice. This ceremonial commemoration went along with the actual physical rebuilding re-consecration of all the

heiau temples in the process of kūkulu hou. This ritually rebuilding happened at a local level at all heiau temple sites strategically placed throughout the main archipelago. The "rebuilding" also ritually embodied in performances involving hand gestures-representing mana, or manamana in all of its meanings commemorating the original historical event that took place at Mokumanamana that help turn the political tide in favor for Wākea and his descendants. This religious system was a ritual cycle that occurred across all main Hawaiian Islands and culminated at Mokumanamana where the sun stood still straight overhead in the sky on one day of the year. The role of ritual power associated with the Northwestern Hawaiian Islands was linked to both the political process of receiving mana (i.e. authority and consecration), but also for successfully predicting the seasons of the year, the timing of weather, harvests, and the overall annual cycle.

The major emphasis of all of this effort was to establish this ʻaha process as a connective "braid" that linked descendants to ancestors and determined which aliʻi had the qualities to rule. It was a mechanism of ramify leaders as a response to a growing pool of intra competitive elite class. Over time, the ʻaha ritual accelerated the sociopolitical development of the chiefdoms through: (1) temple construction and reconstruction; (2) in organization, integration, and synchronization of rituals with the migration of the sun; (3) in elaboration and intensification of ritual performances; and (4) in growing amounts and types of offerings and sacrifices (ranging from food offerings, to investments of labor, and even human sacrifices). The ʻaha became an integrated set of ritual principles that binded chiefs, commoners, and ancestral gods together. Wākea was an important historical figure that re-established dominance over the gods by successfully

completing the first ʻaha and l securing confirmation to rule. He took the basic ideas of Hawaiian religion and amplified it by building his monumental island temple on the same central sacred space outlined in the Hawaiian cosmology as the axis between life and afterlife. He also successfully won the right of primogeniture through re-establishing moe piʻo and having his son Hāloa emerge as the senior line. This represented a creative restructuring of the original mythical stories and its ideals leading to major transformations in Hawaiian society and religion. These important narratives help to provide context as to why our people went to such great lengths to voyage and build up Mokumanamana. This island represented the ability for the nation to thrive through communication and petition to their ancestral spirits and gods.

These are the religious ideological and cultural underpinnings from which emerged people of a single identity – lāhui (i.e., people, nation; literally one people under the sun). Through time, there are other important transformations that occur regarding the ʻaha. The ethno-historical record suggests that the time from approximately A.D. 1225-1330 the ʻaha became more important with the establishment of the ʻaha aliʻi in response to a greater number of chiefs ramified through the genealogies. The intensification of the ʻaha rituals begins about A.D. 1500-1550 with the evolution of these practices extending into aspects of divination and eventually becomes incorporated into the burial practices of chiefs. A majority of these accounts come from Maui and Hawaiʻi islands which were positioned farthest from Mokumanamana. This further supports the notion that all the chiefdoms had equal vested interest in this process. These accounts provide the framework for understand the nature of ritual power and how these islands were sustained by chiefdoms in the main Hawaiian Islands. In the next chapters, voyaging

studies, as well as archaeology will be used to understand the following: (1) the role voyaging played in shaping the settlement of these islands; (2) the timing of ritual organization on Mokumanamana; (3) the labor invested in ritual use of both islands; (4) the sustained and recurrent use of these islands which happened apparently throughout prehistory.

CHAPTER 4

VOYAGING EXPANSION OF HAWAIIAN MARITIME CHIEFDOMS

Voyaging was an ancient form of socio-political power that required constant investments and maintenance that derived from an ancestral Polynesian framework for chiefly authority. The maritime expansion voyaging and colonization to Nihoa and Mokumanamana islands reflect an important dimension of mobility in the development of chiefdoms in the main Hawaiian Islands. These islands represented the elites' growing interest in maintaining a connection with the west, as part of their ideological and spiritual beliefs concerning paths to chiefly power. The Northwestern Hawaiian Islands were some of the most marginal landfalls in the Hawaiian Islands and today they provide unique conditions for examining patterns of voyaging persistence and abandonment after the initial archipelago colonization. There are few archipelagos in Oceania with this particular configuration and arrangement of islands to look at the issues of maritime expansion. These ancient voyages towards the northwest were undoubtedly difficult to sustain because the distance between islands in the chain grew progressively greater moving toward the northwest. Also landfall size and profile diminished, and weather patterns varied in important ways. All of these considerations are biogeographical indicators of island marginality across two dimensions: accessibility and isolation. Accessibility refers to the relative ease (or difficulty) in which to sail to and from the island, while isolation refers to a condition that is a function of the population size, land area, and distance to the nearest neighbor (Irwin 1992, 1998, 2000; Di Piazza et al. 2007). Irwin (1992:176) states that there is an "unambiguous extinction line," that occurs when advancing into scenarios of increasing inaccessibility and isolation. Extinction risk

and death were therefore valid concerns for travelers who could be lost at sea or stranded in the Northwestern Hawaiian Islands in the process of exploring and colonizing this remote region of the archipelago.

Nihoa and Mokumanamana fall within a category of islands that appeared to be abandoned at the time of European contact and were subsequently termed the "mystery Islands" (Bellwood; Kirch 1988). The Mystery Islands are among the last places studied for evidence of island colonization in Oceania, despite being a major area of focus for recent studies in archaeology and voyaging research (Di Piazza and Pearthree 2001a, 2001b, 2004, 2007; Anderson 1980, 2001a; Anderson and White 2002; Anderson and O'Reagan 2000; Anderson et. al 2002; Weisler 1994, 1996, 2004; Weisler and Green 2001). There are at least 25 islands at the biogeographical margins of Polynesia that have records of prehistoric occupation, but were uninhabited at the time when Europeans first arrived (Bellwood 1978: 109-110; Kirch 1984: 89-92, 1988; Irwin 1992: 174-182). Examples include isolated high volcanic islands such as Pitcairn, Raoul, Norfolk, Nihoa and Mokumanamana (Necker); as well as atolls such as Washington, Fanning (Tabuaeran), Howland, Christmas (Kiribati), Malden, Palmerston, and Suwarrow; and the elevated limestone island of Henderson. Additionally, Rapanui (Easter Island) has been discussed in the same context of population collapse, never having fully gone extinct but coming close. The "mystery islands' are often framed within a paradigm identifying low accessibility, high isolation, and low resource abundance as recurring conditions that ultimately dictate the success or failure of island colonization. These marginal landfalls are often cast as fragile and vulnerable environments (precarious and rugged terrain, sparse seasonal rainfall, highly weathered soils, low diversity of terrestrial and marine

biota) where humans have failed to create a stable niche (Di Piazza and Pearthree 2004: 98). One implication of this last conclusion is these islands were never key settings in the colonization of Oceania.

The Mystery Islands such as Mokumanamana and Nihoa however, provide perhaps the most critical setting for both archaeology and voyaging studies to examine the analytical intricacies of the colonization process as it relates to the marginal limits of oceanic settlement and the increasing need for two-way voyaging. Maritime perspectives and navigational theories of settlement have the ability to give structure to the plausibility of potential scenarios for interpreting ethno-historical and archaeological evidence. These types of perspectives have previously been ignored because it had been assumed that all forms of long-distance voyaging diminished with the contraction and lines of communication within Eastern Polynesia and localized interaction spheres at approximately. A.D. 1400. This resulted in the abandonment of long distance voyaging networks and redirected human focus and investments into terrestrial expansion and productivity. In this case however, long-distance voyaging must have continued to some extent across the Hawaiian archipelago in order for Mokumanamana to be established and maintained as a center of ritual power. The crucial role this island played in calibrating the annual calendar and setting the ritual cycle of the entire religious system relied upon substantial maritime investment. The purpose of this chapter is to transition from the cosmological orientations towards physical considerations regarding island colonization and settlement. This section will focus on navigational, geographical, and social circumstances that arise when trying to sail to and from the Northwestern Hawaiian Islands. Islands offer different conditions for the colonization and settlement

according to a range of variables. This allows us to generate higher order generalizations and models and colonization strategies. These include circumstances for ocean voyaging that include climate patterns, length of ocean passages, relative accessibility of islands as targets in the ocean, degrees of island centrality of isolation, and well as canoe performance. These are considerations that must have been taken into account both initially and recurrently in the process of island colonization.

Modeling Island Exploration, Colonization, and Establishment

The Hawaiian archipelago offers the opportunity for examining social adaptations associated with island colonization according to a range of geographic and environmental variables (Table 4.1).

The uniformity and sequencing of different life stages of the Hawaiian Islands moving east to west generally represent the broad range of environmental diversity and habitats amongst remote Oceanic Islands. Large high islands that are located to the east are geologically diverse and rich in resources for settlement. This main Hawaiian group has important windward/leeward distinctions in rainfall, deep valleys with alluvial soils, fringing reefs or barrier reefs offshore. The smaller low islands and atolls are located to the west and are less diverse and relatively impoverished with regards to terrestrial resources. These islands are near sea level, with coral reefs and short of good soil and water. Some of them have extreme habitats that of atolls where the reef encloses a lagoon without a central island. Along it are islets and sand rarely more than a few meters above sea level, but some people have lived successfully on these island for 2000 years or more (Irwin 1992: 194). These islands occur alone or in groups, and the more distant and isolated they became with diminishing size and elevation, then the natural

Table 4.1. Hawaiian Island Variables of Land Area, Seascape Area, Elevation, Degree of Isolation, and Classes of Colonization Success

Island (E to W)	Land Area (km^2)	Seascape Area (km^2)	Elevation (m)	Isolation (km) *	Island Class	Possible Outcomes
Hawaii	10432	24166	4205	155	Parent Community	Settlement
Maui	1886	5106	3055	155	Parent Community	Settlement
Kahoolawe	115	3108	450	27	Remote Community	Settlement
Lanai	365	1296	1027	56	Parent Community	Settlement
Molokai	675	3944	1460	78	Parent Community	Settlement
Oahu	1547	23027	960	173	Parent Community	Settlement
Kauai	1438	15662	1579	173	Parent Community	Settlement
Niihau	186	34112	390	63	Remote Community	Settlement
Nihoa	0.69	56970	244	222	Satellite	Extinction, Abandonment or Use
Mokumanamana	0.19	53906	84	158	Isolate	Extinction, Abandonment or Use
French Frigate	0.38	43505	2	224	Isolate	Avoidance
Gardner	0.02	56218	57	224	Isolate	Avoidance
Maro Reef	0	44036	0	--	--	--
Laysan	3.57	32331	12	620	Isolate	Avoidance
Lisianski	1.48	53031	12	226	Isolate	Avoidance
Pearl and Hermes	0.39	47186	3	155	Isolate	Avoidance
Midway	5.92	16884	4	1868	Isolate	Avoidance
Kure	0.87	6361	6	95	Isolate	Avoidance

*Isolation is measured by the distance to the nearest island with an area equal to or at least 75% of the home island (adapted from Rollet 2002).

flora and fauna became impoverished, but the marine food has remained abundant where there are reefs. These environmental and geographic variables affect the circumstances for ocean voyaging regarding climate, the length of ocean passages, the relative accessibility of islands as targets in the ocean, degrees of island centrality or isolation (Irwin 2000).

In regards to the process of island colonization, Graves and Addison (1995) developed an important conceptual model that highlighted differences regarding the timing and stages of how islands in remote Oceania (including Hawai‘i) came to be discovered and settled. They demonstrate that island colonization encompasses three temporally distinct components: (1) discovery, (2) colonization, and (3) establishment. They argue that most islands in an archipelago were likely discovered at about the same time, but not all of them would necessarily have necessarily undergone the next stages of colonization and establishment at the same, or in some cases at all (Keegan and Diamond 1987). In Hawai‘i, for instance the island of Lāna‘i and Kaho‘olawe were located near Moloka‘i and Maui, but both oral traditions and archaeological evidence suggest that the populations on these islands were established well after the discovery of the archipelago. In this study I adapted this conceptual model to include the varied scenarios and outcomes that are encountered when dealing with the Mystery Islands (Di Piazza 2001a). I do so by breaking the establishment phase into four outcomes or events. These include: (a) extinction, (b) abandonment, (c) occupation, and (d) settlement. These four additional strategies come into effect in the establishment (i.e. post-colonization) stage and outline a larger framework for the model by providing a broader range of outcomes that can result from this three-tier process. Overall this adapted conceptual model helps to account for

all forms of islands in remote Oceania and the process they undergo in regards to island colonization.

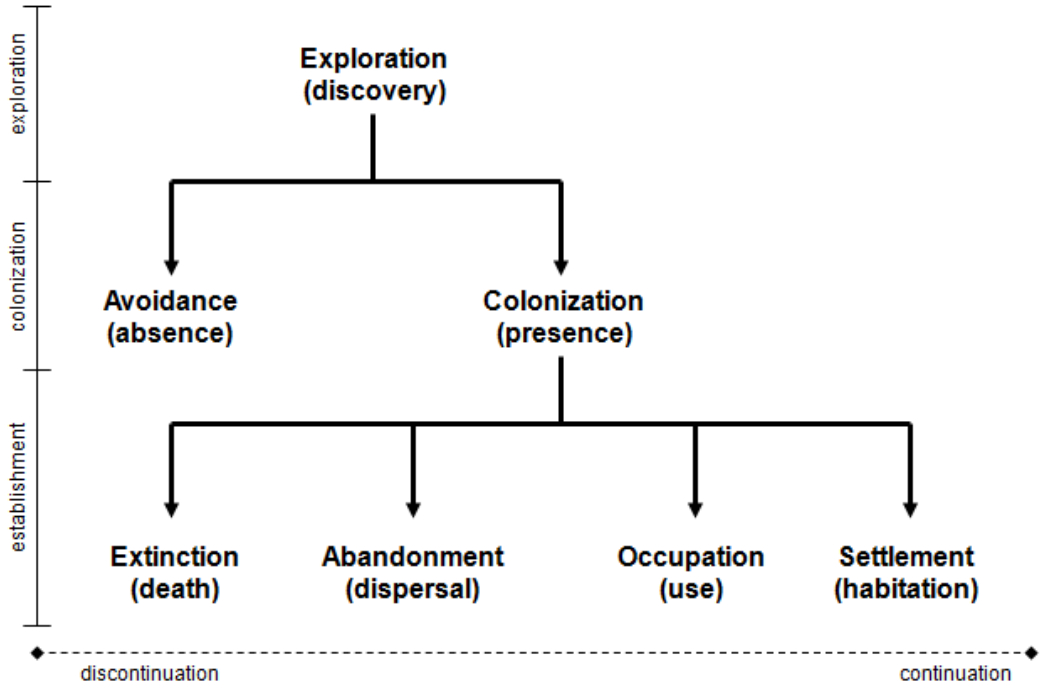

Figure 4.1. Model of Island Colonization Process in Stages of Exploration, Colonization, and Establishment. Each phase has possible outcomes that are shaped by islands dimensions of accessibility and isolation (adapted from Graves & Addison 1995).

Exploration and discovery represent the first stage of the island colonization process, defined as "the geographic exploration of new areas which results in the successful discovery, identification, and location of an island or set of islands" (Graves and Addison 1995:387; Irwin 2000: 394). Irwin (1992: 51-61) proposes that exploration (and discovery) would have to precede colonization for the most distantly located or least accessible islands. With the increasing distance and greater ocean areas to search, most

voyagers would have needed to return to the parent settlement to plan and prepare for the colonization of any new lands. On an archipelagic scale for Hawai‘i this would apply to the exploration and discovery of the Northwestern Hawaiian Islands. The configuration of the islands in the archipelago in a linear row undoubtedly provided incentives for early exploration up the chain allowing it to occur in a systematic and reliable fashion going back and forth between the main Hawaiian Group. This process has been termed "autocatalysis" (Diamond and Keegan 1984; Diamond 1985) and refers to a "positive feedback" that stimulates the continuation of maritime exploration and movement (Irwin 1980; Levison et. al. 1973). The process of colonization however, might have been discouraged by the increasing marginality across the dimensions of size, inaccessibility, isolation, and resource scarcity as one moves west. In other archipelagos, these types of islands often served as staging points for continuous movement or intercept location between two regions (Irwin 1992:116).

Colonization and avoidance represents the second stage of the process which is the purposeful decision to avoid or create a presence on an island. Island colonization refers to the creation of a settlement in a new place and in some cases retaining ties with the parent settlement (Irwin 2000: 394). It represents the placement of human populations on discovered islands, which may or may not lead to processes involving establishment. For the Hawaiian Islands, most of the Northwestern Hawaiian Islands from French Frigate Shoals to Kure atoll probably fell within the category of avoidance as they purposefully decided not to leave physical evidence of human presence (i.e.

material remains) on these remote landfalls.[102] Instead they were remembered through place names, mythologies, and historical accounts. In cases where colonization was attempted, the success of these efforts was dependent primarily upon the ability of populations to adapt to a new niche (i.e., use of resources), ensure demographic stability (i.e., countering population bottlenecks), and deal with potential issues of degradation of environments (Keegan and Diamond 1987: 76-80). In Hawai‘i, colonization efforts were focused primarily on the main island group extending up only to Mokumanamana. These settlement patterns were also linked to the complex system of religion that developed concerning life and afterlife.

Establishment represents the final phase of the colonization process. This stage previously correlated only with settlement or long term habitation of an island. Instead here I break it into four scenarios or outcomes that take into account the total variability and diversity of circumstances in this process.

a. **Extinction** refers to outcomes involved in staying in an area, too small to support a successful community, but marooned, and facing death. It is based on an overwhelming risk associated with naturally impoverished and/or fragile biota susceptible to degradation typically following human alteration of the environment (Irwin 1992: 181).
b. **Abandonment** refers to a group's strategic dispersal or leaving an area because of scarcity, inaccessibility, and isolation. This is based on an assessment of the high risks associated with staying in the current location.

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[102] There is evidence that the Polynesian rat (Rattus exulans) lived on Kure Atoll at the other end of the chain.

This type of establishment focuses investment away into costs of moving, and the likely success of relocating, and the relative advantages of an alternative settlement or the return to a parent settlement site (Di Piazza 2001; Irwin 1992: 176).

c. **Occupation** refers to the repeated use of an area for longer durations, without having to settle or establish permanent habitation of the area. This is based on moderate levels of risk associated with resource scarcity, low accessibility, and potential isolation. This type of establishment focuses investment into movement of populations and resources back and forth for repeated use, creating infrastructure for mobility and transitory behaviors (Dawson 2008).

d. **Settlement** refers to securing long term (multi-generational) habitation and residence of an island or archipelago by a population of sufficient size (i.e., one that has passed the threshold at which a catastrophic accident or reproductive bottleneck would be likely to affect its long term viability) (Graves and Addison 1995: 387; Irwin 2000:394). This is based on low levels of risk due to resource productivity and potential. This type of establishment focuses investment of energy in creating infrastructure for settlement and permanent habitation for long durations (generations). Although uncommon, it could also involve large scale provisioning of an island or area, providing for permanent occupation.

This conceptual model represents a concise framework of the colonization process highlighting the order of phases of events in which human populations undergo in the settlement of islands: (1) exploration; (2) colonization; and (3) establishment. As the

process goes through progressive phases the outcomes are varied depending upon the level of human persistence (continuation) versus the level of dispersal (discontinuation) across a broad range of environmental and climatic variables that are ordered across remote Oceanic Islands. These environmental dimensions include a number of geographical circumstances that measure an island's relative accessibility: patterns of climate (primarily rainfall), island size, distance, and target angle; as well as an islands relative isolation: approximate land/sea ratio, resource abundance; sustainability, predictability; all of which affect the likely outcomes of the colonization process (Irwin 2000: 396). Through the use of this model, it is clear that the mystery islands are informed by all phases of the process from exploration, colonization, as well as all possible outcomes in the establishment phase. During this final phase voyaging may play an increasingly important adaptive role for human survival, especially among islands with high insularity and marginality.

Island Marginality Across Accessibility and Isolation

The "mystery islands" paradigm has limited our understanding of the colonization process by conflating a broad group of marginal islands into a single functional class associated with abandonment and extinction as the only plausible outcomes (Di Piazza and Pearthree 2001a). This single category of "mystery islands" should be expanded to three distinct classes of marginal islands that range in outcomes from the establishment stage in the proposed colonization model which include: a) extinction, b) abandonment, c) occupation, and d) settlement. Here, the term marginality refers to the relative measure of the geographical and ecological constraints that habitat imposes upon its human population. All islands are typically viewed in relative degrees of island insularity

where the effects of biogeography and the diminishing presence of resources can leave inhabitants open to subsistence risks. These ecological constraints have intense effects on populations often undermining their stability and adaptability. These constraints are measured across two important island dimensions –accessibility and isolation. The first dimension of accessibility refers to risks associated with exploration and sustained voyaging interaction. These are variables that are considered when viewing islands as targets for navigation. It compares the relative ease of ocean voyages between specified islands typically measured by plotting their distance in sea miles and the size of the target island as measured by the angle it represents as a target from the starting island. Additional variables regarding inaccessibility include: patterns of climate, island size, distance, and suitable locations to dock canoes. The second dimension of isolation refers to the long-term risk associated with island colonization and settlement. These variables are considered when measuring the ability for populations to settle and stay alive on islands (Irwin 2000). Additional variables regarding isolation include: approximate land/sea ratio, resource abundance, sustainability, and predictability.

Accessibility is a dimension that measures the relative ease or difficulty of actually sailing to an island, which changes depending on the winds encountered as well as the canoes performance relative to the wind (Di Piazza et al. 2007). Typically accessibility becomes more difficult with the increase in distance of ocean travel as islands become spaced farther apart. This difficulty of access increases moving east to west in the Hawaiian archipelago. Island inter-visibility occurs in the main Hawaiian group, but as one moves into the northwest these distances increase and islands cannot be seen from one to the next (Table 4.1). A contemporary assessment of wind and ocean

patterns for the Hawaiian archipelago shows that both the main Hawaiian group and the northwest group were dominated by prevailing easterly movement patterns. Wind is characterized by persistent northeasterly trade winds generated from a system that blows from northeast to the southwest.[103] Contemporary wind data (1985-present) show the northwest portion (15°N to approximately 30°N) showed only modest changes in inter-annual variability as it relates to monthly wind patterns, with the exception of years that had El Niño events, where the prevailing winds show a full direction reversal, strongly blowing out of the south southwest (Desch et al. 2009) (Figure 4.2).

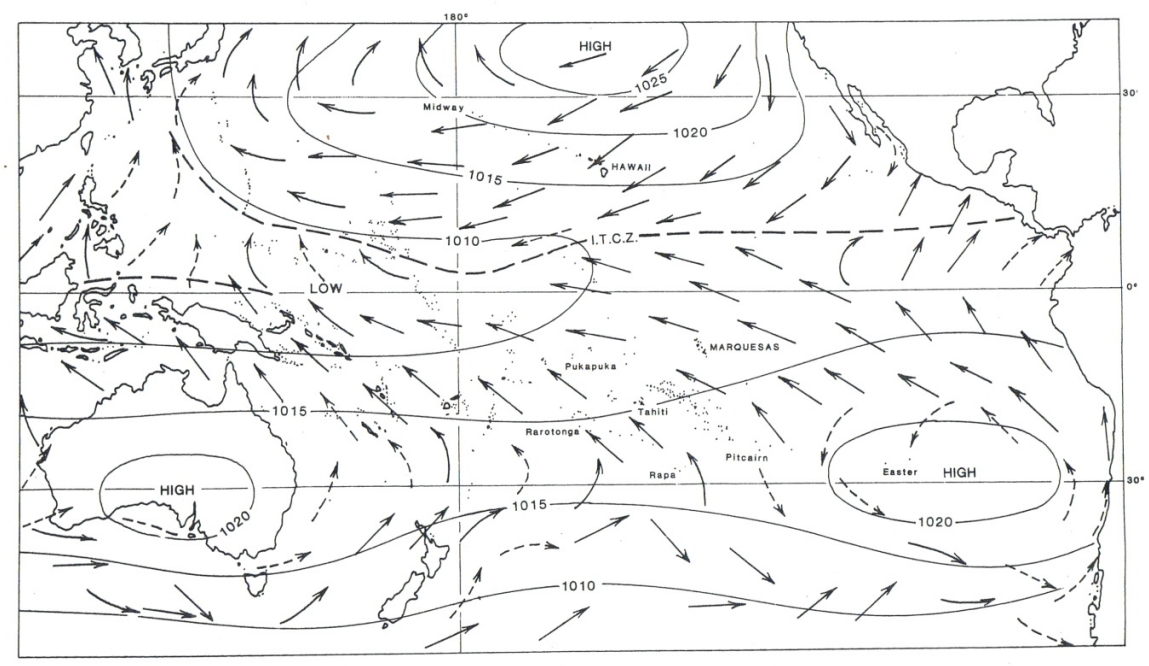

Figure 4.2. Prevailing Wind Patterns in the Pacific Ocean (from Irwin 1992; Adapted from Ocean Passages for the World 1973).

[103] Winds are divided into two categories: (1) easterlies and all other winds that blow from the north east to the south west; and (2) westerlies which are a wind reversal in the opposite direction and help to open the voyaging corridor to the east.

Ocean currents also tend to follow this pattern as the mean flow of surface water over time tends to flow predominately from the east to west in response to the prevailing wind patterns (Desch et al. 2009) (Figure 4.3).

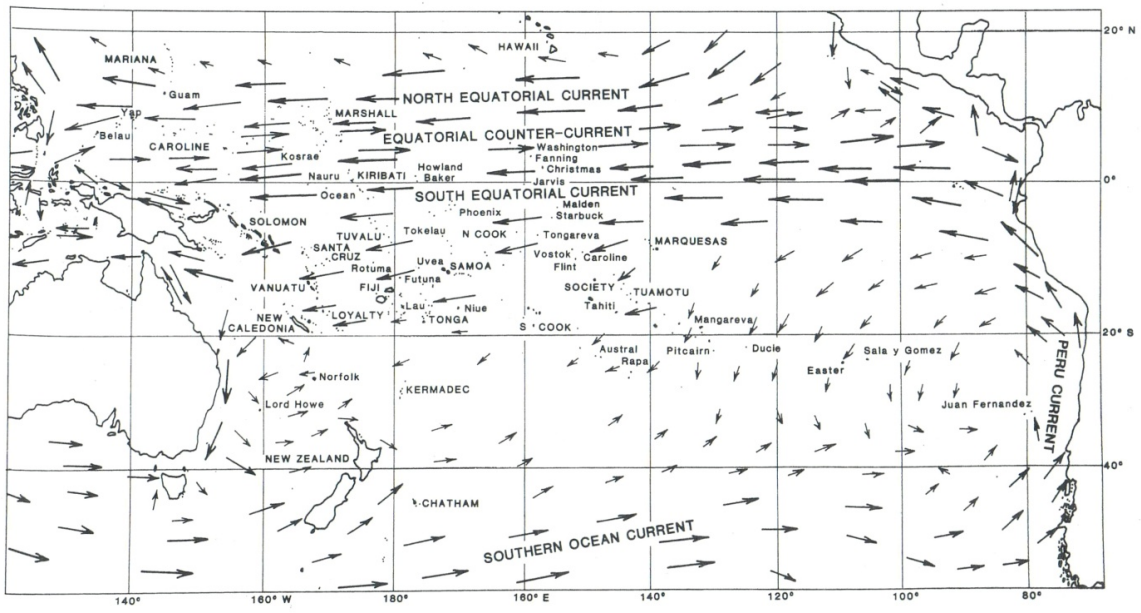

Figure 4.3. Prevailing Ocean Current Patterns in the Pacific Ocean (from Irwin 1992; Adapted from Ocean Passages for the World 1973).

Sea surface height and the associated currents (SSHC) however, show monthly patterns as March-May has the lowest values of sea surface height. Density changes in regards to SSHC impacts sea level variability on seasonal and inter-annual time scales (Gilson et. al 1988). This indicates that traveling to the Northwestern Hawaiian islands from the main Hawaiian islands (to the west downwind) was quick and required less effort, as the dominant easterly winds and ocean patterns flowed in that direction. The return voyage however, would be extremely difficult going across and against the

prevailing winds and currents (to the east upwind). These challenges to canoe performance have been confirmed by experimental and computer simulated voyaging (Di Piazza & Pearthree 2004; Di Piazza et al. 2007; Finney 1967, 1977; 2007; Irwin 1992, 1998, 2000; Irwin et al. 1990; Levison et al. 1973).

Isolation is a dimension that measures the ability for populations to remain living on islands. These parameters grow as land to ocean area ratios increase and as smaller marginal islands are located at farther distances from parent islands and settlements. Larger main islands typically can function as stand-alone islands because of the abundance of more varied resources, greater environmental diversity, and the predictability of weather patterns, in part a function of higher elevation. Smaller islands that are distantly located and have low elevations generally do not have enough resources to support large populations of people over durations of time. These patterns occur in the Hawaiian archipelago as the main parent settlements are located in the south east of the chain, while the smaller more marginal islands are located in the northwest (Table 4.1; Figures 4.4 to 4.6).

Ratios of land area to seascapes increase island isolation exponentially creating higher costs associated with maintaining communication between areas. Estimated values of land and sea areas are given in Table 4.1. The values for the ocean area are taken from a model that establishes boundaries midway between adjacent islands to create a series of continuous seascapes, which have been closed with an arc using the shortest possible radius to enclose the polygon (Figure 4.7).

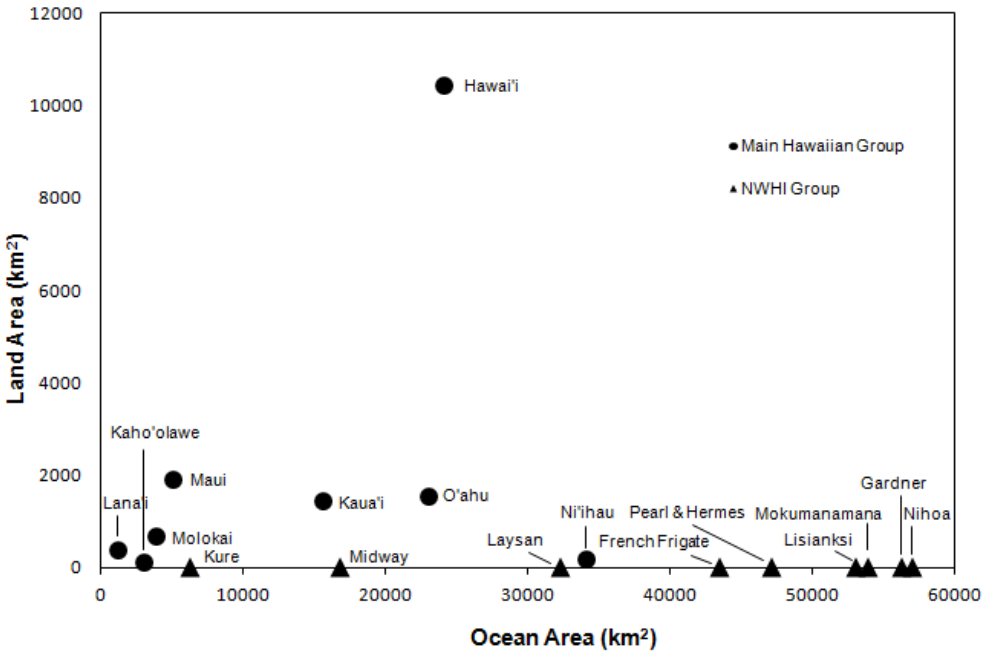

Figure 4.4. Area of Land versus Surrounding Ocean for the Islands in the Hawaiian Archipelago. A distinction is demonstrated for the degree of isolation between NWHI and MHI. Seascapes increase by an order of magnitude as you move into the northwest.

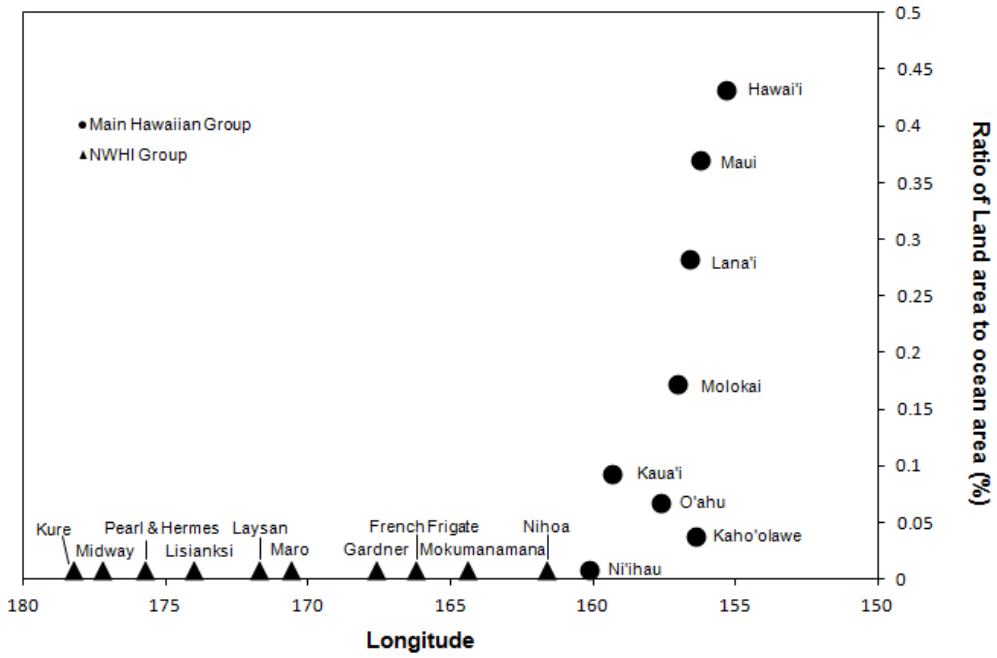

Figure 4.5. Ratio of Land Area to Ocean Area Plotted by Longitude. There is a clear distinction between the main Hawaiian group and the Northwestern Hawaiian Islands.

Figure 4.6. The Polynesian Proto-type Voyaging Canoe Hōkūleʻa Attempting a Long-distance Voyage in the Northwestern Hawaiian Islands in 2006. Photo credit: Naʻalehu Anthony.

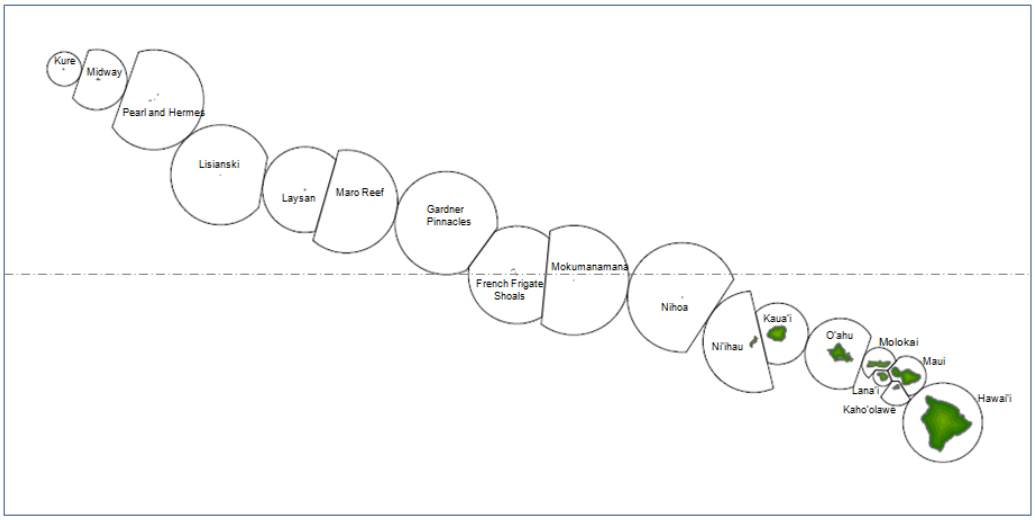

Figure 4.7. "Seascape" Model for the Hawaiian Islands Shows the Area of Ocean that Lie Closer to Islands Contained within Each Division, than to Any Other Island. This method minimizes area of enclosed ocean while allowing boundaries to be shared by contiguous islands. Ratios of land area to sea area can be derived for different islands. Changes in the patterns of island isolation correspond with patterns in archaeological chronology for settlement.

Figure 4.4 shows the relative positions of islands in the Hawaiian archipelago and their values show a clear separation between degrees of isolation for the main Hawaiian Islands and the Northwestern Hawaiian Islands. In this graph Mokumanamana and Nihoa represent some of the most isolated islands in the archipelago. Figure 4.5 shows the ratio of land to sea area as it is plotted from west to east on longitude. This also supports the geographical distinctions associated with increasing isolation moving into the northwest.

The diminutive sizes and large ocean areas of the northwest islands created severe resource problems in the following areas: (1) decreasing the total amount of diversity of biota to 4.7% of that of the main Hawaiian group (Eldredge & Evenhuis 2003: 28); (2) constraining the islands ability to generate fresh water due to lower elevations with no orographic processes, making them susceptible to drought and other climatic irregularities; (3) limiting the amount of arable land due to the geological age of bedrock (>6 mya) and nutrient poor soils, posing serious constraints on agricultural food production; (4) having a nearly complete absence of timber that limited wood for housing, cooking, and for canoes; (5) stunted and limited reef structures would have limited the amount of seafood for foraging (Hobson 1984; Okamoto & Kanemaka 1984); and (6) in combination all these factors enhance unpredictability rendering human populations susceptible to "ecological crunches" and natural disasters. Nihoa and Mokumanamana have a land total together of 0.797 km^2, which amounts to only 0.0047% of the total land area of the Hawaiian Islands (16,636 km^2).

Di Piazza and Peartree (2001a) propose a new classification system of the mystery islands that accounts for these variables and patterns that will be adapted and

applied here. Four major categories of islands have been developed which represent the broad range of islands in remote Oceania and exist in the Hawaiian archipelago. These include these island classes and the web of relationships they have to each other: (1) Parent communities; (2) Remote communities; (3) Satellites; and (4) Isolates. An assessment of these classes across basic island dimensions provide a starting point in investigating how islands influence the colonization process and the role of voyaging and interaction in supporting these efforts. These variables include: island size (km^2), elevation (m), and isolation (km) (Table 4.1). A description of each class of island across these variables and how they are defined in relation to other is as follows:

- **Parent Communities** refer to large-sized islands (>300 km^2) that are centrally located as a stand-alone or within a group of Parent Communities. These islands have the ability to support sizable resident populations and have nearby remote communities, satellites, and isolates. These types of islands are high islands (>500 m) and offer an abundance of consistent subsistence resources, highly productive agricultural potential and large amounts of fresh water, vast amounts of timber, and good marine and avian resources. In this context these types of islands do not need voyaging interaction to sustain populations as distances of isolation are typically inconsequential. They do however sometimes draw upon specialized resources of Remote Communities and Satellites. They provide the support for Remote Communities, satellites, and Isolates. Socio politically, these islands typically function on the scale of independent chiefdoms. Examples: Main Hawaiian Islands- Hawai‘i, Maui, O‘ahu, Moloka‘i, Lāna‘i.

- **Remote Communities** refer to medium-sized islands (25-300 km^2) that are nearby (<50 km) to Parent Communities and have the ability to support sizable resident populations and have nearby satellites. These types of islands are high islands (250-500 m) that offer the best combination of consistent subsistence resources, good agricultural potential and water, good timber resources, good marine and avian resource. In this context, these types of islands do not need voyaging interaction to sustained populations, but if pushed to their limits would: (1) need to rely on Parent communities or multiple satellites for support; (2) abandon and relocate onto a Parent community. They can be utilized to some extent in supporting satellites and isolates. Socially and politically these islands typically function on the scale of remote subsidiaries. Examples: Main Hawaiian Islands- Kahoʻolawe, Niʻihau.
- **Satellites** refer to small islands (1-50 km^2) that are (50-150 km) from the Remote Communities and Parent Communities; and have the ability to support only limited populations for short periods of time. These types of islands are fragments of high islands (100-250 m) have good combinations of subsistence resources, average agricultural potential (limitations in size) and limited water, limited timber resources, and good marine and avian resources. In this context, these types of islands need voyaging interaction to sustain population for longer durations of time, and if pushed to its limits would: (1) need to rely on Remote communities or Parent communities for support; (2) abandon and relocate onto a Remote or Parent community; or (3) force being marooned and face extinction. They can be utilized to some extent to support

isolates. Social politically these islands could have shared interest by independent chiefdoms or remote subsidiaries. Examples- Northwestern Hawaiian Islands- Nihoa.

- **Isolates** refer to tiny islands (< 1 km^2) that are (>150 km) from Satellites, Remote Communities, and Parent Communities and do not have the ability to support populations for any period of time. These types of islands are low to fragmentary high islands (<100 m), have little or no subsistence resources, poor agricultural potential (limitations in size) and little or no water, no timber, and good marine and avian resources. In this context, these types of islands need voyaging interaction to sustain populations for even the smallest periods of time, and if pushed to its limits would: (1) need to rely on Satellites, Remote communities or Parent communities for support; (2) abandon and relocate onto a Satellite, Remote or Parent community; or (3) force being maroon and face extinction. These islands are too marginal to offer any support to other islands and are often avoided in the colonization process. Socially and politically these islands could have shared interest by independent chiefdoms or remote subsidiaries. Examples- Northwestern Hawaiian Islands- Mokumanamana, French Frigate Shoals, Gardner Pinnacles, Laysan, Lisianski, Pearl and Hermes, Midway, and Kure.

The dimensions of accessibility and isolation structure the outcomes the islands undergo in the colonization process. For the Hawaiian Archipelago, inaccessibility in relation to island size, elevation, and prevailing wind and current patterns make islands difficult to travel back and forth from as you move into the northwest region. Isolation

also increases along this direction as the distances between islands grow as their ability to stay in reach of support islands diminishes. Thus, the riskiest islands to access and stay living on were in the northwest region, and voyaging and transportation costs also increased following this pattern. With this understanding, the main Hawaiian Islands (Hawai‘i, Maui, Kaho‘olawe, Lāna‘i, Moloka‘i, O‘ahu, Kaua‘i, and Ni‘ihau) fall within the class of islands called Parent and Remote Communities. These were islands of large land size, closely located often as an aggregate of islands, with higher elevations for rainfall, and resource quality sufficient to support a self-sustaining population for any duration of time. Parent and Remote Communities are often associated with colonization persistence and continuation, as settlement becomes the likely outcome of the process. They are able to employ what is called the "rescue effect," in their ability to rescue smaller islands from extinction through the influx of population and/or resources (Keegan and Diamond 1987: 58). There are a few known examples in remote Oceania where Remote Communities have not survived (i.e., become extinct or abandoned with relocation to better landfalls; e.g., Tabuaeran, Pitcairn, Orona in the Phoenix Islands, and Caroline in the Line Islands) (Di Piazza and Pearthree 2001a), although these are not the norm.

The Northwestern Hawaiian Islands (Nihoa, Mokumanamana, French Frigate Shoals, Gardner, Laysan, Lisianksi, Pearl & Hermes, Midway, and Kure) represent the opposite end of the spectrum of these attributes as island areas were diminished, elevations lower, and isolation as a function of distance to its nearest support island increased dramatically. Risk is magnified as a function of these variables combined. Nihoa is the only island that can be categorized as a true Satellite because it is nearest to

the main Hawaiian Islands. Satellites are often associated with a certain degree of uncertainty and risk and in the colonization process could result in either the establishment of occupation (without full investment settlement), abandonment, or extinction. Mokumanamana represents the first of the islands that are considered isolates, as all the rest of the Northwestern Hawaiian Islands also fall within the category of isolates. Isolates are often associated with high uncertainty and risk in the colonization process and either results in avoidance all together, or the establishment of occupation (without full investment settlement), abandonment, or extinction. In both of these categories, where islands are too small to support self sustaining populations alone, they relied more heavily on inter-island voyaging as a means to keep the island habitable (or appear occupied) for longer periods of time (i.e., the "commuter effect"; Keegan and Diamond 1987: 60; Irwin 1992; Weisler 1995). Additionally, small remote islands selectively favored adaptations such a keeping populations to smaller dispersed groups, diversified use of resources, and a high level of mobility (Cherry 1985).

Two-Way Voyaging and Sailing Capabilities

"Indeed, Hawaiian canoes had evolved into vessels suited only to coastal or inshore fishing or travel and were no longer capable of open-ocean navigation." (Kirch 1985: 66)

Voyaging played a critical adaptive role in human survival for islands throughout Oceania. While traditional routes of long-distance voyaging contracted between the Hawaiian archipelago and Central Polynesia, the knowledge systems and practices associated with these traditions were maintained with the continuation of voyaging to the Northwestern Hawaiian Islands. This ability to maintain two way voyaging and interaction was the primary means in which to counter the limitations posed by

inaccessibility and isolation. Maintaining voyaging with the Northwestern Hawaiian Islands required great navigational skill and knowledge likely done by chiefly elites who were navigators themselves traveling oceanic pathways that were religious rites of passage. The double hulled Polynesian voyaging canoe was likely the primary type of vessel used to travel long-distances, as it had greater carrying capacity and stability, rather than the smaller outrigger canoes (Figure 4.6; Finney 1967: 144; Finney 1977). These were relatively advanced watercraft capable of sailing hundreds if not thousands of kilometers across open-ocean, carrying a range of 20-40 people with heavy loads of migrants, food and water supplies, and domesticated plants and animals needed to survive and build a colony, and well as maintain voyaging interaction back and forth between the main Hawaiian group.[104] These double-hulled canoes were either a combination of sailing and paddling, or strictly sailing crafts. The combination vessels had relatively low freeboards, definite bow and stern structural differences, while the sailing vessels had relatively high free boards, with double-ended hulls (either end could serve as the bow or stern). Hawaiian canoes of both types likely had a basic Polynesian sprit sail, a triangular sail mounted apex downward. It is a fore-and-aft sail that can take wind from either side, distinct from other types of sails that only took wind from behind (Irwin 2008: 16).

Polynesian navigation and voyaging systems were based on important concepts that proved to be reliable in discovering islands, tracing their course back to their homeland, and then sending out canoes for colonization efforts with resources and people (Finney 1967, 1977; Irwin 1992; Lewis 1972). Three main skills of practical navigation

[104] It's estimated that the double hulled canoes that brough the first Polynesian explorers to Hawai'i could carry anywhere from 20-40 people (Kirch 2010: 129). Finney (2004, 2006) estimates double hulled canoes at the contact era could hold between 30-40 people, while contemporary experimental canoes typically carry about 12-19 people

were: (1) steering a course at sea, (2) maintaining a running fix on one's position by dead reckoning, and (3) making an island landfall (Irwin 1992: 45). How these tasks were accomplished has been written upon extensively (Lewis 1972; Gladwin 1970; Finney 1979). Steering a course as sea was accomplished by leaving known landmarks behind on fixed bearing related to particular island destinations. At night stars were used a sidereal compass to navigate as a source of direction- as they rise and set on the same bearing four minutes earlier each night as seen from the previous position. This was used as a means to gain general orientation and utilizing stars on the horizon to indicate a desired course. Also multiple stars often times follow the same track and these were memorized as they appear at different rising times over the course of the year. During the day, the sun was used as a fairly accurate guide early and late in the day, it also changed its bearing throughout the year. Dead reckoning was a process whereby ones course and distance is calculated from their departure point by compass bearings, measurements of distance and time, and estimates of current and leeway. Finally, land fall was gained by looking for marked locations based on zenith stars and expanding targets (i.e. indicators in nature to detect islands before they are actually seen such as homing seabirds, land clouds, lagoon reflections in the sky, swell patterns, and phosphorescence (Lewis 1972). Latitude sailing was implemented as a strategy of sailing to the windward side of the destination, and upon reaching the latitude, sailing downwind along that line to make landfall. In just a few millennia a large part of the world's ocean surface had been explored and settled using these navigational strategies.

Voyaging studies demonstrate that reliable canoe technology along with number of navigational strategies and maritime perspectives were employed to ensure a certain

degree of certainty in the island colonization process. This information helps us to structure and understand the degrees of plausible outcomes in regards to the Northwestern Hawaiian Islands. Ocean and climatic conditions largely determine the nature in which canoes can travel and find islands. These factors affect both the early stages of exploration all the way to the establishment stage and investment into voyaging interaction as a means to keep populations alive in marginal environments.

Voyaging Challenges and Investment Costs

Hawaiian navigation and voyaging faced real challenges in maintaining communication and interaction with the main Hawaiian group. While traveling to the Northwestern Hawaiian Islands was relatively easy when canoes were driven by the prevailing winds and currents, it was the return trip that posed problems as it required canoes to perform against the prevailing trends. Double hulled long-distance voyaging canoes are constrained in performance when going against wind, as they cannot face closer than 70-80^{o} to the wind on extended voyages without greatly losing efficiency (Finney 1977:1283; Anderson 2001: 29). Typically this was sufficient for the purposes of travel however it required the canoes to make longer, shallow tacks one side to then the other towards the windward goal. Canoes typically lose four miles for every one mile gained when traveling directly windward, greatly increasing the amount of time and cost put into voyaging and sustaining these remote island outposts. Also these trade winds and currents become increasingly challenging as one moves more northwest and the distance to the safest landfall widens dramatically. Although measuring the time and effort put into voyaging, it is largely circumstantial depending on the winds and canoe performance, the relatively degree of effort can be established by examining the shortest

distance of travel to the closest main Hawaiian Islands, Kauaʻi. Kauaʻi is approximately 271 km from Nihoa and 557 km from Mokumanamana. Estimated canoe speeds can be taken from the Hōkūleʻa a 19 m long modern double hulled canoe with 2 masts which has a conservative average of 4 knots per hour (7.4 km per hour) and up to 8 knots per hour (14.8 km per hour) on extended periods (Anderson 2001: 26).[105] Based on this average speed it would take minimally 18 -37 hours to get to Nihoa, and minimally 38-75 hours to arrive at Mokumanamana (under moderate trade wind conditions). On the return trip however, this time increases; it would take 152–300 hours from Mokumanamana, and 72–148 hours from Nihoa. This means it can take about 4 to 8 days total round trip from Kauaʻi to Nihoa, and about 8 to 16 days round trip from Kauaʻi to Mokumanamana. These are difficult voyages to sustain over long periods of time even from the closest main Hawaiian Island. These challenges grow exponentially when measuring the effort against the other main Hawaiian Islands to the east.

Two combinations of vessels were probably available that could have been used to sail to and from the Northwestern Hawaiian Islands from the main Hawaiian group, each with their advantages and disadvantages. Smaller sized canoes were ideal because they were quicker and less cumbersome when dealing with issues of what do with the canoes once on-island. These smaller canoes would have allowed people to stay on island longer as there are a number of documented strategies such as using constructed ramps to drag the smaller canoes onto the rocky shoreline (Holmes 1981; Kapahulehua in Maly 2002), and/or using long rope lines to tie the canoes to cliff sides while the wind

[105] Finney (2006: 131-132) estimates that with a traditional sprit sail a larger sized canoe like the Hōkūleʻa could conservatively average anywhere from 4 to 6.5 knots per hour with boosts going as high as 10-12 knots per hour. More recent visits to the Northwestern Hawaiian Islands by the Hōkūleʻa utilized a lateen sail, which increases the speed of the canoe.

keeps the canoes offshore hanging out in sea like kites (per. communication with Dr. Ben Finney). Larger sized canoes would have been useful in the initial stages of island colonization bringing in a greater number of people and supplies (up to 30 days of food, water, and other provisions) to do the construction work of building up the islands (Irwin 1992: 43-44, 99, 135; Lewis 1994: 71-81). The lack of a docking place or location to successfully anchor for longer durations was likely a problem for larger sized canoes that would have to remain transitory in the vicinity either waiting for the occupants to finish their work, or forced to leave and return at a later time. It is possible that a combination of canoe sizes were utilized, as smaller canoes could be used for parties of elites that needed to stay longer and remained docked on island; while larger canoes could be used for transporting necessary supplies and people but remaining transitory moving to and from the main Hawaiian Islands. These combinations of mobile strategies would have been a viable means in which to deal with the constraints of canoe landing areas.

Early Strategic Exploration into the Northwest

It is generally agreed upon in voyaging studies that the first stage of exploration followed the safest approaches possible first going into the direction that is normally upwind to ensure the most secure return home (downwind) (Irwin 1992; 1998; 2006: 82). A 'safe sailing model' for voyaging and exploration can be explained in two phases: going and returning. Typically the difficult upwind phase is preferred to be in the first phase of going, followed by an easier downwind phase returning. This method of sailing had to be adapted and it evolved as ocean areas for exploration expanded and sailing outside the tropics became more difficult (Irwin 1992:9). These are the circumstances regarding the ocean and wind that Oceanic people dealt with in the migration to Central

Polynesia when traveling west to east. For the Hawaiian archipelago however, early explorers would have to go in the opposite direction from east to west to venture into the northwestern section of the chain. This pattern goes against the 'safest sailing model' as canoes would have to travel into the northwest downwind first and return home to the main Hawaiian group upwind. Sailing downwind is dangerous because of the difficulty in determining the effort needed to return against wind. Based on this knowledge, it may have required early explorers to return by a different route through different weather systems and patterns, or it could have meant that the weather and climatic conditions were different in early Hawaiian pre-contact history.

Climate variability undoubtedly shaped the nature of voyaging exploration to and from the Northwestern Hawaiian Islands with rhythmic oscillating inter-annual, multi-decadal, and centennial-scale patterning of precipitation and temperature (Cobb et al 2003; Jones et al 2001). Archaeological and paleo-climate studies have shown a correspondence and agreement between El Niño - Southern Oscillation events (ENSO) events with eastern migrations that that were documented archaeologically in Central Polynesia (Anderson 2003, Anderson 2006; Anderson et al. 2006; Irwin 2008: 22). ENSO marked an important shift regionally towards a warmer climate which provided stable voyaging conditions with mild trade winds and strong periodic westerly wind shifts. These favorable voyaging patterns began approximately A.D. 450 and culminated about A.D. 1100-1300 (Bridgeman 1983; Graham et al 2007: 278; Nunn 1998, 2000). After this period a shift occurred back to the prevailing easterlies from A.D. 1400-1850 (or more recent interpretations of A.D. 1550-1850) with stronger trade winds and an increased incidence of storms during what was called the "Little Ice Age" (LIA) (Finney

1985; Jones et al 2001). The El Niño conditions in the south reduced the average strength of early trade winds so that opportunities to sail east on westerly wind reversals increased with these climatic changes. These would have provided ideal sailing conditions for exploration of the Northwestern Hawaiian Islands early on based on a 'safe sailing model.' Additionally, climatic data shows that this period of time would be the worse for any type of colonization and settlement efforts as El Niño - Southern Oscillation was associated with tropical droughts increasing the risks associated with survival on smaller islands (Anderson et al. 2006).

Sailing between known and unknown islands is of high risk, but sailing into open-ocean can be fatal. Exploration of the Northwestern Hawaiian Islands was perhaps not as risky as other areas in the Pacific because the archipelago is configured in a linear formation. The islands moving west however, do become more remote and smaller targets (Irwin 1992:7). Nihoa and Mokumanamana are assigned as remote satellite and isolate, respectively, and would have had the best conditions for exploration and discovery prior to A.D. 1300, perhaps as early as the initial period of colonization of the Hawaiian archipelago A.D. 800-1000. It can be assumed that early explorers searched the extent of the islands in the archipelago before deciding where to invest their energy into settlement. Colonization efforts to establish a human presence on Nihoa and Mokumanamana could have been done anytime after their discovery, or waited for durations of time to pass. Colonization and the Establishment phases of this process would have been more difficult post. A.D. 1300 and required voyagers to develop greater strategies to counter the risks associated with climatic changes that went against the 'safe sailing model.' At that time it was likely established that the islands in the far northwest

(e.g., Kure) were too difficult to travel to on a regular basis and their limitations in size, elevation, and isolation from the nearest supporting island made them too dangerous to colonize and was avoided altogether. The focus of colonization was limited primarily to the main Hawaiian group, but efforts to establish a presence in the NWHI included the two closest islands: Nihoa and Mokumanamana.

Recurrent Use as a Strategy for Settlement

Hawaiian navigation was a part of a larger Polynesian system that was strategically planned based on optimal situations, carefully observing marked seasonal differences when the easterly trade wind prevailed, and when they were replaced with westerlies (Finney 1967, 1977, 1985; Finney et. al. 1989; Anderson et. al 2006; Irwin 2008). In regards to colonization and settlement more investment and effort was needed for voyaging than earlier phases of exploration. There are important climatic patterns that shape the strategies employed in voyaging to colonize an island. The prevailing trade winds that blow from the sub-tropical highs towards the equator run opposite in two hemispheres; the northern hemisphere (where Hawaii is located) has northeast trades, and the southern hemisphere has southeast trades. This pattern is generated by global atmospheric circulation where pressure systems and consequently winds, move in response to heating differences that change with the seasonal position of the sun (Meehl et al. 2007; Peterson et al 2012). There are two exceptions to this pattern that Hawaiians likely exploited to overcome challenges of returning home upwind- these include: (1) the Westerlies (wind), and (2) small scale El Niño events. Both were variable climatic shifts that seasonally reversed the direction of these patterns in the favor of voyaging.

The "Westerlies" often times occur at various short periods in the summer and can be exploited to sail east, requiring travelers to only tack windward when the episode drops off and is replaced with the easterly trade winds. These wind shifts exist for short periods (weeks) throughout the year. Smaller scale El Niño events were episodic climatic perturbations that essentially created the same beneficial scenario but occurring irregularly at an interval of about every 2-7 years (or in some extreme cases for entire periods of time such as ENSO) in response to a large scale weakening of the trade winds. These westerly wind reversals can last from a few months to a year and are difficult to predict. Ethnographic and experimental evidence shows that Polynesians were able to adapt to this wind regime to use periodic episodes to travel east faster (Finney et. al 1989) and these same principles could have been applied in Hawai'i. Both of these periodic climatic conditions would have created a scenario where the 'safe sailing model' could be applied, addressing dangers associated with the return trip. This would have opened a voyaging corridor in which migrants could travel back to the main Hawaiian group from the Northwest Hawaiian Islands. A scenario such as this would have been beneficial to travelers from eastern islands in the chain such as Maui, and Hawai'i who had to travel the longest distances to reach Nihoa and Mokumanamana. This suggests that while sustained interaction would be difficult, any of the chiefdoms from the main Hawaiian group could have accessed and maintained communication with Nihoa and Mokumanamana, if they used the appropriate sailing and navigational strategies.

Recurrent occupation and sustained inter-island long distance voyaging might have been the best option in the establishment phase as a strategy for remote islands such as Mokumanamana and Nihoa. Since these islands are impoverished in certain key

resources and materials, particularly water, food, and fuel (Davies 2006), humans were therefore responsible for introducing materials, implements, and needed resources and materials to the island that cannot be produced locally. The danger associated with being marooned and relying solely on the islands resources posed a real risk to island colonization. Voyaging could have played a key role in facilitating the transfer or domestic plants and resources not introduced at the time of initial colonization and sustaining populations for durations of times past the carrying capacity of the islands (Weisler 1995, 1996, 1997). Archaeological research will be able to clarify these nuances more allowing us to understand whether Mokumanamana and Nihoa underwent a process of settlement and abandonment or extinction; or perhaps providing a new strategy of purposeful recurrent occupation as means to avoid the risks of settlement. The persistence of an inter-island maritime voyaging network after colonization would demonstrate the degree of human effort associated with voyaging to sustain populations for varying degrees of time on these islands. It would ultimately demonstrate the lengths Hawaiian chiefdoms would go for ritual and religious purposes.

Discussion

This chapter demonstrates that voyaging and interaction is a critical aspect of understanding the exploration and colonization of the Northwestern Hawaiian Islands. Voyaging studies' are considered non-archaeological research yet they provide viable lines of evidence for understanding the context of voyaging and the parameters of island colonization processes. This type of research provides a context for the ethno-historical data and archaeological evidence, as well helping to shape the practical reality of how voyaging occurred and was sustained in the Northwestern Hawaiian Islands. Through

this modeling it is clear that voyaging had to be maintained as an important mode for securing the authority and power for Hawaiian chiefdoms. The maritime expansion into this northwest region represented the culmination of navigational and maritime voyaging skills that stemmed from long-distance voyaging, migration, and settlement of Eastern Polynesia which was achieved regionally by A.D. 1200 (and conservatively at A.D. 800-1000 in Hawai‘i). Two way voyaging and interaction between archipelagos may have declined by about A.D.1400 (Irwin 1992), with localized interisland voyaging networks breaking down at various periods of times from: A.D. 1450 in Marquesas due to hostile intergroup relations (Rollet 2002); A.D. 1500 in South East Polynesia region (including Pitcairn, Hernderson, Mangareva; Weisler 1996); A.D. 1600 in the Line and Phoenix group (Phoenix Islands, Kiribati, Tabuaeran). In Hawai‘i however, ancestral Polynesian navigational knowledge and maritime skill were reapplied locally and shifted seamlessly into a new form of long-distance inter island interaction that surpassed these terminal ends. This investment placed into voyaging in turn helped aid the emergence of ritual power and religion with the colonization of Nihoa and Mokumanamana.

Island colonization was a process that was affected across island attributes and measured by the dimensions of inaccessibility and isolation. This meant that it was much more difficult to remain on islands in the northwestern portion of the archipelago. Accessibility in regards to wind and ocean patterns made traveling to the Northwestern Hawaiian Islands downwind (to the west) easy, but return sailing to the main Hawaiian group (upwind) extremely difficult. Isolation also played an important factor as land area to ocean area ratios increased moving west as distances increased from parent islands and settlements. Climate variability and shifts may have played the most important role in

shaping maritime strategies, as the period pre- A.D. 1300 presented ideal climate conditions that would have incentivized and encouraged early exploration. The constant presence of westerly winds would have enabled voyagers to return home (east) quickly and safely. After this period however from A.D. 1300 to 1850 these patterns reversed presenting major challenges for voyaging in this region. The colonization of Mokumanamana and Nihoa would have fallen within this period, Irwin (1992) suggests prehistoric Polynesian voyaging strategies likely adapted to a wider range of weather patterns resulting from this new climatic variation. These shifts required seafarers to develop better technology, maritime skills as a necessary means for island communities to maintain contact. As a far and remote satellite and isolate, distantly located away from their parent communities in the main Hawaiian group, higher degrees of investment were probably placed in voyaging and new strategies were developed to exploit westerly wind reversals. This represented a new challenge for Hawaiian social adaptation as greater overall strategies needed to be developed to survive on smaller islands, for longer durations of time, compensative for a wider ocean with smaller targets (Irwin 1998: 111).

Given the overwhelming geographic and environmental dangers it was likely that "permanent" settlement was purposefully avoided on these islands. The mobility provided by voyaging canoes allowed populations to move to and from these islands. These canoes also had the ability of bringing over large quantities of resources and supplies for survival to counter the insular nature of these islands. Nihoa played an important role in reducing these risks by offering a shorter distance of sail and a stopping point for re-supplying, before undertaking the hardest leg of the sailing journey to Mokumanamana. In other areas in Central Polynesia, westward islands offer safety and

protection because they are large departure targets with suitable resources to re-provision should the sailing conditions be poor and you need to voyage back. In the Hawaiian Islands however, these northwestern islands provide only small targets with little or no resources should sailing be too difficult. This situation could result in canoes being pushed farther west and out of the range of the islands. This is a real danger as being set out to the middle of the sea with no bearing was a possibility should the necessary precautions be ignored. I propose that the benefits of maintaining these settlements for ritual use outweighed the difficulty in voyaging, leading to the establishment of a state sponsored religious system that incorporated these islands into a ritual system. Beyond this, the incorporation of Nihoa and Mokumanumanu into the cycle of religious practices resulted in the gain of important seasonal knowledge for the expansion of terrestrial resource production systems, particularly dry-land farming, in the main Hawaiian group. This was critically important as climatic variation and oscillating patterns during this period likely destabilized local resources as it did in other parts of Polynesia (Allen 2008). As a result ritual practices associated with calibrating the annual calendar and the changing of the seasons and their associated social dimensions became an important aspect of survival. In the next chapters I demonstrate the lengths to which chiefs and their supporters would have to undergo to secure access and sustain voyaging to these islands.

CHAPTER 5

SUSTAINING RITUAL USE AND HUMAN OCCUPATION

The pre-contact colonization and settlement of Nihoa and Mokumanamana have largely been framed in a context of what is considered insular fatality, a dire scenario where resource limitations presented insurmountable obstacles for colonists ultimately leading them on a trajectory of over-exploitation, collapse, and eventual abandonment (or death) (Anderson 2006: 43; Diamond 2005: 115; Emory 1928: 12; Cleghorn 1987: 26; Kirch 1985: 93). Lack and unpredictability of resources may have significantly impacted the ability of groups to sustain themselves and could have resulted in changes in demography, adaptations such as storage and mobility, or the abandonment of settlements. These often times leaves recognizable traces in the archaeological record. The Malthusian concept of "overshoot" is often applied here referring to the outstripping of resources relative to human needs that occurs when populations are on an unsustainable trajectory for environmental, technological, or social reasons. This overshoot inevitably leads to societal collapse and abandonment represented as the rapid loss of established levels of social, political, and/or economic complexity (Tainter 2006: 60). In the case of Nihoa and Mokumanmana, both islands (along with Easter Island) have been portrayed in the popular literature as prime examples of island collapse conjuring up images of environmental crises, catastrophes, and mass migration (Diamond 2005:115). In these scenarios, colonists over-exploited fragile resources leading in some cases to faunal (primarily bird species) extirpation or extinction and/or deforestation as documented in early archaeological sequences in different parts of the world (e.g. Anderson 1995, 2002; Keegan 1995; Martin and Steadman 1999). These perspectives

however deny or limit human ingenuity and the capacity for Oceanic people to adapt and or adopt flexible adjustments including a host of strategies that could have sustained life on the islands past their "carrying capacities" for durations of time.

Colonization is a process of settlement that has been equated with the long-term occupation of habitation sites, ones of sufficient size and duration that leave an unambiguous chronometric signature on the record (Spriggs and Anderson 1993). Settlement 'permanence' however can be expressed in different ways, and traditional conceptions need to be expanded to account for greater mobility among communities. Success in the colonization process therefore should include the extent to which a group occupies a place repeatedly through recurring use (despite resource limitations and voyaging difficulty). This type of behavior is expressed in the archaeological record in the persistence of a settlement chronology and also by cultural variation that cannot be accounted for by temporal factors that indicate movement and interaction between places. On islands that are shaped by extreme environmental conditions, settlement in the traditional sense may have been purposefully avoided as an integral strategy of the island colonization. In these scenarios voyaging is relied upon as a means for island communities to establish themselves, maintain occupation, and re-provision. Voyaging vessels therefore were a fundamental mechanism for dealing with island insularity (Anderson 2004: 264).

Nihoa and Mokumanamana have a colonization and settlement history that is centered on ritual use; and human occupation has continued on this remote region for an extended period. This chapter will take a closer look at previous settlement assumptions for these islands and challenges stereotypical notions of abandonment and extinction.

Settlement patterns will show that Mokumanamana had a central primary ritual purpose and that Nihoa had a wider range of functions as a support island. A regional chronology will be established that will give greater insight to the timing and duration of maritime voyaging expansion and colonization of Nihoa and Mokumanamana. This settlement chronology will help us understand the nature of island occupation and how these efforts aligned with the settlement history of the main Hawaiian Islands. Long distance travel and voyaging interactions will play a critical adaptive role in supporting populations to stay on these islands for longer durations beyond their normal carrying capacity. A number of methods will be employed to track human movement and interaction between the main Hawaiian Islands and the Northwestern Hawaiian Islands. They will also give insight as to the degree of human exploitation of local resources and whether it was subsidized through outside sources. These methods include: (1) seriation of residential structures to provide a relative chronology of habitation construction and a greater understanding of the movement of human labor to and from the islands; (2) paleo-botanical identification of charcoal and macrobotanical samples that will help us to reconstruct the island flora, possible impacts to them, and potential habitats of origin; (3) geochemical sourcing of basalt materials and artifacts to understand potential movement and transportation of important stone tools and items; (4) and the implementation of food productions practices, in regards to the role they played in increasing food stability on the islands and where these production systems originate elsewhere in the main Hawaiian Islands. Through this empirical study of the archaeological record and surviving materials we will begin to understand the nature of island colonization and settlement of these remote islands.

Creating an Archaeological Inventory

Nihoa and Mokumanamana are small, isolated islands that have been difficult to access even for early researchers interested in understanding its regional settlement (Apple 1973; Emory 1928; Hunt 1992; Cleghorn 1988; Rainwater 1958; Riley 1982; Yen 1969). Most of the previous investigations faced enormous fieldwork constraints and were only afforded a meager amount of time in the field (Ni= est. 40 days total; MM=12 days total). Yet they have provided the baseline for what we know about the islands' archaeological record. Despite challenges posed by access and the inhospitable environments on these islands, these previous efforts have documented over 140 archaeological sites. Archaeological survey, limited excavation, and artifact collection were first conducted by the Bishop Museum in two field seasons from 1923-24. The field work was led first by Bruce Cartwright, and later Kenneth Emory as part of the Tanager Expedition documenting a remarkable archaeological record that included habitation (large platforms and terraced areas), rock shelters, stone enclosures, agricultural features, burials, and several shrines which Emory (1928) called "marae" given their formal similarity to religious structures found in central eastern Polynesia. Cultural materials from these islands were some of the first to be applied to the new radiocarbon dating method that was established in 1950 (Libby 1954; Rainwater 1958). In 1969, Douglas Yen went to Nihoa to inspect the agricultural features and determine the degree of soil productivity and the nature of agricultural development on the island (Yen 1969). The next major documentation effort occurred in 1984, as these islands were investigated again by Paul Cleghorn (1984, 1988) and Eric Komori from the Bishop Museum. They re-examined Emory's sites and descriptions and recording an additional

22 sites for Nihoa (33% increase bringing its total to 88) and 6 sites for Mokumanamana (3% increase bringing its total to 52). Based on the available inventory of sites from these studies, functions of the sites were postulated based on the following: (1) morphological similarities with archaeological sites of known functions in the main Hawaiian Islands; and (2) artifacts and other cultural materials associated with sites (Emory 1928; Cleghorn 1988). Finally, in 1992, Terry Hunt and Elizabeth Gordon from the Department of Anthropology University of Hawai‘i re-excavated sites dug by Emory to recover flora and artifactual remains. They conducted excavations at seven sites including two rock shelters (50-Nh-57 and -58), two habitation/religious stone faced terraces (50-Nh-41 and -42), agricultural terraces at two locations (50-Nh-24 and -55), and a walled enclosure habitation site (50-Nh-25). They also conducted an extensive survey, and recorded previously unknown religious sites, and constructed detailed maps of ten sites.

Between 2005 and 2011, archaeological field investigations were conducted for this dissertation project on both Nihoa (2005, 2006, 2008) and Mokumanamana (2008, 2009, 2011) in three short field seasons each. On Nihoa, a total of 21 days were spent on the island doing a focused survey to relocate and map religious sites, habitation sites, which include caves, rock shelters and open habitation sites. On Mokumanamana, a total of 28 days were spent on the island doing an extensive survey to relocate and map religious sites and habitation caves. A total of 32 plan view maps (Ni =22; MM =10), 14 profile/front view maps (Ni =7; MM =7), and 7 complex maps (MM =7) were done in greater detail with tape and compass and site forms were completed documenting architectural information on a wider range of traits and attributes. Limited materials were

recovered including: coral samples (Ni=40; MM=2) from ritual contexts for ^{230}Th dating; 23 geological samples (Ni=11; MM=12) as island source materials for geochemical analyses; 8 bags of soil samples (Ni=5; MM=3) were taken from agricultural areas (50-Nh-15, -24, -55, -80, -88; 50-Nk-44, -45, -47) for analyses of nutrient abundance and availability to determine their viability for cultivation. Additional surface collections of basalt artifacts were also completed to add to the range of artifact classes documented and to attempt to characterize them through geochemical composition. These included two important classes of ritual artifacts: sorcery cups (Brigham 1092:58),[106] and a half completed stone image, and two leg appendages. Overall the archaeological data of Nihoa and Mokumanamana (both past and present) was compiled into a single database with plan view maps (n=141), profile/front face maps (n=14), and site forms (n=78) so they could be systematically compared for this study (Kikiloi Nihoa/Mokumanamana Site Inventory 2006-2009).

Nihoa and Mokumanamana have produced a rich artifact assemblage with about 400 artifacts that have been collected. These are currently stored in the Bernice Pauahi Bishop Museum and the University of Hawai‘i at Mānoa Archaeological Laboratory. A database of all the artifacts collected or recorded from the two islands has now been completed (Kikiloi NWHI Artifact Collections Database 2009). For this study, a range of traditional Hawaiian archaeological artifact classes has been employed based on ethnographic, historical, and presumed functions (cf. Field 2003). These artifacts

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[106] Mislabeled as “cup mortars,” these small smoothly ground cup shaped items, were crafted to be held in one’s hand. The base is roundly conical, and very smooth. The rim is convex but highest on the inside. In the central portion of is a small hole. This hole was used to put “bait” in to burn as it is related to ceremonies of sorcery and Hawaiian spirituality. It was a process of calling back ancestral spirits from the afterlife to do their bidding.

include: stone materials such as broken and whole adzes, adze preforms, basalt flakes, hammerstones, modified and unmodified basalt, ground stones, sorcery cups, stone bowls, exceptionally detailed anthropomorphic stone images, a stone bird perch, and coral used as ritual offerings in heiau construction and use; organic material from excavations that produced samples of introduced flora including an assemblage of charcoal remains (charred wood recovered from hearths and midden deposits), ipu fragments (gourds; *Legenaria siceria*), kukui nuts (candlenut tree; *Aleurites molaccana*), wiliwili wood (*Erythrina sandwicensis*), and ulu wood (breadfruit tree; *Artocarpus altilis*); marine and terrestrial faunal material such as leho (cowry shells; *Cyprea* & *Conus sp*.), tortoise shell fragments, and bird bone awls. These cultural materials provide evidence of a host of activities that include subsistence activities such as fishing and gathering of marine resources, cultivating dry land crops; food processing and preparation, cooking, and water collection and storage; manufacture or maintenance of stone tools and fishing gear; and ritual activities, including religious ceremony and burial of the dead. There remain challenges to the study of these artifacts, their archaeological contexts are sometimes uncertain and associated proveniences of certain materials were not recorded, particularly for those recovered during early archaeological investigations (Emory 1928). This is not surprising given the lack of time depth associated with Hawaiian prehistory when this work was done. Despite the abundance of materials collected from Nihoa and Mokumanamana, they have somewhat inconsistent and imprecise radiocarbon age determinations. Thus, prior to this research the timing and duration of colonization of these islands remained poorly known. The archaeological

sites and their materials will be discussed in greater detail to understand settlement patterns and chronology in this chapter.

Settlements Patterns for Nihoa and Mokumanamana

A settlement pattern approach is utilized in archaeology where individual features and sites are examined and interpreted in the context of a larger settlement landscape. Socio-political land use informs our understanding of Hawaiian social, political, and economic organization and adaptations of chiefdoms to various ecosystems (Kirch 1985; Weisler and Kirch 1985; Field et al. 2010). This approach assumes that the way in which human populations disperse themselves over and across islands and their landscapes is purposeful, and a response to many social and environmental factors. In the main Hawaiian group, the ahupua'a is the basic sustainable social-political land unit under direct control of the chiefs. Nihoa and Mokumanamana provide a maximum population estimate (200 people) that would make these islands a comparable settlement unit to an ahupua‘a.[107] We can also examine the structure and organization of settlement space within these two tiny remote islands of the main Hawaiian group. There are more than 140 structural features and site complexes that make up the archaeological landscape of Mokumanamana and Nihoa. They are broadly grouped into several functional classes including: (1) habitation features, across a spectrum of use that ranges from temporary to permanent (Rosendahl 1972), associated with domestic life, such as dwelling spaces for living, cooking, and specialized activities; (2) ritual features that are designated for worship, sacred rites, interment of the dead, and religious activities; and (3) resource

[107] Nihoa and Mokumanamana Islands have a rough approximation of population that can range anywhere from 60-200 people (Emory 1928; Cleghorn 1988; Davies 2009) depending on housing counts (170-200 people), carrying capacity of food (100+ people), carrying capacity of calories (1000+ people), and availability of water from local resources (20-60 people).

procurement, production and craft specialization areas that supported economic and subsistence activities. These broad categories help to provide a framework for discussions of variation and spatial patterns exhibited in each island study area. This will aid in understanding the different functional and integrated roles these small remote and isolated islands played in the northwest region of Hawai‘i.

On Nihoa Island there are a total of 89 archaeological sites including those used for temporary habitation, semi-permanent residence, ritual use, and agricultural production (Table 5.1). These sites include: 18 exceptionally well-constructed open habitation sites with massive dry laid stone platforms, averaging 30 m^2 in area, and are up to 3 m in height (20% of sites); 24 cave and open shelters that served as zones of habitation with protective walls to close them off from the elements (26% of sites); 18 ritual sites and smaller shrines on the ridge tops and within the protected valleys that have smaller stone foundations, with dramatic single linear arrangements of upright stones, and coral scattered on the surface (20% of sites).

A calculation of total ritual area versus habitation area shows that approximately 963 m^2 of the tiny island was dedicated to religious purposes and 886 m^2 was dedicated to habitation purposes. This represents a nearly even distribution between ritual and secular use of the island. Although comparative data are hard to come by, for most other areas in the main Hawaiian Islands, the distribution between secular habitation surface area and sacred, ritual surface area would be skewed towards the former (even taking into account the construction of large heiau on these islands). Areas on Nihoa not designated for domestic and ritual purpose were put into dryland agricultural food production with approximately 9 complexes of dry laid stone-faced terraces covering an extensive area of

65 ha (650,000 m^2; approximately ~10% of the land area). The island's soil is rocky loam that is enriched with organic material and bird guano and would have been ideal for crop growth. Human burials were also previously identified on the island (both adults and children) and there are about five of cairns that likely contain additional burials. The presence of burials suggests an effort to establish semi-permanent settlement of the island that likely included land use rights.

Table 5.1. Attributes of Nihoa Site Complexes by Locations

Attributes	West & West Palm Valleys	Miller & Middle Valley	Middle-East Palm Ridge	East Palm Valley	East Valley	Totals
No. of Sites	8	21	17	25	18	89
Habitation Sites						
Residential Sites	0	3	4	8	3	18
Open Shelters	0	1	4	2	0	7
Cave Shelters & Overhangs	1	5	1	2	7	16
Total Area	14 m^2	169 m^2	160 m^2	438 m^2	105 m^2	886 m^2
Religious Sites						
Temples	3	6	0	4	2	15
Shrines	0	2	0	1	0	3
Total Area	272 m^2	301 m^2	0 m^2	275 m^2	115 m^2	963 m^2
Burial Sites	3	0	1	0	3	7
Agricultural Sites	1	3	7	7	2	20
Lithic Production Sites	absent	present	absent	present	absent	n/a
Unknown Function	0	1	0	1	1	3

*Total area for habitation sites were taken from: (1) an average of 13.4 m2 per cave and applied per the number of caves in each section of the island; and (2) and average of 11.4 m2 per open shelter and applied per number of shelters in each section of the island. Final calculations were rounded to the nearest number.

Nihoa's artifact collections consist of mostly utilitarian items that represent a wide range of domestic and subsistence activities (i.e., adzes, preforms, hammerstones, adze materials, ground stones), and also some prestige ritual items – primarily 'sorcery cups' used by kahuna or the priest class for ceremonies (n=2). Also present were a range of unique stone vessels made of vesicular basalt that demonstrate some degree of thickness and standardization, but range in size and shape from large bowls, jars, pots, and dishes (n=27). These vessels reflect a considerable amount of investment in craftsmanship (Brigham 1901: 54-55; Cleghorn 1988: 43), transport, and manufacture. These vessels are evidence of settlement permanence as water storage devices and were capable to holding liquids ranging from 250 milliliters to nearly 18 liters. As such they likely reflect religious leaders' commitment towards recurrent occupation (Emory 1928: 46, 114). Specific areas in the Middle and East Palm valleys on the island have some evidence of lithic craft production and possibly specialization with hammer stones, adze preforms, and ground stones recovered. Overall, the archaeology of Nihoa reflects a wide range of human activities: domestic or habitation related practices associated with households, ritual practices associated with religious organization, and subsistence and procurement efforts associated with food and plant production, fishing, bird collection, and shellfish gathering. Both domestic and ritual activities were of primary importance, however a number of other activities were also present that went beyond these two components. The number and occurrence of a variety of sites and cultural materials indicate the island was used in all dimensions of human occupation. I suggest further that groups occupying Nihoa pushed towards establishing a more permanent and sustained

presence on the island moving towards actual settlement rather than intermittent use (Figure 5.1).

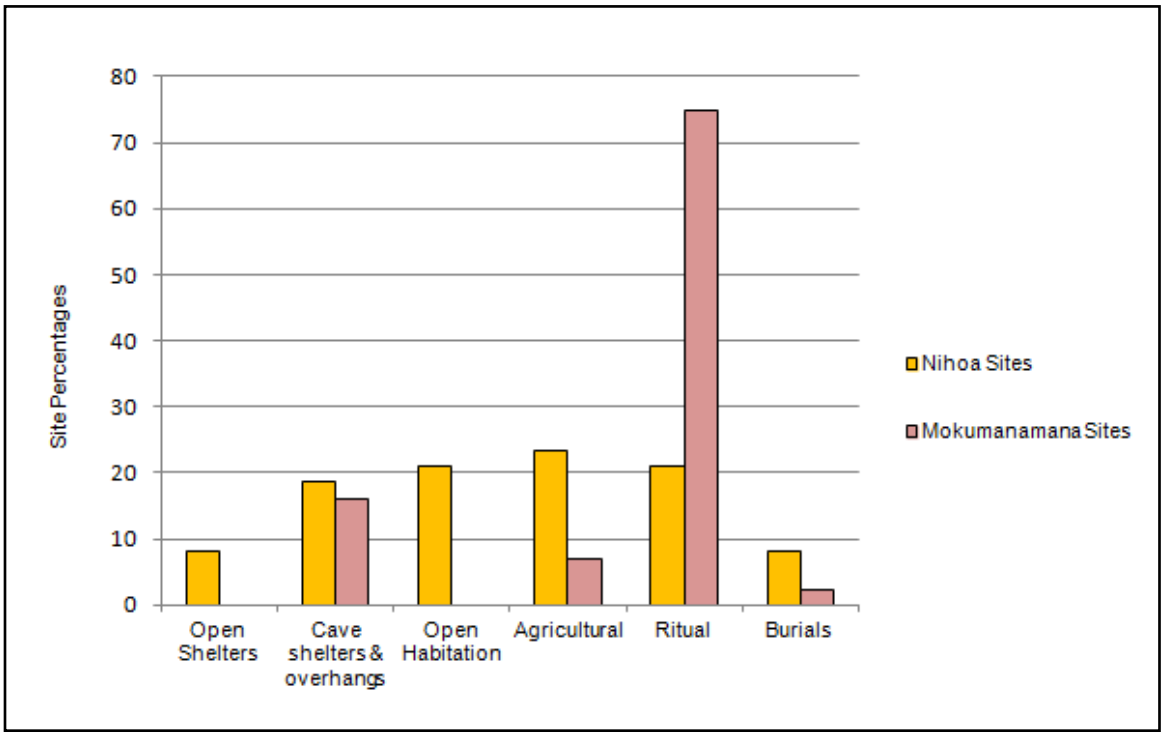

Figure 5.1. Comparison of Settlement Patterns of Nihoa and Mokumanamana

The Nihoa island topography is shaped like an amphitheater, with the island's surface exhibiting a steep southward slope of 23°. The back north side of the island drops to a cliff 900' asl that provides shelter to the island from the prevailing trade winds. The island has several ephemeral streams contained within south-flowing drainages across the island with three fresh water seeps at the bottom of the stream channels. Minimal sediment is deposited on Nihoa except in the drainages due to steep topography (Clapp et. al 1977; Emory 1928; Palmer 1927). The settlement pattern on Nihoa shows

approximately five sections generally divided by each major valley and also including a central ridgeline extending down the center of the island on a north south axis (Figure 5.2).

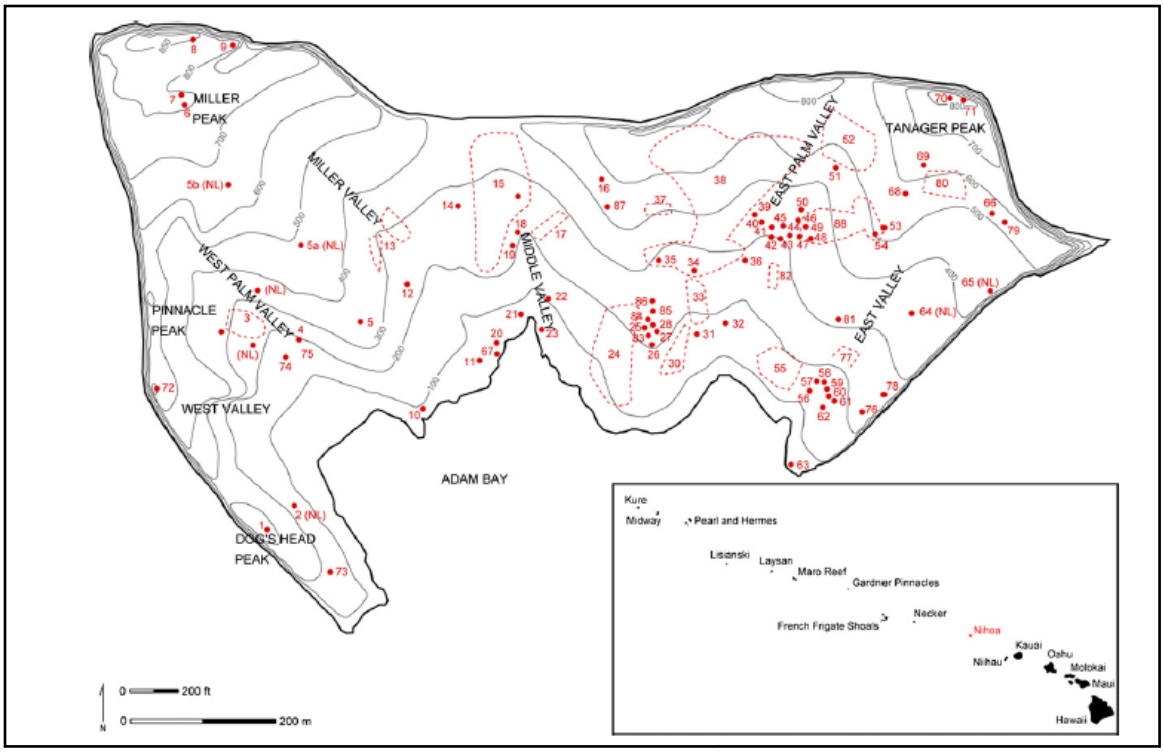

Figure 5.2. Map of Archaeological Sites on Nihoa Island

The first area is West-West Palm Valley which includes a total of 8 sites. The largest heiau on the island named Niniʻōʻā (50-Nh-01) is located in this section of the island on a promontory called "dog's head," and is the most prominently located complex with view planes from the eastern ridge lines where habitation complexes are positioned. Another large heiau (actually recorded as two sites 50-Nh-74, -75) is located at the base of the West Palm valley overlooking Adam's Bay. In this section were three burial sites

were located, along with a single habitation cave and a small terraced area for agriculture. The second area includes Miller and Middle Valleys and has 21 sites including nine habitation sites (consisting of open habitation sites, open shelters, and cave shelters), six major temples, and two shrines on the top of Miller's peak. Three large agricultural areas are located on the top plateau of this section, as it is the flattest portion of the island with significant soil development. The third area is the ridge dividing Middle Valley and East Palm Valley that has approximately 16 sites. Clustered on the spine is a site complex named "Middle-East Palm Ridge Complex" consisting primarily of intermixed open habitation sites and open shelter sites. The area is relatively exposed to the winds, but with a commanding view of the bay. There are no ritual sites in this section, a single burial was previously identified, and the slopes are terraced with seven medium-sized agricultural areas.

The fourth area is East Palm Valley with 26 sites primarily focused on habitation. A site complex located in the interior of the valley named here the "East Palm Valley Habitation Complex" includes six well-constructed, larger, open habitation sites with high retaining walls that reflect a considerable amount of labor investment. This area was likely the main residential area for small groups that would have visited the island for varying durations of time. Also the cultural materials recovered from these sites document a number of activities regarding subsistence and ritual use. Four major heiau sites as well as two cave habitations are intermixed within this cluster. A few sites are located outside the complex including a residential site and open shelter on the upper ridgeline defining the edge of East Valley, as well as a single shrine on the top of Tanagers Peak. There are also seven medium-sized agricultural areas on the slopes in

this section of the island. Finally, the fifth area is East Valley with 18 sites primarily focused on cave or rock-shelter based habitation. The lower coastal portion of this area has a site complex called the "East Valley Overhang Shelter Complex" that includes four cave shelters and three open habitation sites (platforms) intermixed and tightly clustered on a ledge with a protected overhang overlooking the eastern portion of Adam's Bay. Based on the materials recovered it was determined that marine activities were of primary focus at this complex. Adjacent to the complex are two small-sized agricultural areas. Two temples are also located in this area, one on the point that extends into the bay, and another on the eastern edge of the island, along with three burial cairns. Overall, Nihoa supported considerable number of habitation sites most of which are situated on the eastern end of the island. Temporary habitation sites (i.e., cave shelters, open shelters) are clustered in Middle and Miller Valley, Middle-East Palm Ridge, as well as East Valley. More permanent open habitation sites are located primarily in East Palm Valley. Ritual sites, which occurred in similar numbers to habitation sites, are dispersed and spread relatively evenly throughout the sections of the island.

On Mokumanamana Island there are a total of 52 archaeological sites (Table 5.2). These sites include: 33 ritual sites (63.5% of total sites), each consisting of a central platform foundation averaging 82.5 m^2, with a smaller low rectangular ahu that supports a series of upright stones; 7 habitation shelters that average 13.5 m^2 (caves which showed clear signs of occupation; 13.5% of total sites) and 12 rock outcrop modifications of unknown function (23% of total sites). A calculation of total ritual area versus habitation area shows that approximately 2,723 m^2 of the tiny island was dedicated to religious purposes, while only 108 m^2 was dedicated to habitation purposes. This represents an

extremely uneven distribution of ritual and secular use of the island, and the area devoted to ritual on Mokumanamana is threefold larger than the ritual area developed on Nihoa despite the considerably smaller size of Mokumanamana. The island does not provide for the same agricultural potential as that of Nihoa, as it is characterized by poor soil development and has substantial areas of exposed bed rock.

Table 5.2. Attributes of Mokumanamana Site Complexes by Locations

Attributes	NW Cape	Annexation Hill	Flagpole Hill	Summit Hill	Bowl Hill	Totals
No. of Sites	4	10	21	3	14	52
Habitation Sites						
Cave Shelters & Overhangs	2	1	1	0	4	7
Total Area*	27 m^2	13.5 m^2	13.5 m^2	0	54 m^2	108 m^2
Religious Sites						
Temples	1	8	18	2	4	33
Total Area	42 m^2	603 m^2	1506 m^2	146 m^2	426 m^2	2723 m^2
Agricultural Sites	0	0	2	1	0	3
Lithic Production Sites	absent	absent	absent	absent	present	1
Unknown Function	1	1	0	0	5	7

*Total area for habitation sites were taken from an average of 13.5 m^2 per cave and applied per the number of caves in each section of the island. Final calculations were rounded to the nearest number.

There are however, three areas (50-Nk-44, -45, -47) that might have had supported food production efforts at any given time totaling approximately 25 terraces (estimated total area of 7,315 m^2).[108] Establishing dryland terraces for food production was likely a precautionary tactic because of the possibility of being temporarily isolated on the island. It is unlikely that these fields could have produced much food as the island setting is windswept, presenting a problem for retention of soil moisture. One set of human remains were recovered from the Bowl Cave habitation site (Emory 1928). The predominance of ritual sites in relation to temporary habitation suggests that the island settlement was focused on ritual practices (Figure 5.1).

Mokumanamana's artifact collection consists of a smaller range of utilitarian artifacts, and a number of highly crafted anthropomorphic stone images, also known as ki'i. This particular style of stone image is unique to Hawai'i in the sense that they are crafted to have full body lengths that are proportional to their heads. They also have attributes of a very detailed relief carving and shaping done to their heads and faces that are not seen in other places in Polynesia. Ritual objects such as the finely crafted anthropomorphic stone images (n= 14) and a sorcery cup (n=1) were collected from surface contexts on or nearby the central heiau (50-Nk-12) on Annexation Hill. Bowl Cave (50-Nk-40) was the primary habitation locale where a number of utilitarian items such as include basalt adzes and preforms, awls and cutting tools, hammerstones, ground stones, net or octopus lure sinkers, and stone vessels were recovered. Together, these assemblages indicate a more limited set of activities took place for specific types of

[108] The agricultural sites were recorded by the Tanager Expedition (Emory 1928), but some were heavily impacted or destroyed by bombing during WWII.

economic, subsistence, and ritual purposes. Most of these items have counterparts on Nihoa and the main Hawaiian group, but the stone images are much more stylized and refined than even other examples from the Hawaiian Islands (Cleghorn 1988). These stone images represent a large investment of energy to manufacture and were likely used for sacred ritual ceremonies. It has been suggested that artisans from both islands likely fashioned these items from local stone resources (i.e., stone vessels from sub-rounded vesicular basalt beach rocks, hammer stones from water worn pebbles; ground stones, files, awls, and adzes from fine-grained basalt dike stones (Emory 1928). Overall the narrow range of materials and absence of habitation investment suggest that people came to the island for recurrent use (rather than occupation), as there would have been severe limitations and constraints in sustaining a population of people over any duration of time.

Mokumanamana Island is shaped as a sharply rising ridge of volcanic bedrock consisting of remnants of a volcanic cone (Palmer 1927: 22). The island is made up of basically two parts- one principal ridge running nearly due east and west; and a northwest cape that hooks back towards the northeast direction. The main ridge has four alternating rounded crests with three shallow saddles in between. The crests and peaks of the ridge are of hard rock substrate with steep slopes and little or no vegetation. The saddles support a few plants established in the shallow soils. There are no definite stream water runoff drainage channels and surface water from rain either sinks into the rocks or drains through unorganized channels. All of the temple sites on the island are clustered on either the Northwest Cape or the four main crests and their adjacent saddles that run east-west on the principal ridgeline- Annexation Hill, Flagpole Hill, Summit Hill, and Bowl Hill (Figure 5.3). Flagpole Hill (and adjacent saddle areas) have the highest density of

heiau temple sites (n=21) and heiau site 50-Nk-12 appears to be the central temple based on its location and its unique stylistic morphology. Most of the stone images were recovered from this temple (Emory 1928). Habitation shelters are situated primarily on the interior slopes above the bay: on the north face of the main ridgeline and also on the south ridgeline of the northwest cape. The three potential agricultural areas are located within the saddles between Flagpole-Annexation, Annexation-Summit, and Summit-Bowl crests. There was one workshop located in the saddle of Bowl Hill where a cache of 30 large water worn stones had been transported from the shoreline for crafting of ritual anthropomorphic stone images and potentially as large hammer stones to quarry slabs of dike material (i.e., for adzes).

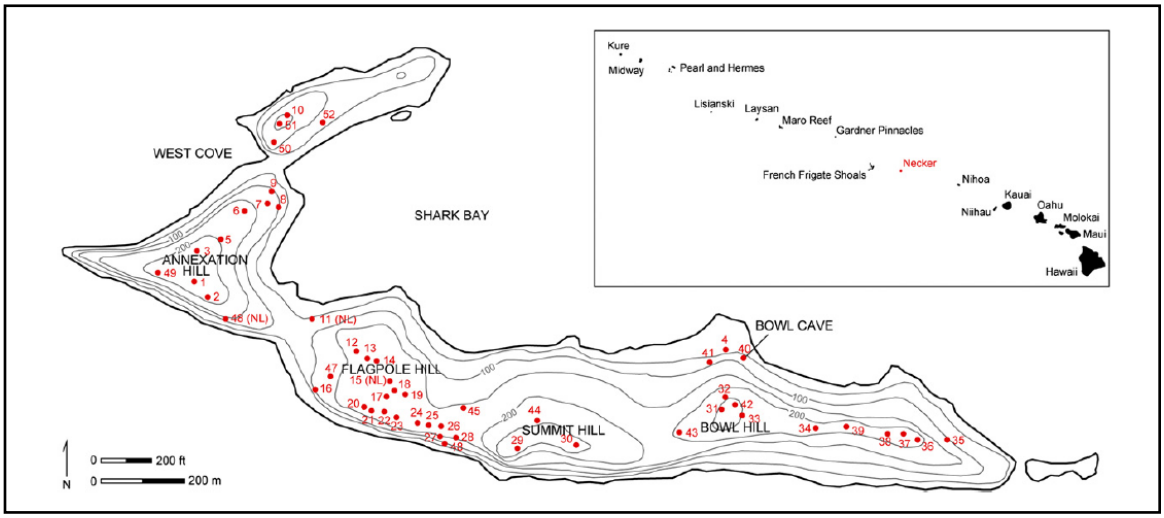

Figure 5.3. Map of Archaeological Sites on Mokumanamana (Necker) Island

Nihoa and Mokumanamana shared a common history but exhibit contrasting settlement patterns that can aid in understanding the different roles these islands played in the past (Table 5.1; Figure 5.1). The even distribution of site functional classes and extensive agricultural zones on Nihoa indicate that there was a larger range of more diversified in activities on the island that reflected investment in subsistence and habitation. Ritual appears to be significant but does not exceed the effort or area devoted to the construction and use of habitation sites. Human effort and investment went into building up the eastern portions of the island with a large number of temporary habitation caves and shelters, as well as the larger stone foundations of open habitation sites. Also the presence of several areas devoted to dry-land agriculture with a total area many times larger than the combined ritual and habitation areas suggests a level of food production investment for more permanent (or longer term occupations) that would have been supported by more abundant and reliable food supplies. Mokumanamana shows a much more limited number of site classes, as ritual sites make up the majority of sites on the island. The number of ritual sites dwarfs habitation sites by a factor of 3 to1, and the areas dedicated to ritual activities are more than 25 times larger than areas devoted to habitation. Also there is a noticeable absence of drylaid rock terraced residential sites located in open areas on Mokumanamana. This suggests that the focus was primarily on the ritual use of the island and little effort went into building permanent structures for longer term residence. Instead, caves were converted to temporary shelters and used for habitation over shorter durations. For comparison, 8 times more area was dedicated to habitation on Nihoa than on Mokumanamana. Conversely, about 3 times more area was dedicated to ritual on Mokumanamana than on Nihoa.

The investment strategically placed into both islands as a coupled settlement unit and the distance of both from the main Hawaiian group suggests that the occupation and/or settlement of these islands would have been funded and subsidized in part by the elites (ali‘i) and that this investment likely reflects the considerable religious and political value placed on the islands by high chiefs in their effort to secure Nihoa as a staging ground for the ritual use of Mokumanamana as an island temple.

Establishing a Settlement Chronology

Establishing a temporal framework regarding the colonization and settlement of Nihoa and Mokumanamana was of primary importance for this research. Most of the hypotheses and speculations about the islands have been done in the absence of a reliable chronology. Previous efforts to date samples from Nihoa and Mokumanamana were problematic and resulted in inconclusive results. On Nihoa, two radiocarbon dates came from a single split sample from a bluff shelter (50-Nh-60) that yielded two disparate ages: 520 ± 200 bp (M-480) and 890 ± 90 bp (GAK-754). These two date intervals barely overlapped at two standard deviations (Rainwater 1958). One of the laboratories (Gakushuin) is widely known for inconsistent dates during this time, likely the result of contamination and insufficient sample treatment. Others have suggested their results are unreliable (Kirch: 1984: 73; Wilmhurst et al. 2010; Anderson and Spriggs 1993). Hunt (1992) provided a single date (BA-57857 255 ± 60 bp) on charcoal recovered from a stone slab-lined hearth at the base of excavations at an open habitation site (50-Nh-42). When calibrated this samples dates to between A.D. 1463-1694 (at two standard deviations). For Mokumanamana, two samples were found in the lower levels of a single rockshelter (50-Nk-40, “Bowl Cave”) and submitted for radiocarbon dating. A piece of

charcoal was placed at 166 ± 200 bp (uncorrected); and a piece of wood produced a modern date of less than 250 bp. For this latter, modern date, Emory explains it as the result of contamination during storage on an open shelf (Libby 1954:742). Cleghorn (1988:44) has sorted through these dating problems and provides two interpretations for the discrepancies. For Nihoa, he provisionally suggests the island has an occupation span from A.D. 1000-1700. For Mokumanamana, he suggests that the island occupation span was either very late (i.e., post A.D. 1700) or earlier (A.D 1500-1600).

Building a reliable and more precise settlement chronology for these islands began with gaining access to existing materials in the collections of the University of Hawai‘i at Manoa Archaeological Laboratory and the Bishop Museum. This research took into account the sensitivity of the existing archaeological record and placing a renewed importance of utilizing past collections as a viable means in which to study these islands. As a result the field work component did not include any additional excavations that would impact the archaeological sites. I recognized the tradeoff would likely be a loss in regards to the resolution of the chronological questions, particularly for Mokumanama where little excavation had been undertaken. A portion of the datable samples for both islands came from excavations done by the Bishop Museum Tanager Expedition in 1923-24, with little or no evidence that the recovery was systematic with respect to the vertical provenience of the samples. In order to compensate for this, all available samples from these excavations were dated making it more likely to encompass more of the span of time represented in each site area. The Bishop Museum had in its possession three additional specimens from Nihoa with no recorded provenience

including a netting shuttle (50-Nh-58; cave shelter), gourd fragments (50-Nh-58), and a canoe tiller (50-Nh64; cave shelter) (Figures 5.4-5.6).

The Bishop Museum had a total of eight specimens for Mokumanamana Island: five kukui nuts (BM# INV.625a-e), a wooden fragment (BM# INV. 626) from the main habitation site, Bowl Cave (50-Nk-40); a kukui seed coat (BM# 306.11), and a unidentified seed mislabeled "kukui seed coat" (BM# 306.10) from a ritual temple site that was later severely impacted during the WWII bombing (50-Nk-13) (Figures 5.7-5.14).

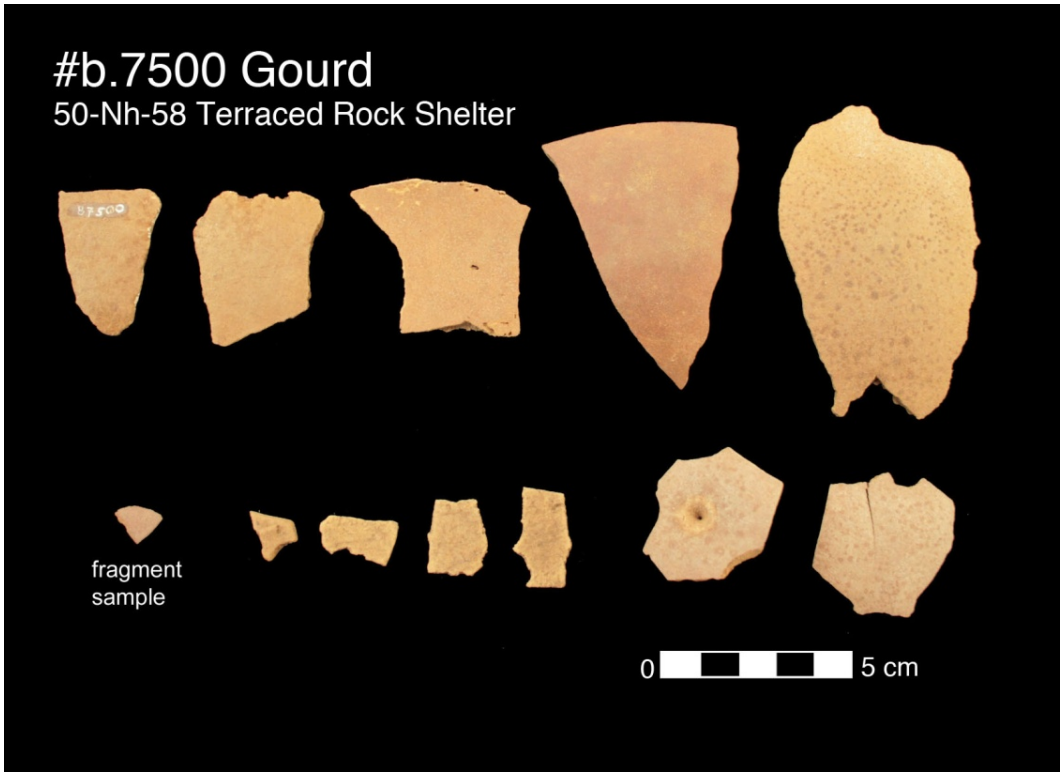

Figure 5.4. Gourd (ipu; Lagenaria siceraria) Collected from Nihoa Island Site 50-Nh-58, a Terraced Rock Shelter in the East Valley Overhang Shelter Complex. Bishop Museum Collections.

Figure 5.5. Breadfruit (ulu; Atrocarpus altilis) Canoe Tiller Collected from Nihoa Island Site 50-Nh-64, a Cave Shelter in the East Valley Just Inland of the East Valley Overhang Shelter Complex. Bishop Museum Collections.

Figure 5.6. Kauila (Alphitonia ponderosa) Hardwood Netting Shuttle Collected from Nihoa Island Site 50-Nh-58, a Terraced Rock Shelter in the East Valley Overhang Shelter Complex. Bishop Museum Collections

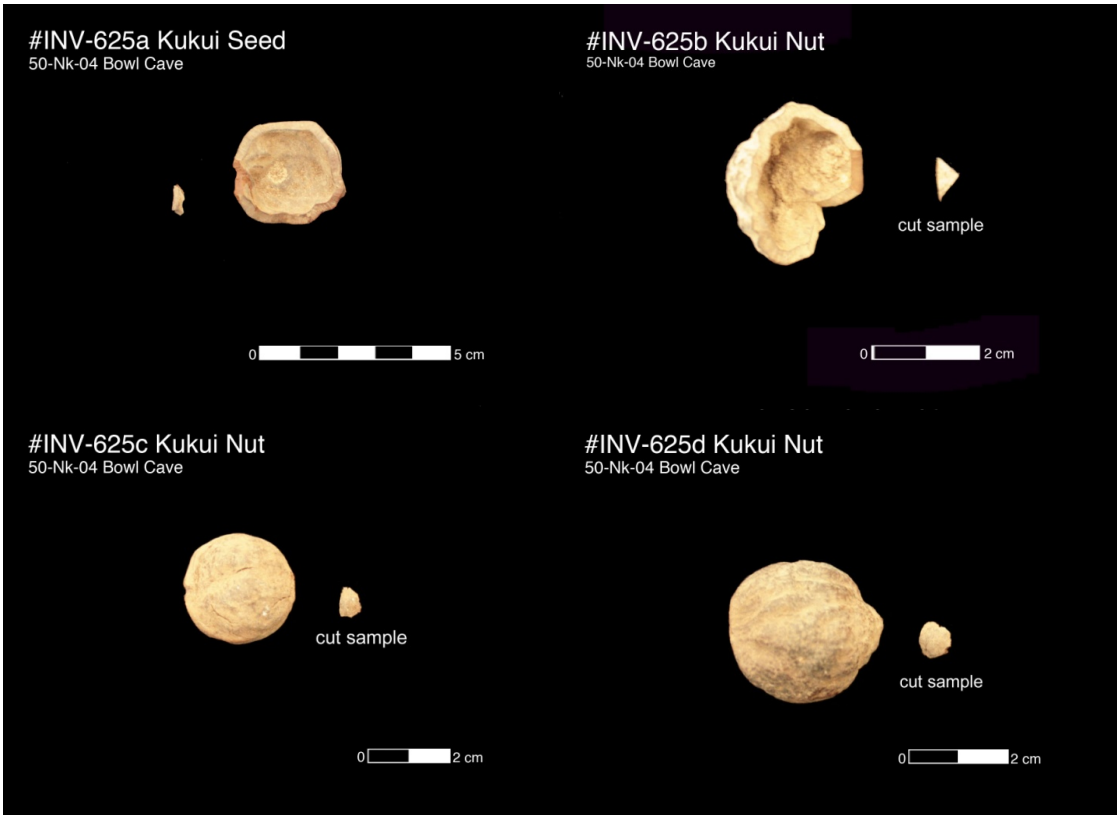

Figure 5.7-5.10. Candlenut (kukui; Aleurites moluccana) Collected from Mokumanamana (Necker) Island Site 50-Nk-04 Called Bowl Cave, a Habitation Cave on the Interior Bay Side of Bowl Hill. Bishop Museum Collections.

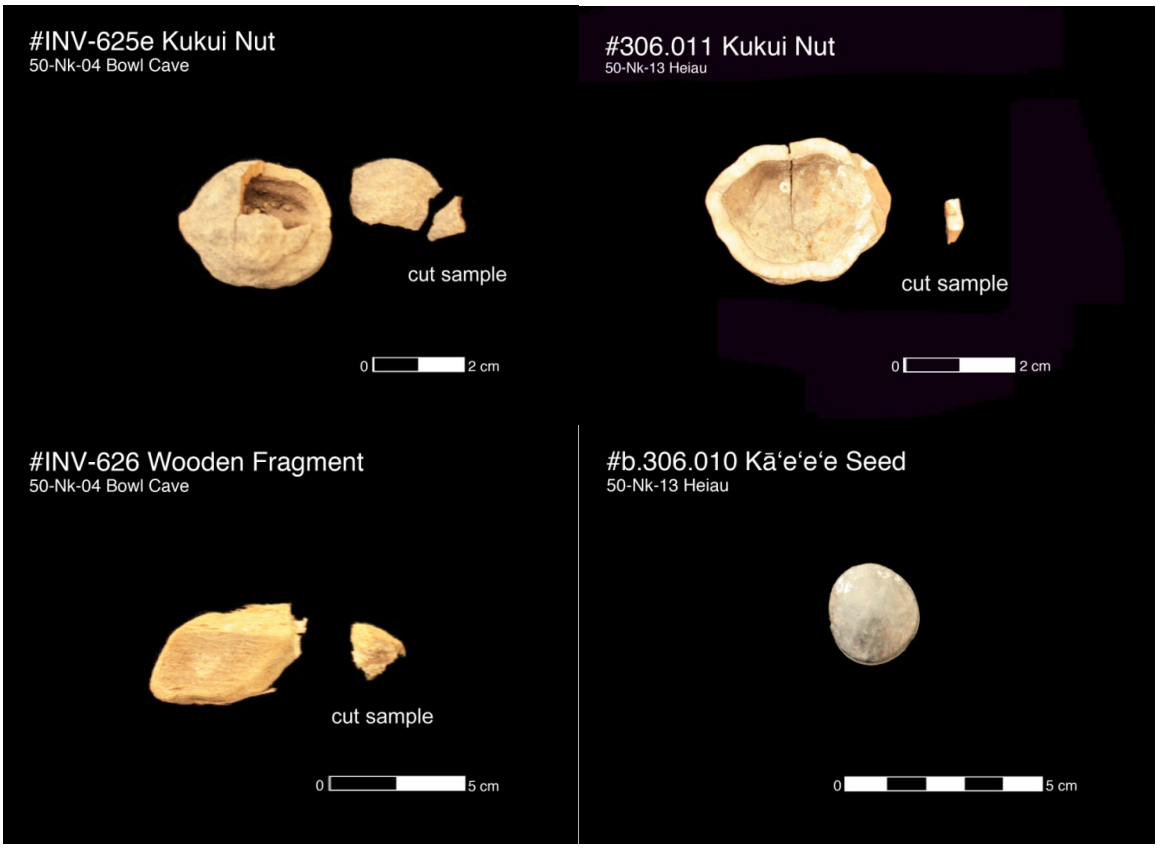

Figure 5.11-5.14. Candlenut (kukui; Aleurites moluccana) Collected from Mokumanamana (Necker) Island Site 50-Nk-04 Called Bowl Cave, a Habitation Cave on the Interior Bay Side of Bowl Hill. Also a Wooden Fragment from the Same Cave Identified as Breadfruit (ulu; Arocarpus altilis). Bishop Museum Collections.

The other collection of datable samples came from excavations done by Hunt (1992) during field work on Nihoa twenty years ago.[109] In the collections were bulk charcoal samples recovered from a variety of contexts, collected from eight different sites (50-Nh-19, -24, -25, -41, -42, -55, -57, -58) including temporary habitation shelters, open habitation structures, and agricultural features.

[109] These charcoal remains were recovered from re-excavated sites, from what was thought to be areas not previously dug, near fire hearths (Hunt 1992).

A total of 23 samples of carbonized plant material and organic specimens were selected for radiocarbon dating for Nihoa (n=15) and Mokumanmana (n=8) from the available materials in the collections. Samples were identified by Gail Murakami from International Archaeological Research Institute, Inc. (IARII) using Hawaiian botanical reference materials. Further discussion on the paleo-botanical identifications results will be presented later in this chapter. Through this identification process, short-lived taxa such as ʻāweoweo (*Chenopodium oahuense*) were selected whenever possible in order to avoid issues with in-built age or old wood effects (Dye 2000; Dye and Pantaleo 2010). In some cases however, longer lived taxa were selected because they were the only samples available for dating. Additional samples included artifacts specimens of Polynesian introduction such as the ipu gourd (*Lagenaria siceraria*), kauila hard wood (*Alphitonia ponderosa*), wood from breadfruit (*Artocarpus altilis*), wood and nuts from kukui (*Aleurites moluccana*), as well as an uncommon native seabean vine (*Muscuna gigantean*), and an unidentified piece of cordage. For Polynesian introductions such as the ipu gourd, inbuilt age was not of concern. Samples were dated though accelerator mass spectrometry (AMS) radiocarbon dating at two laboratories- Beta Analytic, Inc. and the National Ocean Sciences Accelerator Mass Spectrometry Laboratory (NOSAMS). Results from both laboratories are presented in Table 5.3.

Table 5.3. Calibrated Radiocarbon Dates from Habitation, Residential, and Agricultural Features for Nihoa; and Habitation and Ceremonial Features on Mokumanamana. Underlined dates reflect 2σ calibrated age ranges, while bolded dates reflect combined probabilities that are 80% or greater.

Lab No.	Location	Type	Site	Provenience Layer and Level	Material	Measured Radiocarbon Age	$^{13}C/^{12}C$ Ratio	Conventional Radiocarbon Age	Calibrated Age Range B.P (2σ)*
BA-300413	Nihoa	Habitation	Site 19	none	aheahea	280 +/- 30 BP	-21.3	340 +/- 30 BP	**1470-1640 (95.4%)**
BA-300414	Nihoa	Agriculture	Site 24	2.1	aheahea	180 +/- 30 BP	-24.2	190 +/- 30 BP	**1648-1694 (22.3%)** **1727-1813 (53.5%)** 1918-1955 (19.6%)
BA-300415	Nihoa	Habitation	Site 41a	1.1	aheahea	190 +/- 30 BP	-23.4	220 +/- 30 BP	**1642-1684 (36.7%)** **1735-1805 (44.5%)** 1932-1955 (14.2%)
BA-300416	Nihoa	Habitation	Site 41b	2.2	aheahea	260 +/- 30 BP	-22.7	300 +/- 30 BP	**1520-1593 (27.8%)** **1619-1670 (52.8%)** 1780-1800 (12.6%) 1943-1954 (2.2%)
OS-95451	Nihoa	Habitation	Site 42c	2.3	aheahea		-25.9	430+/-25 BP	**1426-1490 (94.2%)** 1603-1609 (1.2%)
OS-95452	Nihoa	Habitation	Site 42d	2.4	aheahea		-22.2	385+/-25 BP	**1444-1523 (71.3)** **1574-1626 (24.1%)**
BA- (Hunt 1992)	Nihoa	Habitation	Site 42	2.4	not mentioned	230+/-60 BP	-23.4	255+/- 60 BP	**1463-1694 (67.0%)** **1727-1813 (21.3%)** 1919-1955 (7.2%)
BA-300417	Nihoa	Agriculture	Site 55	test	aheahea	160 +/- 30 BP	-21.6	220 +/- 30 BP	**1642-1684 (36.7%)** **1735-1805 (44.5%)** 1932-1955 (14.2%)
BA-300418	Nihoa	Habitation	Site 57a	1.2	aheahea	180 +/- 30 BP	-22.1	230 +/- 30 BP	1530-1538 (0.8%) **1635-1684 (44.4%)** **1736-1805 (39.0%)** 1935-1955 (11.2%)
BA-300419	Nihoa	Habitation	Site 57b	1.2	gourd	250 +/- 30 BP	-23.4	280 +/- 30 BP	1499-1502 (0.4%) **1513-1601 (54.2%)** **1616-1666 (38.4%)** 1784-1796 (2.3%)

Table 5.3 (continued). Calibrated Radiocarbon Dates from Habitation, Residential, and Agricultural Features for Nihoa; and Habitation and Ceremonial Features on Mokumanamana.

Lab No.	Location	Type	Site	Provenience Layer and Level	Material	Measured Radiocarbon Age	$^{13}C/^{12}C$ Ratio	Conventional Radiocarbon Age	Calibrated Age Range B.P (2σ)*
BA-300420	Nihoa	Habitation	Site 57c	1.3	cordage	240 +/- 30 BP	-24.9	240 +/- 30 BP	1526-1556 (5.4%) **1632-1682 (51.3%)** **1738-1751 (1.2%)** **1762-1803 (29.4%)** 1937-1955 (8.0%)
OS-95411	Nihoa	Habitation	Site 58	none	gourd		-21	325 +/- 30 BP	**1484-1644 (95.4%)**
BA-300421	Nihoa	Habitation	Site 58a	1.1		240+/-30 BP	-24.7	240 +/-30 BP	1526-1556 (5.4%) **1632-1682 (51.3%)** **1738-1751 (1.2%)** **1762-1803 (29.4%)** 1937-1955 (8.0%)
OS-95453	Nihoa	Habitation	Site 58b	1.2	aheahea		-23.1	435+/- 25 BP	**1425-1485 (95.4%)**
OS-95454	Nihoa	Habitation	Site 58c	1.3	aheahea		-24.2	400+/- 25 BP	**1438-1519 (82.5%)** 1593-1619 (12.9%)
OS-95633	Nihoa	Habitation	Site 64	none	ulu		-27.57	310+/25	**1492-1603 (73.2%)** **1614-1648 (22.2%)**
OS-94547	Mokumanamana	Habitation	Site 4	none	kukui		-21.9	165 +/- 25 BP	**1664-1697 (16.9%)** **1725-1815 (52.3%)** **1835-1878 (7.0%)** 1916-1954 (19.2%)
OS-94514	Mokumanamana	Habitation	Site 4	none	kukui		-25.2	150 +/- 30 BP	**1667-1709 (16.3%)** **1718-1784 (31.5%)** **1796-1890 (30.3%)** 1910-1951 (17.3%)
OS-94516	Mokumanamana	Habitation	Site 4	none	kukui		-25.7	380 +/- 25 BP	**1446-1523 (67.0%)** **1572-1630 (28.4%)**
OS-94517	Mokumanamana	Habitation	Site 4	none	kukui		-22.8	380 +/- 25 BP	**1446-1523 (67.0%)** **1572-1630 (28.4%)**
OS-94515	Mokumanamana	Habitation	Site 4	none	kukui		-19.2	410 +/- 25 BP	**1435-1515 (87.7%)** 1600-1618 (7.7%)

Table 5.3 (continued). Calibrated Radiocarbon Dates from Habitation, Residential, and Agricultural Features for Nihoa; and Habitation and Ceremonial Features on Mokumanamana.

Lab No.	Location	Type	Site	Provenience Layer and Level	Material	Measured Radiocarbon Age	$^{13}C/^{12}C$ Ratio	Conventional Radiocarbon Age	Calibrated Age Range B.P (2σ)*
OS-94518	Mokumanamana	Habitation	Site 4	none	breadfruit		-23.7	415 +/- 25 BP	**1433-1501 (89.1%)** 1507-1551 (0.7%) 1601-1616 (5.7%)
OS-94542	Mokumanamana	Heiau	Site 13	none	kukui		-24.9	190 +/- 25 BP	**1654-1687 (21.1%)** **1731-1809 (54.5%)** 1926-1954 (19.8%)
OS-95634	Mokumanamana	Heiau	Site 13	none	ka'e'e'e		-27.25	40+/-25 BP	1696-1726 (17.7%) **1813-1836 (12.4%)** **1846-1851 (1.1%)** **1876-1918 (63.4%)**

An OxCal plot of the probability distributions for these dates at 2σ is provided in Figures A.1-A.2 (see Appendix). In general, intervals of at least 80% probability distribution were utilized as the threshold for interpreting the available dates. The chronometric settlement chronology for Nihoa is developed here based on fifteen ^{14}C AMS dates that come from eight different sites including: habitation caves and rock overhangs (50-Nh-19, -57, -58, -64), open habitation sites (50-Nh-41, -42) and two agricultural sites (50-Nh-24, -55). The closed habitation sites (i.e., caves and rock overhangs) that are primarily located in the Middle Valley and the East Valley Overhang Shelter Complex have dates that occur throughout the sequence at 1σ from cal A.D. 1425-1805.

The open habitation sites that occur across the landscape but are closely clustered in the East Palm Valley Habitation Complex also have dates that range almost identically at 1σ from cal from A.D. 1426-1805. Additionally, Hunt's (1992) single published date (BA-57857) at 1σ of cal A.D. 1463-1694, 1727-1813 (98.3%) falls within this occupational sequence for residential structures. The agricultural sites surprisingly have dates that occur late within the sequence at 1σ for 50-Nh-24 at cal A.D. 1648-1694, 1727-1813 (75.8%); and 50-Nh-55 at cal A.D. 1642-1684, 1735-1805 (81.2%). Overall, the settlement chronology of Nihoa spans from A.D. 1425-1813 exhibiting a continuous sequence that extends past European contact. Rainwater's (1958) single "reliable" date (M-480) at 2σ of cal A.D. 1117-1950 continues to fall outside this sequence at the early end of its distribution. This single anomalous date lacks precision when calibrated as the bulk of its probability distribution is associated with the earliest intervals. The absence of information regarding the sample identification, preparation, and analysis makes it

unreliable for inclusion in the settlement chronology. These dates suggest recurrent use of the island in terms of both temporary and permanent forms of investments over long periods of time.

The chronometric settlement chronology for Mokumanamana is developed here based on eight ^{14}C AMS dates that come from two sites- Bowl Cave habitation site (50-Nk-40) and a heiau temple (50-Nk-13) (Figure 5.15).

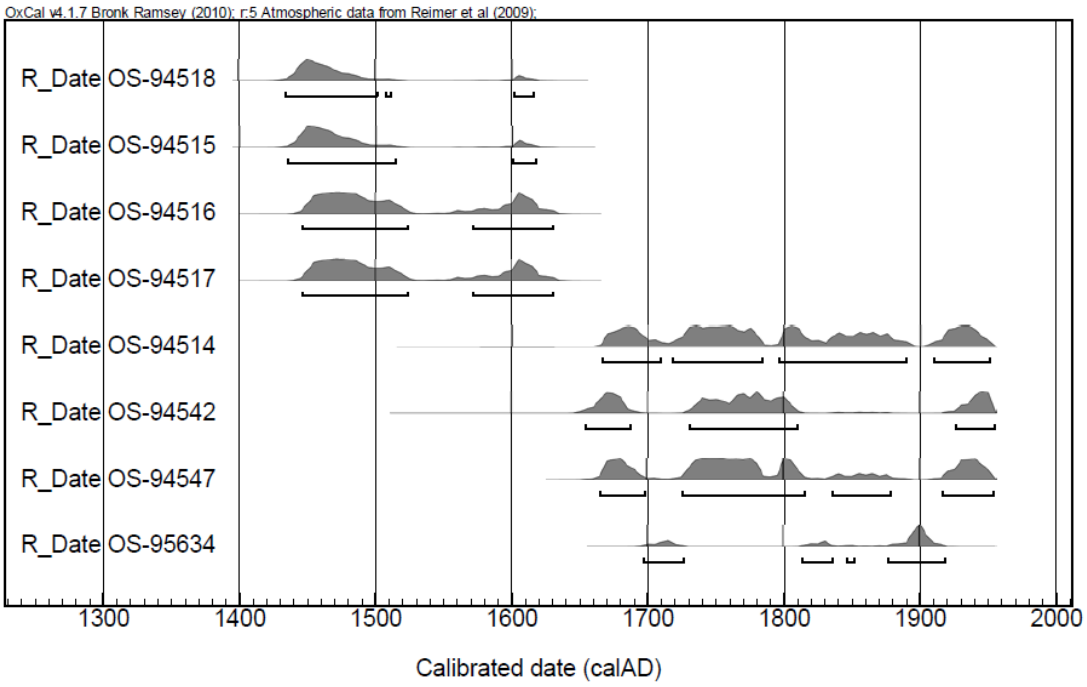

Figure 5.15. Calibrated Settlement Chronology for Mokumanamana (Necker) Island Calculated with OxCal 4.1.7 Using Atmospheric Data from the IntCal09 Curve. All dates are on habitation materials, except for two on materials from a heiau.

These dates likely do not encompass all of the island's prehistory given the minimal amount of excavation done at the two sites. Bowl Cave was the main habitation site for Mokumanamana as a majority of the cultural material and specimens were

recovered from this shelter. Also the only record of human remains from the island came from this cave. Samples from cave excavations show that it was occupied through a sequence of early and later intervals which at 2σ span: cal A.D. 1433-1501, cal A.D. 1435-1515, cal A.D. 1446-1523, cal A.D. 1446-1523, cal A.D. 1718-1784, cal A.D. 1725-1815.[110] The heiau temple site that provided the second set of dates is centrally located on Annexation Hill adjacent to what is thought to be the main heiau 50-Nk-12 (due to the concentration of stone images collected from it). Samples from this site produced late dates at 1σ of cal A.D. 1654-1687, 1731-1809 (75.6%), and A.D. 1813-1836, 1846-1851, 1876-1918 (85.9%). Interestingly the terminal date for occupation of this island extends well past early European contact, including the period of early nation-state formation period of Hawaiian history and also into the modern era. Libby's (1954) two modern dates also fit into this sequence. When calibrated at 2σ they range from cal A.D. 1439-1950 (166 ± 200 bp) and cal A.D. 1450-1950 (0 ± 250 bp). The settlement chronology based on these ^{14}C AMS dates are associated primarily with habitation features but within the context of ritual use of the island. The settlement chronology for habitation caves spans from A.D. 1433-1815, with extended sporadic visits into the early 1900's. The dated sequence supports the proposition that human occupation on MM reflected recurrent use rather than settlement.

The chronological results for both Nihoa and Mokumanamana should be assessed together as an aggregate because they share common histories and have varying yet integrated settlement patterns. The durations of time that are represented in the intervals

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[110] The netting shuttle of kauila wood came back as an anomalous date which may have been a result of contamination. The results of this AMS date will be excluded from the analysis.

of chronometric dates for both islands suggests a level of permanence in the settlement record that could have only been achieved from the mobility that voyaging would have provided in allowing populations to move to and from these islands. When combined, the regional chronology supports the view that there was recurrent use of this portion of the archipelago occurring from approximately A.D. 1400, continuing through European contact (post A.D. 1800), and periodically into modern times (post A.D. 1900). This represents a span of at least 400 years in which Hawaiians relied upon voyaging interactions and mobility between the northwest and the main islands to sustain human occupation. Mokumanamana fits well into this model of occupation (rather than settlement) as the interval and duration of dates, absence of open habitation sites, and limited number of cave shelters suggests a strategy of temporary and recurrent use. Nihoa on the other hand demonstrated characteristics that lean closer towards actual settlement, as it had a more diverse array of settlements with habitation caves, open habitation sites, ritual sites, and agricultural sites occurring across the landscape. Substantial investment is seen in the size and scale of open habitation sites which are signatures that typically identify elite residences. Finally, the late occurrence and scale of agricultural food production (i.e. dry land systems that cover most of the island) at approximately A.D. 1650 indicates that there may have been a push to keep specialists stationed on this island for longer durations. Given these differential patterns, it is likely that Nihoa functioned primarily as a support island and permanent staging place to support the ritual use of Mokumanamana. These results dispel previous assumptions or pronouncements that abandonment and/or extirpation of human occupation were the inevitable consequences for these islands' histories (Bellwood 1978; Cleghorn 1988; Irwin 1992; Kirch 1985).

Instead occupation was clearly a purposeful colonization strategy that allowed the islands to be used recurrently for longer durations of time. This regional chronology will be examined in greater detail with the inclusion of seriations and additional methods of chronometric dating.

Habitation Site Seriations- Expanding the Chronometric-Based Chronology

Building an ordinal-based sequence of open habitation site construction for Nihoa was an important step to understanding the overall settlement chronology for the island and the evolution of architectural design over time. When relative sequences are used in tandem with chronometric dating as an integrated chronology, it becomes a valuable tool for understanding change through time and across all of the groups. These open habitation sites were identified based on archaeological inference from observed features, and also based on the types of artifacts recovered from the sites. Morphologically some open habitation structures look like ritual structures, but were differentiated by the absence of ahu and stone uprights as well as ritual coral offerings. A total of 15 residential sites were documented and were analyzed using the method, seriation, which uses stylistic traits in artifacts to order or arrange those artifacts. Seriations can be employed to establish patterns of change through time and can be applied to structures such as heiau (temples) in Hawai‘i (Kikiloi 2002; Graves and Abad 1996, Mulrooney and Ladefoged 2005; McCoy et al. 2011), marae (ritual structures) in the Society Islands (Cochrane 1997, 1998, 1999), and residential architecture in Hawai‘i (Graves et al. 2002; O’Conner et al. 1998). When properly developed (with stylistic traits) and applied (to materials from a local area and of the same functional class) it is possible to create a relative chronology. For Nihoa open habitation features seriation of design traits may

track the sequence over which these features were constructed on the island. Additionally, seriation can provide a means with which to track social interaction and the movement of people from one area to the next (Cochrane 1996:22). Thus, there may be spatial relations revealed or suggested by seriation analyses.

There are seven architectural traits for Nihoa residential sites recorded as present or absent. These traits were taken and adapted from previous studies originally applied to Hawaiian heiau temple architecture (Graves and Cachola-Abad 1996: 23; Kikiloi 2002; Mulrooney and Ladefoged 2005; McCoy et al 2011) and later adapted to Hawaiian residential sites (O'Conner 1998; Graves et al. 2002). These eight traits include: (1) Walls, (2) Retaining Walls,(3) Flushed Perimeters, (4) Notching, (5) Interior Features, (6) Raised Surfaces, and (7) Multiple Exterior Levels. All seven of these traits may occur independently fall within three structural dimensions: A) Perimeter; B) Interior; C) Exterior. Perimeter dimensions include: 1) Walls which are freestanding, two-sided, faced and both horizontally and vertically extended rock alignments that can either stand alone or be occur on top of retaining walls; 2) Retaining Walls which are horizontally and vertically elaborated rock alignments placed against a sloping landscape and faced on one side; 3) Flushed perimeters which are a perimeter designation that has no elaborations and is flush to the natural grade and topography; 4) Notching which refers to an inverted corner of an otherwise four-sided perimeter. Interior Dimensions were combined to include: 1) Interior features which are relatively small-sized internal structures and features located within the perimeter of heiau including but not limited to small platforms, walls, cairns, raised or lowered levels; and 2) Raised surfaces which consists of two or more different surfaces of different grades in the interior of the structure.

Exterior dimensions were combined to include: 1) multiple exterior levels which refer to two or more different surfaces of different grades outside the perimeter separate from the main structure.

Temporally sensitive traits that exhibited a continuous distribution were utilized to build a relative chronology. All of the attributes that were identified from residential sites displayed these temporally sensitive characteristics and included: (1) walls (alone and one retaining walls), (2) retaining walls, (3) flushed perimeters, (4) notching, (5) interior features, (6) raised surfaces, and (7) multiple exterior features. The seriation was ordered and refined until the trait distributions were continuous as a condition of the model. Additional information was observed and recorded including cupboards which were typically present in the corner of wall features. Also many of the residential sites had what was a "niho" (lit. tooth) perimeter which was the deliberate placing of stones upwards vertically at tend ends of retaining walls to give it an appearance of teeth. Finally, often times there would be uprights embedded at the ends of residential sites either in the wall or retaining wall or directly into the court, these seemed to be non-functional and non-structural and entirely stylistic. These additional observations did not order well however in the seriation and were conflated into the dimensions listed above. Certain features were not useful in distinguishing change such as walls (along and on retaining walls), as well as retaining walls that persisted throughout the temporal sequence. Both of these attributes appear to be present due to different functional reasons: walls to provide foundational support for wooden superstructures to be built on top them; and retaining walls to manage sloped terrain). Retaining walls were kept in the seriation however for continuity because it accounts for the only present attribute for

some residential sites. Table 5.4 shows the best-fit seriation for Nihoa residential sites which maximizes the temporal continuity of the features described above and minimizes the gaps.

The seriation of residential sites for Nihoa classified 15 residential foundations into nine temporal phases of settlement activity, demonstrating great variability in architectural classes (Table 5.4). These architectural forms evolve from highly variable structures to more simple structures in this general order: a) Ni-TU1: early notched platform structures with walls (alone or on retaining walls), retaining walls, and multiple exterior levels; b) Ni-TU2: notched platform structures with walls, retaining walls, interior features, and multiple exterior levels; c) Ni-TU3: notched platform structures with walls (alone or on retaining walls), retaining walls , flushed perimeters, interior features, and raised surfaces; d) Ni-TU4: platform structures with walls (alone or on retaining walls), retaining walls, flushed perimeters, interior features and raised surfaces; e) Ni-TU5: notched platform structures with walls (alone or on retaining walls), retaining walls, flushed perimeters and raised surfaces; f) Ni-TU6: notched platform structures with walls (alone or on retaining walls), retaining walls, , and flushed perimeters; g) Ni-TU7: platform structures with walls (along or on retaining walls), retaining walls, and flushed perimeters; h) Ni-TU8: platform structures with walls (along or on retaining walls), and retaining walls; i) Ni-TU- 9 platform structures with retaining walls and flushed perimeters. In general, the seriation was robust with all seven attributes demonstrating persistence over time with only two gaps present at different intervals of time (temporal unit 4 and 8).

Table 5.4. Occurrence Seriation of Nihoa Open Habitation Sites

Nihoa residential features	Location	Size (sq m)	Wall (alone or on retaining wall)	Retaining wall	Flush perimeter	Inverted corner	Interior feature	Raised surface	Multiple exterior levels	Chronometric Dating	TU	Age Estimates
50-Nh-28	Middle-East Palm	21	●	●		●			●		1	est. pre AD 1400 (based on seriation position)
50-Nh-15	Miller-Middle	24	●	●		●	●		●		2	
50-Nh-34	Middle-East Palm	17	●	●	●	●	●	●			3	
50-Nh-17	Miller-Middle	32	●	●	●		●	●				
50-Nh-53	East Palm	21	●	●	●		●	●			4 (pre AD 1425-1500)	Construction: pre AD 1450-1525 (based on seriation position)
50-Nh-42 & 43	East Palm	74	●	●	●	●		●		A.D.1426-1490 (94.2%) A.D. 1444-1523 (71.3%)	5 (AD 1450-1525)	Construction: AD 1425-1525 Occupation: AD 1425-1525+
50-Nh-18A	Miller-Middle	24	●	●	●	●		●				
50-Nh-25	Middle-East Palm	35	●	●	●	●					6	
50-Nh-18B	Miller-Middle	11	●	●	●							
50-Nh-41	East Palm	45	●	●	●					A.D. 1520-1593, 1619-1670 (80%) A.D. 1642-1684, 1735-1805 (81%)	7 (AD 1550-1650?)	Construction: AD 1520-1670 Use: AD 1520-1805+
50-Nh-59 & 60	East	54	●	●	●							
50-Nh-46	East Palm	30	●	●	●							
50-Nh-39	East Palm	15	●	●							8 (post AD 1650)	AD 1650-1850 (based on Nk-13)
50-Nh-44	East Palm	189		●	●						9	
50-Nh-36	East Palm	14		●	●							

*Note: Site 50-Nh-29 was not included as it was unable to be relocated

For Nihoa Island, the AMS ^{14}C dates along with the seriation provided a more nuanced approach to understanding of the settlement chronology for the island. The chronology was created first through the ordering of architectural classes present in the seriation which form nine temporal units. Second, the intervals are further refined by the associated chronometric dates that represent construction and use events that span across the different classes. Additionally, well dated cave shelters that are situated directly adjacent to these larger open habitation sites provide dates from secondary contexts based on their associated proximity. These dates add further clarity to the chronology. Finally, overall age estimates were inferred for these intervals based on their position in the sequence. All of these methods combined help to provide a level of confidence towards the understanding of the duration and patterns of human occupation on Nihoa Island.

The timing of construction for Nihoa open habitation sites had to be formulated based on the available chronometic dates that reference construction events, most of which were present in the middle of the sequence at temporal unit 5 (50-Nh-42/-43 at 2σ cal. A.D. 1426-1490) and temporal unit 7 (50-Nh-41 at 1σ cal. 1520-1593, 1619-1670 80.6% prob.). The early range of both dates reference the first use/construction event because they originate from wood charcoal samples recovered from the base of hearths (50-Nh-42 Unit 1, Layer II, Level 4; and 50-Nh-41 Unit 1, Layer II, Level 2- both base of cultural deposits). The construction dates for two additional sites (one from each temporal unit), can be inferred by their proximity to adjacent cave shelters that have been dated. Sites 50-Nh-18a and b in Middle Valley are located next to cave shelter 50-Nh-19 at 2σ dates to cal A.D. 1470-1640. Site 50-Nh-59/60 in East Valley is next to cave shelter 50-Nh-57 which dates to cal A.D. 1632-1803 at 2σ. The inclusion of both of these dates

supports the accuracy of the seriation orderings as they fit well into the chronometric sequence of construction already established. Together all of these dated events help to anchor the middle portion of the chronology in regards to construction timing. Based on this understanding it can be inferred that the initial construction of open habitation sites at some point before A.D. 1400 and termination of construction efforts likely occurred sometime after A.D. 1650.

The duration of use of Nihoa open habitation sites was formulated utilizing the same approach, but instead chronometric dates that derive from later stratigraphic contexts were used. In temporal unit 5 (50-Nh-42/-43 at 1σ dates use to cal. A.D. 1444-1523, 1574-1626 95.8% prob.) and temporal unit 7 (50-Nh-41 at 1σ cal. 1642-1684, 1735-1805 81.2% prob.). Sites 50-Nh-18a and b in Middle Valley are located next to cave shelter 50-Nh-19 at 2σ which again dates use to cal A.D. 1470-1640. Site 50-Nh-59/60 in East Valley is next to cave shelter 50-Nh-57 which dates use at 1σ to cal A.D. 1513-1601, 1616—1666 (92.6% prob.) and cal. A.D. 1635-1684, 1736-1805 (83.4% prob.). Based on these chronometric dates it can be inferred that the duration of use of these sites spanned to approximately A.D. 1800. In general, the span of time of construction and use of Nihoa open habitation sites corresponds to the same amount of time that sheltered sites (i.e., caves) were utilized (A.D. 1525-1805).

Pushing Past Island Resource Limitations

The Nihoa and Mokumanamana Islands have always been discussed in the context of their insularity- the notion that oceanic islands are somehow unto themselves bounded environments because they are surrounded by water and separated by great distances from other terrestrial places. With the establishment of human populations on

these islands their success or failure has always been correlated to (or seen as a function of) the islands' environmental carrying capacity. Both of these islands pose unique environmental conditions that offered varying degrees of local resource support to aid early colonists. As small fragmentary high islands, both islands had an abundance of avian and marine resources as reliable sources of protein for food. Nihoa has approximately 17 species of sea birds and shorebirds that nest on its slopes with an estimated population of 500,000. Mokumanamana has approximately 16 species of sea birds and shorebirds with an estimated population of 100,000 (Anonymous 1984: 3.16). Birds are an abundant resource of these islands as it could have been a secondary economic driver for occupation to procure prestigious feathers for material culture (Brigham 1899, 1901). In addition, these islands have resident seal and turtle populations, an abundance of shellfish, and a reef structure that supports high fish populations (Davies 2009: 48). Typically the depletion of faunal resources (Olson and James 1982; Kirch and Yen 1982) results in social pressures to abandon islands (Anderson 2002: 385), as these accessible resources are often times the first to be depleted. Davies (2009: 79-86) in his computer simulation analysis of resource limitations indicates that there were sufficient avian and marine resources to support growing populations for long durations.[111] These fauna resource populations were likely managed for abundance as a means to directly improve living conditions and to sustain these easily accessible food sources. Other critical resources would have been significant factors in sustaining long-term occupation,

[111] Davies (2009) using an agent based model simulation establishes that avian and marine resources could have maintained population growth (primarily focusing on Nihoa) for 125-250 years (with over 1000-25,000 individuals). The population would essentially overcrowd the available amount of living space before depleting the resources entirely.

including: water,[112] timber, fine grained basalt, and food (carbohydrates) (Davies 2009: 64-71, 72-77, 82-86; Lebo and Johnston 2007).

As developed previously in this study, human occupation can be a deliberate strategy of island colonization that evolved as a response to insularity. Occupation could be a means in which to establish a more permanent presence on the islands, yet avoid the potential risks associated with resource limitations. Identifying strategies that would have increased survival had to account for: (1) the transportation of colonists as labor back and forth between regions; (2) the absence of significant stocks of timber resources and their replacement by imports of exotic woods from the main Hawaiian Islands for fuel, construction, and ritual use; (3) ways to supplement or replace existing fine-grain basalt resources with better quality stone from the main Hawaiian Islands; (4) the adoption and implementation of agricultural food production systems to complement existing local protein supplies. Isolation, therefore, was not likely an absolute or uniform quality of Nihoa and Mokumanamana as voyaging could have played a critical role in moving populations and resources back and forth between parent communities and satellites and isolates. Here I summarize a variety of data from archaeology, paleobotany, geochemistry, and soil nutrient studies that would have important implications for the interpretation of the chronology and settlement patterns for this region of the archipelago. I propose that the movement of people and transportation of resources enabled human populations on these islands to exceed the local carrying

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[112] Water is a factor that cannot be measured archaeologically, but field investigations has shown at least some indication of efforts being put towards water storage (i.e. places with basin catchments, stone vessels being used to catch water drip from cave shelters and residential sites with intermittent gullies next to it). Additionally, ground water may have been accessible through digging past the sand on Nihoa's Adam's beach to access the fresh water lenses. The other resources however, can be measured through the archaeological record and will be the focus of analysis in the following sections.

capacity and could have provided the basis for a presence in the region based on recurrent use rather than permanent settlement.

Movement of People as Labor for Construction

Nihoa's large open habitation sites represent the largest labor effort in relation to settlements that appears in the island's archaeological record. The size and scale of these structures are impressive for a small island as many have high vertical retaining wall faces that were built up to create open flat surfaces for living. The Nihoa open habitation seriation can aid in our understanding of settlement planning and site construction in regards to: (1) their locations across the landscape; and (2) the amount of the labor investment that went into their construction as settlement evolved over time. In the earlier intervals of the settlement chronology three locations on the island are being targeted for relatively contemporaneous construction efforts of smaller sized house foundations (<35 m^2). These include the central portion of the island across the Miller-Middle Valleys, the central Middle-East Palm ridgeline, as well as the East Palm Valley. Over time however there was a clear shift in construction (as indicated in the latest invervals of seriation order) towards the East Palm Valley (and to a lesser extent East Valley). The eastern porition of the island becomes firmly established as a central area for more permanent expressions of habitation. This sequence of building show at the latest intervals a general trend towards foundations of increasing sizes (to 45 – 189 m^2).

The seriation of open habitation sites include a considerable amount of variation across all the architectural classes. Also evident is a high degree of cultural transmission that allows each trait to persist for varying durations over time. The degree in which certain traits continue and discontinue could be an indication of spatial movement of

people (as labor) as new ideas originate from different places of origin. This pattern occurs primarily early in temporal units 2-6, as traits such as inverted corners disappear for an interval and then reappear; this also occurs in somewhat syncopated fashion for attributes such as flushed perimeters, interior surfaces, raised surfaces, and multiple exterior levels. While the design traits of residential sites on Nihoa do not match well with the limited scale of residential seriations done so far in Pāhinahina, Kahua 1 & 2, Makiloa, and Kaloko in South Kohala and North Kona, Hawai'i (O'Connor 1998),[113] they do exhibit some similarities to heiau architecture documented across all of the islands. This will be discussed further in the next chapter in regards to developing a ritual chronology of heiau construction. It is suggested here however that the number of temporal units and diversity represented in the seriation, along with the rapid changes in trait persistence and switches in sequencing in the earlier intervals of construction indicate that there was a broad degree of social interaction during this period. This further suggests the level of geographic interaction involved an aggregation pool of workers from multiple islands that were utilized for the colonization and construction of longer term elite residences. Thus, there is evidence for the rapid cultural transmission of different stylistic traditions represented in this single seriation and may be expression of spatial interaction and converging social identities.

[113] O'Connor (1998) utilized traits such as curvilinear walls, and low walls as ways to order seriations of residential sites on the western coast of Hawai'i Island. Additional traits such as core-filled walls and high walls, were signatures of post-contact development. These traits were not utilized and not obviously present in the Nihoa assemblage.

Importing Wood and Plant Resources for Fuel, Construction, Tools, and Ritual Use

Nihoa and Mokumanamana Islands are thought to have possessed little to no known timber resources in pre-contact times (Conant 1985: 141; Chapin et. al 2004; Davies 2009) as these resources were likely imported from the main Hawaiian Islands. Timber resources were ranked second only to water resources in a recent modeling of sustained human occupation of the islands (Davies 2009: 72-77). Timber was vital for constructing shelters, making common implements, having firewood for cooking, as well as a number of ritual purposes. On Nihoa, there are only 27 vascular plant species known to exist, including 21 native species, among them only 12 are endemic to the Hawaiian Islands, three of which only occur on Nihoa including a native loulu palm (*Pritchardia Remota*) and additional shrubs (*Schiedea verticillata*, and *Amaranthus brownie*). On Mokumanamana, there are only 5 vascular plant species known and five are native. The dominant plant species is a low shrubland, *Chenopodium oahuense*. The identification of macro-botanical wood specimens and charcoal samples from Nihoa and Mokumanamana was utilized in this research as a means to address questions regarding changes in island landscapes, cultural interaction and exchange systems. This identification was done for 20 separate contexts from 11 archaeological sites on both islands. Approximately 12 plant taxa were identified in Nihoa charcoal assemblages that originated from the main Hawaiian Islands, one of which was probably established as part of the local ecosystem at some point in time. Additionally, 12 unknown taxa are represented in the charcoal assemblages that do not match other identified samples or currently known plants that are established on the island. Table 5.5 lists the charcoal assemblage by identified and unidentified taxa.

Table 5.5. Wood Taxa Identification for Nihoa and Mokumanamana Islands. Shaded rows indicate identified samples submitted for AMS or conventional radiocarbon dating. *Cf means comparable to in latin.

Island	Area	Site	Depth	Material	Taxa	Common Name	Hawaiian Name	Type	Origin/Habitat	Part	Count
Nihoa	Middle Valley	50-Nh-19	No Prov.	Wood (charcoal)	Myoporum sandwicense	Bastard sandlewood	Naio	Tree	Native MHI	Wood (WIDL 1103-16)	13
Nihoa	Middle Valley	50-Nh-19	No Prov.	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-17)	69
		50-Nh-19	No Prov.	Wood (charcoal)	Cf. Asteraceae		Possibly koʻokoʻolau, naʻenaʻe	Shrub	Native	Wood (WIDL 1103-18)	6
		50-Nh-19	No Prov.	Wood (charcoal)	Cf. Syzygium sp.	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-19)	19
		50-Nh-19	No Prov.	Wood (charcoal)	Cf. Chamaesyce sp.		ʻakoko	Shrub	Native	Wood (WIDL 1103-20)	2
		50-Nh-19	No Prov.	Unknown plant part (charcoal)	Not identified					Unknown (WIDL 1103-20a)	1
Nihoa	Middle Valley	50-Nh-24	Layer/Level 2.1	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-44)	2
		50-Nh-24	Layer/Level 2.1	Wood (Charcoal)	Cf. Bidens sp.		koʻokoʻolau	Shrub	Native	Wood (WIDL 1103-45)	1
Nihoa	Middle Valley	50-Nh-25	Layer/Level 2.1	Wood (Charcoal)	Unknown 8					Wood (WIDL 1103-65)	5
		50-Nh-25	Layer/Level 2.1	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-66)	2
Nihoa	East Palm Valley	50-Nh-41	Layer/Level 1.1	Wood (Charcoal)	Cf. Prosopis pallida		kiawe	Tree	Historic introduction	Wood (WIDL 1103-67)	1
		50-Nh-41	Layer/Level 1.1	Wood (Charcoal)	Unknown 4					Wood (WIDL 1103-68)	1
		50-Nh-41	Layer/Level 1.1	Wood (Charcoal)	Cf. Pinus sp.		pine	Tree	Exotic	Wood (WIDL 1103-69)	1
		50-Nh-41	Layer/Level 1.1	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-sn)	1
Nihoa	East Palm Valley	50-Nh-41	Layer/Level 2.2	Wood (Charcoal)	Unknown 5					Wood (WIDL 1103-74)	1
		50-Nh-41	Layer/Level 2.2	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-75)	13
		50-Nh-41	Layer/Level 2.2	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-sn)	1

Table 5.5 (continued). Wood Taxa Identification for Nihoa and Mokumanamana Islands.

Island	Area	Site	Depth	Material	Taxa	Common Name	Hawaiian Name	Type	Origin/Habitat	Part	Count
Nihoa	East Palm Valley	50-Nh-41	Layer/Level 2.3	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-1)	3
Nihoa	East Palm Valley	50-Nh-42	Layer/Level 1.1	Wood (Charcoal)	Cf. Syzygium		Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-2, 3, 8, 10)	95
		50-Nh-42	Layer/Level 1.1	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-4, 9)	9
		50-Nh-42	Layer/Level 1.1	Wood (Charcoal)	Not identified					Bark (WIDL 1103-5)	3
		50-Nh-42	Layer/Level 1.1	Wood (Charcoal)	Unknown 1					Wood (WIDL 1103-6, 7)	5
Nihoa	East Palm Valley	50-Nh-42	Layer/Level 2.2	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-11, 13, 14)	35
		50-Nh-42	Layer/Level 2.2	Wood (Charcoal)	Cf. Sesbania tomentosa		ōhai	Shrub	Native	Wood (WIDL 1103-12)	—
		50-Nh-42	Layer/Level 2.2	Wood (Charcoal)	Unknown 2					Wood (WIDL 1103-15)	5
		50-Nh-42	Layer/Level 2.2	Wood (Charcoal)	Unknown 9					Wood (WIDL 1103-80)	1
Nihoa	East Palm Valley	50-Nh-42	Layer/Level 2.3	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-21, 76)	178
		50-Nh-42	Layer/Level 2.3	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-22)	1
		50-Nh-42	Layer/Level 2.3	Wood (Charcoal)	Myoporum sandwicense	Bastard sandlewood	naio	Tree	Native	Wood (WIDL 1103-23)	9
		50-Nh-42	Layer/Level 2.3	Wood (Charcoal)	Unknown 3					Wood (WIDL 1103-78)	2
		50-Nh-42	Layer/Level 2.3	Wood (Charcoal)	Unknown 8					Wood (WIDL 1103-79)	5
		50-Nh-42	Layer/Level 2.3	Wood (Charcoal)	Unknown 9					Wood (WIDL 1103-80)	1
		50-Nh-42	Layer/Level 2.3	Wood (Charcoal)	Unknown 12?					Cf. tuber (WIDL 1103-77)	2

Table 5.5 (continued). Wood Taxa Identification for Nihoa and Mokumanamana Islands.

Island	Area	Site	Depth	Material	Taxa	Common Name	Hawaiian Name	Type	Origin/Habitat	Part	Count
Nihoa	East Palm Valley	50-Nh-42	Layer/Level 2.4	Wood (Charcoal)	Cf. Aleurites moluccana		candlenut, Kukui	Tree	Polynesian introduction	Wood (WIDL 1103-24)	4
		50-Nh-42	Layer/Level 2.4	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-25)	2
		50-Nh-42	Layer/Level 2.4	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-26)	573
		50-Nh-42	Layer/Level 2.4	Wood (Charcoal)	Unknown 3					Wood (WIDL 1103-27)	34
Nihoa	East Palm Valley	50-Nh-55	Ag test	Wood (Charcoal)	Cf. Pinus sp.		pine	Tree	Exotic	Wood (WIDL 1103-70)	1
		50-Nh-55	Ag test	Wood (Charcoal)	Cf. Syzygium		Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-71)	2
		50-Nh-55	Ag test	Wood (Charcoal)	Unknown 4					Wood (WIDL 1103-72)	1
		50-Nh-55	Ag test	Wood (Charcoal)	Unknown 11					Wood (WIDL 1103-73)	1
		50-Nh-55	Ag test	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-sn)	1
Nihoa	East Valley	50-Nh-57	Layer/Level 1.2	Wood (Charcoal)	Unknown 8					Wood (WIDL 1103-57)	18
		50-Nh-57	Layer/Level 1.2	Wood (Charcoal)	Unknown 9					Wood (WIDL 1103-58)	2
		50-Nh-57	Layer/Level 1.2	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-59)	36
		50-Nh-57	Layer/Level 1.2	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-60)	70
		50-Nh-57	Layer/Level 1.2	Wood (Charcoal)	Cf. Asteraceae		Possibly koʻokoʻolau, naʻenaʻe	Shrub	Native	Wood (WIDL 1103-61)	3
		50-Nh-57	Layer/Level 1.2	Wood (Charcoal)	Chamaesyce sp.		ʻakoko	Shrub	Native	Wood (WIDL 1103-62)	2
		50-Nh-57	Layer/Level 1.2	Wood (Charcoal)	Cf. Pteridophyta		Many names	Fern	Native	Cf. Rhizome (WIDL 1103-63)	2
		50-Nh-57	Layer/Level 1.2	Wood (Charcoal)	Unknown 10					Wood (WIDL 1103-64)	1
		50-Nh-57	Layer/Level 1.2	Wood (Charcoal)	Unknown 1					Wood (WIDL 1103-64a)	1

Table 5.5 (continued). Wood Taxa Identification for Nihoa and Mokumanamana Islands.

Island	Area	Site	Depth	Material	Taxa	Common Name	Hawaiian Name	Type	Origin/Habitat	Part	Count
Nihoa	East Valley	50-Nh-57	Layer/Level 1.2	"Gourd"	Lagenaria siceraria		Gourd,Ipu	Vine	Polynesian Introduction	Specimen	1
Nihoa	East Valley	50-Nh-57	Layer/Level 1.3	"Cordage"	No identification		No identification	n/a	n/a	Specimen	1
Nihoa	East Valley	50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-46)	26
		50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Unknown 1					Wood (WIDL 1103-47)	3
		50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Cf. Dodonaea viscosa		ʻaʻaliʻi	Shrub	Native	Wood (WIDL 1103-48, 56)	6
		50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-49)	39
		50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Unknown 6					Wood (WIDL 1103-50)	3
		50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Unknown 7					Wood (WIDL 1103-51)	2
		50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Cf. Santalum ellipticum		ʻiliahialoʻe	Shrub	Native	Wood (WIDL 1103-52)	1
		50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Chamaesyce sp.		ʻakoko	Shrub	Native	Wood (WIDL 1103-53)	10
		50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Cf. Pteridophyta		Many names	Fern	Native	Cf. Rhizome (WIDL 1103-54)	2
		50-Nh-58	Layer/Level 1.1	Wood (Charcoal)	Unknown 8					Rhizome (WIDL 1103-55)	10
Nihoa	East Valley	50-Nh-58	Layer/Level 1.2	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-28)	28
		50-Nh-58	Layer/Level 1.2	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-29)	4
		50-Nh-58	Layer/Level 1.2	Wood (Charcoal)	Unknown 4					Wood (WIDL 1103-30)	6
		50-Nh-58	Layer/Level 1.2	Wood (Charcoal)	Cf. Aleurites moluccana		candlenut, kukui	Tree	Native	Wood (WIDL 1103-31)	1
		50-Nh-58	Layer/Level 1.2	Wood (Charcoal)	Cf. Bidens sp.		koʻokoʻolau/ many names	Shrub	Native	Wood (WIDL 1103-32)	3
		50-Nh-58	Layer/Level 1.2	Wood (Charcoal)	Unknown 6					Wood (WIDL 1103-33)	4

Table 5.5 (continued). Wood Taxa Identification for Nihoa and Mokumanamana Islands.

Island	Area	Site	Depth	Material	Taxa	Common Name	Hawaiian Name	Type	Origin/Habitat	Part	Count
		50-Nh-58	Layer/Level 1.2	Wood (Charcoal)	Unknown 1					Wood (WIDL 1103-34)	2
Nihoa	East Valley	50-Nh-58	Layer/Level 1.3	Wood (Charcoal)	Unknown 4					Wood (WIDL 1103-35)	32
		50-Nh-58	Layer/Level 1.3	Wood (Charcoal)	Chenopodium oahuense		ʻāheahea, ʻāweoweo	Shrub	Native	Wood (WIDL 1103-36)	23
		50-Nh-58	Layer/Level 1.3	Wood (Charcoal)	Cf. Syzygium	Mountain apple, roseapple, java plum	Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi	Tree	Native	Wood (WIDL 1103-37, 42)	66
		50-Nh-58	Layer/Level 1.3	Wood (Charcoal)	Cf. Poaceae		Grass			Stem (WIDL 1103-38)	1
		50-Nh-58	Layer/Level 1.3	Wood (Charcoal)	Unknown 5					Stem (WIDL 1103-39, 43)	11
		50-Nh-58	Layer/Level 1.3	Wood (Charcoal)	Cf. Pteridophyta		Many names	Fern	Native	Cf. Rhizome (WIDL 1103-40)	1
		50-Nh-58	Layer/Level 1.3	Wood (Charcoal)	Cf. Bidens sp.		koʻokoʻolau/ many names	Shrub	Native	Wood (WIDL 1103-41)	
Nihoa	East Valley	50-Nh-58	No Prov.	"Netting Shuttle" (b.7846)	Alphitonia ponderosa		Kauila	Tree	Native	Wood	Specimen
Nihoa	East Valley	50-Nh-58	No Prov.	"Gourd"	Lagenaria siceraria	Gourd	Gourd, Ipu	Vine	Polynesian introduction	Wood	Specimen
Nihoa	East Valley	50-Nh-64	No Prov.	"Canoe tiller"	Artocarpus altilis	Breadfruit	Ulu	Tree	Polynesian Introduction	Wood	Specimen
Mokumanamana	Bowl Hill	50-Nk-04	No Prov	"Kukui seed" (INV 625-a)	Aleurites moluccana	Candlenut	Kukui	Tree	Polynesian Introduction	Seed	Specimen
Mokumanamana	Bowl Hill	50-Nk-04	No Prov.	"Kukui seed" (INV 625-b)	Aleurites moluccana	Candlenut	Kukui	Tree	Polynesian Introduction	Seed	Specimen
Mokumanamana	Bowl Hill	50-Nk-04	No Prov.	"Kukui seed" (INV 625-c)	Aleurites moluccana	Candlenut	Kukui	Tree	Polynesian Introduction	Seed	Specimen
Mokumanamana	Bowl Hill	50-Nk-04	No Prov.	"Kukui seed" (INV.625-d)	Aleurites moluccana	Candlenut	Kukui	Tree	Polynesian Introduction	Seed	Specimen
Mokumanamana	Bowl Hill	50-Nk-04	No Prov.	"Wood Frag." (INV.626)	Artocarpus altilis	Breadfruit	Ulu	Tree	Polynesian Introduction	Wood	Specimen
Mokumanamana	Flagpole Hill	50-Nk-13	No Prov.	"Kukui seed coat" (306.011)	Aleurites moluccana	Candlenut	Kukui	Tree	Polynesian Introduction	Seed	Specimen
Mokumanamana	Flagpole Hill	50-Nk-13	No Prov.	"Kukui seed coat" (306.010)	Mucuna gigantea	Seabean	Kāʻeʻe, Kāʻeʻeʻe	Vine	Native	Seed	Specimen

Table 5.6. Ubiquity Index for Nihoa Charcoal Assemblage of Wood Taxa

Area	Site	Depth	Unknowns	Cf. Poaceae	Cf. Asteraceae sp. (Bidens)	Cf Pteridophyta sp.	Chnopodium Oahuense	Cf. Chamaesyce sp.	Cf. Sesbania tomentosa sp.	Cf.Santalum ellipiticum	Myoporum sandwicenses	Cf. Dodonaea Viscosa	Cf. Syzangium	Aleurites moluccana	Artocarpus altilis	Propus pallida	Cf. Pinus sp.
				Grasses, herbs, ferns			Small and large Shrubs				Large shrubs, small trees		Small and large trees				
Middle Valley	50-Nh-19	No Prov.			+		+	+			+		+				
Middle Valley	50-Nh-24	Layer/Level 2.1			+		+										
Middle Valley	50-Nh-25	Layer/Level 2.1	8										+				
East Palm Valley	50-Nh-41	Layer/Level 1.1	4				+									+	+
East Palm Valley	50-Nh-41	Layer/Level 2.2	5				+						+				
East Palm Valley	50-Nh-41	Layer/Level 2.3											+				
East Palm Valley	50-Nh-42	Layer/Level 1.1	1				+						+				
East Palm Valley	50-Nh-42	Layer/Level 2.2	2, 9						+				+				
East Palm Valley	50-Nh-42	Layer/Level 2.3	3, 8, 9, 12				+				+		+				
East Palm Valley	50-Nh-42	Layer/Level 2.4	3				+						+	+			
East Palm Valley	50-Nh-55	Ag test	4, 11				+						+				+
East Valley	50-Nh-57	Layer/Level 1.2	1, 8, 9, 10		+	+	+	+					+				
East Valley	50-Nh-58	Layer/Level 1.1	1, 6, 7, 8			+	+	+		+		+	+				+
East Valley	50-Nh-58	Layer/Level 1.2	1, 4, 6		+		+						+	+			
East Valley	50-Nh-58	Layer/Level 1.3	4, 5	+	+	+	+						+				

Plant types were documented and categorized into four major units including: (1) annuals, perennial grasses, herbs, and ferns; (2) common small to large shrubs; (3) large shrubs to small trees; and (4) small to large trees. Utilizing a ubiquity index I measured the number of times each plant type occurred across the sample units. Table 5.6 shows a breakdown of categories of plant types and their presence or absence in the charcoal record. Two taxa, ʻāweoweo and ʻōhia ʻai, were found in every context sampled for wood identification. While the former occurs on the islands, ʻōhia ʻai would have required transport given its growing requirements. Annual and perennial grasses, herbs, and ferns were recorded including plant taxa that were never identified on Nihoa before including a grass (*cf. Poacaeae sp.*),[114] an herb similar to koʻokoʻolau (*cf. Asteraceae*), and a fern similar to hapuʻu (*cf. Pteridophyta*). It is unknown whether these plants were transported, or were once naturally occurring on the island at one period in time, although these types of ferns occurs only in wetter, usually upland environments in Hawaii. These plants are originally found in a diversity of habitats including dry, mesic, and wet environments. The grass (*cf. Poaceae*) was found in earlier stratigraphic contexts, while the herb (*cf. Asteraceae*) and fern (*cf. Pteridophyta sp.*) was found throughout early and late contexts. All three of these short lived plants were found in cave habitations. Common small and large shrubs were also recorded such as plants previously known to exist on the island including the dry coastal shrubs ʻāweoweo (*Chenopodium oahuense*), ʻakoko (*cf. Chamaesyce sp.),* ʻōhai (*cf. Sesbania tomentosa*). Additionally the coastal sandlewood shrub ʻiliahialoʻe (*cf. Santalum ellipticum*) was recorded in the charcoal

[114] In biology, the abbreviation has one additional use in open nomenclature: it denotes specimens or populations that resemble a known taxon, but differ in details; they thus may or may not refer to an undescribed taxon.

record but was not known to occur on the island previously. In addition to ʻāweoweo which is the most dominant plant taxa in the charcoal assemblages, all of the other dry coastal shrub plants documented show up somewhat later in the record. Also, it is possible that coastal sandlewood was once established on Nihoa as it naturally occurred in dry coastal environments elswhere. This coastal sandlewood shrub is commonly found on all the main Hawaiian Islands except Kahoʻolawe, but rare on Kauaʻi and Hawaiʻi. It has however been found as far up the chain as Laysan Island.

The presence of larger shrubs and small trees were recorded included naio (*Myoporum sandwicensis*) and ʻaʻaliʻi (*cf. Dodonaea viscosa*) which grow to be medium sized hard wood trees that are typically found in a range of environments including coastal, dry, mesic, and wet environments. Both of these plants are found in all the main Hawaiian Islands except Kahoʻolawe. The naio shows up in early to mid contexts in the charcoal record, and the ʻaʻaliʻi shows up late. It is unlikely that either of these plants were ever naturally established on Nihoa. Finally, small trees and larger trees recorded were mountain/rose apple (*cf. Syganzium sp.*), kukui (*Aleurites moluccana*), ulu (*Artocarpus altillis*), kauila (*Alphitonia ponderosa*) and exotic species to Hawaiʻi such as kiawe (Mesquite; *Propus pallida*), and pine (*cf. Pinus sp.*). None of the native tree species listed here naturally occurs in dry coastal environments, and all are typically found in mesic to wet environments. The mountain apple species was found continuously in the charcoal record, while kukui shows up in early to mid contexts. Both exotic species are examples of pine and kiawe are found in dry environments, but were likely transported after from being collected in secondary coastal settings (i.e. drift wood) in pre-contact times. In the case of kiawe, it is an example of post-contact transport of

this exotic wood to the island. Both plants show up late in the charcoal record. Finally, there was also the noticeable absence of loulu palm (*Pritchardia remota*) that was surprisingly not recorded in any of the charcoal assemblages, but is now found naturally occurring on the island.

The cultural uses of the plants and trees that were identified in the charcoal records are recorded in Table 5.7. The most abundant shrub represented in the charcoal record was ʻāweoweo (*Chenopodium oahuenses*). This plant is commonly found in the main Hawaiian Islands (except Kahoʻolawe), and also on the NWHI, including Lisianski, Laysan, FFS, Mokumanamana and Nihoa. Other studies have attempted to link ʻāweoweo to dry land agriculture perhaps being included in crop rotations with sweet potatoes or even being growth with them. The plant itself might have been cultivated as fuel as well as a source of greens to meet dietary needs, as it is consumed in other cultures in the new world. The ubiquity index does show that ʻāweoweo was somewhat more common in the upper levels of excavation perhaps hinting that it became the dominant vegetation with the increasing presence of man and the manipulation of the landscape. The most abundant tree represented in the charcoal record which occurred in almost all levels of deposition was mountain/rose apple (*Syzangium sp*.). This Polynesian introduced hardwood has known to be a ritual wood used primarily for the superstructure of temples (i.e. fence enclosures, house posts and rafters) and well as secular construction materials (Weisler and Murakami 1991; Abbott 1992: 5; Lamb 1981). It has also been documented as being used for fuel in other places in Hawaiʻi as well, perhaps as a secondary use when it no longer served its intended ritual function (Apple 1971: 31-32). Certain smaller tree woods such as naio, ʻaʻaliʻi were commonly used a ridge poles, rafter

posts, and thatching posts in house constructions. Other large trees such as breadfruit (ulu), kukui (candlenut), and kauila were trees used for house posts, fence enclosures, and the carving on images and idols for religious worship (Kolb and Murakami 1994).

In addition to the presence of various types of wood used for ritual purposes and construction materials, other types of plant taxa were used for a number of domestic purposes. Artifacts for everyday living were fashioned out of wood materials as well as a water containers were made from gourds (ipu; *Lagenaria siceraria*) present in the East Valley Overhang Shelter Complex and a netting shuttle made from a dry forest hardwood tree called kauila (*Alphitonia ponderosa*) was found in the same area. A canoe tiller made of breadfruit wood was recovered from a cave shelter in upper East Valley. Additionally, field excavations on Nihoa also recovered a piece of sweet potato from the context of a fire place but it was subsequently misplaced during its accession into collections. For Mokumanamana, there was less diversity of plant taxa identified, as most of the specimens originated from Bowl Cave (50-Nk-04), and a heiau site (50-Nk-13) located on Annexation Hill. In Bowl Cave, there were five candlenuts (kukui; *Aleurites moluccana*) recovered. On the single heiau site a kukui nut and a seed from a native seabean vine called kā‘e‘e‘e were recovered.

Table 5.7. Plant Uses for Plants from Nihoa Charcoal Assemblages and their Distribution in the Hawaiian Archipelago

Form	Hawaiian Name/ Common Name	Scientific	Source	Distribution	Known Uses
Crops	ʻUala/Sweet potato		Transported	Dry to mesic	Food
	Ipu/Gourd	Lagenaria siceraria	Transported	Dry to mesic	Water containers, containers, percussion instrument, food, serving dishes, medicine
Grass, herbs, ferns	None	Cf. Poaceae sp.	Established but no longer present	Dry to mesic	Unknown
	Possibly koʻokoʻolau, naʻenaʻe	Cf. Asteracae sp.	Established but no longer present	Dry to mesic	Unknown
	None	Cf. Pteridophyta	Established but no longer present	Mesic to wet	Food, thatch, bedding, mulch, medicine,
Small shrub to large shrub	ʻĀweoweo, Goosefoot, pigweed, lambs quarter	Chenopodium oahuenses	Established	Coastal, dry, subalpine (Found on all MHI except Kahoolawe; NWHI- Lisianski, Laysan, FFS, Mokumanamana, Nihoa.	Possible food, fuel.
	ʻĀkoko	Cf. Chamaesyce sp.	Established	Coastal to mesic	Fuel
	ʻŌhai	Cf. Sesbania tomentosa	Established	Coastal, dry (All MHI; NWHI- Nihoa and Mokumanana).	Fuel, flowers
	ʻĪliahialoʻe/ Coastal Sandlewood	Cf. Santalum Ellipiticum	Established but no longer present	Coastal, dry (On all MHI except Kahoolawe, rare on Kauaʻi and Hawaiʻi; NWHI- Laysan)	Fuel, flowers
Large Shrubs to small trees	Naio/Bastard Sandlewood	Myoporum sandwicenses	Transported	Coastal, dry (All MHI, except Kahoʻolawe)	Building superstructures- ridgepoles, posts, rafters, thatching poles, canoe parts, torches, fuel, flowers.
	Aʻaliʻi	Cf. Dodonaea Viscosa	Transported	Coastal, dry, mesic, wet (All MHI except Kahooolawe)	Building superstructures- ridgepoles, posts, rafters, thatching poles, fuel, canoe parts, tools, medicine, dyes, flowers.
Small to large trees	ʻ Possibly ʻōhiʻā hā, hā, kauokahiki, paʻihi, paʻihiʻihi /Mountain apple, Rose Apple	Cf. Syzangium sp.	Transported	Mesic, wet (All MHI except Niʻihau & Kahoʻolawe)	Building superstructures- ridgepoles, posts, rafters, thatching poles. Temple enclosures (fences), religious idols, medicine, fuel, food
	Kukui/ Candlenut	Aleurites moluccana	Transported	Mesic, wet (All MHI except Kahoʻolawe)	Torches, lamps, medicine, dyes, religious idols, fuel. Fire starter, canoe parts.
	Ulu/Breadfruit	Artocarpus altillis	Transported		Food, Canoe parts, religious idols, fuel.
	Kauila	Alphitonia ponderosa	Transported	Dry, Mesic (All MHI except Niʻihau and Kahoʻolawe; rae everywhere except Kauaʻi)	Agricultural tools (ʻōʻō), weapons (spears, clubs, etc.), religious idols.
	Kiawe/Algaroba, Mesquite	Propus pallida	Transported	Dry (exotic to Hawaiʻi)	Fuel
	Pine	Cf. Pinus sp.	Transported	Mesic, wet (exotic to Hawaiʻi)	Fuel

A number of culturally valuable woods and plant cultivars were identified here to have been transported by canoe vessels to these remote islands as they lacked many of the necessary flora needed to survive. Since most of these large shrubs to trees could not have naturally grown in these coastal dry environments, we can conclude that most of the timber resources were imported. These larger shrubs and trees reflect wood taxa that originate from a diversity of habitats from coastal, dry, mesic, and wet. This makes it possible to link these specimens to a number of environmental contexts from the main Hawaiian Islands, supporting the idea that numerous social groups may have accessed these northwest islands. These plants include: gourds (ipu; *Lagenaria siceraria*) and the hard wood tree kauila (*Alphitonia ponderosa*) that come from dry land settings (although they could have also been grown locally on Nihoa); candlenut (kukui; *Aleurites moluccana*) and breadfruit (ulu; *Artocarpus altilis*) that come from wetter settings along coasts or low elevations; rose apple (*cf. Syzangium*) that comes from upland wetter settings; and finally pine (cf. Pinus sp.) that would occur from secondary gatherings from coastal settings. These reflect the additional costs associated with staying on Nihoa and Mokumanamana for durations of time. This led to the importation of timber from multiple sources of origin in the main Hawaiian Islands to help support this ritual system.

Transportation of Basalt Tools and Stone Items

Stone is the most common material for tools and implements found throughout Hawai‘i, as its relative abundance and durability in the archaeological record has made it a vital part in understanding aspects of intra- and inter- island communication, trade, and social political reach. Archaeological interpretations of the scale and intensity of Hawaiian political power has frequently looked at the organization of stone tool

economies and craft specialization as a means to assess social-political influence of the elite class across social-political divisions (e.g. Bayman and Nakamura 2001; Cordy 1981; Cordy and Kaschko 1980; Earle 1977; Hommon 1986; Lass 1994, 1998; Mills et al 2011; McCoy 1990). Over the past two decades, Polynesian geochemical provenance studies have become a major focus in archaeological research due to the absence of other materials such as pottery, volcanic glass, or obsidian sources. Despite this attention, the modes of stone tool production and distribution are still poorly understood and it has not been determined how these systems varied regionally and whether chiefs controlled distribution (Lass 1994; McCoy 1990; Mills et al 2011). The focus of this portion of the study on Northwestern Hawaiian Islands stone tools attempts to see whether artifacts from this region were derived from local resources or from other locations in the main Hawaiian group.

X-ray fluorescence (XRF) is a powerful analytic tool applied to stone to determine chemical composition of both artifacts and raw materials to understand the nature of pre-contact inter- and intra- island interaction (Allen and Johnson 1997; Earle 1997a; Lebo and Johnson 2007; Mills et al. 2008; Sheppard et al. 1997; Sinton and Sinoto 1997; Weisler 1993, 1996, 1997). This analysis of NWHI materials took an organized and systematic approach to (1) sample collection (or organizing the information of existing collections); (2) chemical analysis, and (3) statistical evaluation (Glascock et al. 1998). The basalt artifact collections from Nihoa and Mokumanamana islands were ideal for this study because they provide a discrete assemblage that allows us to differentiate between sources and potentially track movement of materials and tools using elemental compositional data derived from the EDXRF, PXRF, and WDXRF

analyses. Approximately 179 stone artifacts and pieces of lithic material from 20 features and 10 locations on Nihoa; and from 4 features and 3 locations on Mokumanamana were submitted for xrf analyses (a total of 10 stone artifact types including modified stone, hammerstones, grindstones, adzes/performs/flakes, awls/cutting tools, pavement stones, stone sinkers vessels, bird perch, sorcery cups, and stone images) and 22 non-artifactual geological source specimens from Nihoa (n= 40 artifacts; n= 16 geological source samples) and Mokumanamana (n= 46 artifacts; n= 18 geological source samples) were analyzed. Artifacts and cultural materials recovered from Nihoa and Mokumanamana suggest the occupants of the islands engaged in both independent and attached craft specialization systems.

Characterization of geological sources and stone artifacts for the islands was accomplished using three x-ray fluorescence (XRF) methods- wave length dispersive x-ray fluorescence (WDXRF), energy dispersive x-ray fluorescence (EDXRF), and portable x-ray fluorescence (PXRF). WDXRF is a destructive technique that allows greater accuracy and precision and can determine a broader range of elements. EDXRF and PXRF are non-destructive techniques that have less accuracy and precision,[115] but are cost-effective, and faster to process with minimal preparation requirements. In this study, WDXRF was the primary method used for geological source samples that were deemed expendable which allowed greater assurance about the accuracy and precision of results.

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[115] Data quality involves two parameters, accuracy and precision. Accuracy involves the use of reference standards to determine how closely the measurements the actual concentration of an element in a sample. Precision measures how closely repeated analyses of the same samples produce the same results (Lebo and Johnson 2002: 867). Non-artifactual geologic source materials from Nihoa (2 total) and Mokumanamana (5 total) had already been collected and analyzed using ICP-MS and WD-XRF (Lebo and Johnson 2007). These were also incorporated in different ways into the statistical evaluation methods for comparative value.

EDXRF and PXRF was the primary method used for artifact collections that consisted of cultural heritage items. It was a viable means to obtain the largest data set possible while preserve the integrity of the items and in certain cases allowing rapid on site analysis of non-transportable artifacts. All three approaches provided data on the full range of trace elements (with the exception of Barium in some cases).[116] Chemical alteration and weathering was identified early on as a potential issue for the Nihoa and Mokumanamana samples because of phosphates from sea spray and bird fecal matter (Lunblad et al. 2011).[117] As a precaution, each artifact and material was given a sonic bath to remove surface contaminants as best as possible. Other factors such as old weathered and uneven surfaces were addressed by positioning the stone artifacts and materials on sides that did not exhibit those features. All three methods of x-ray fluorescence analysis focused on 9-10 trace elements concentrations attained in each analysis. Mean and standard deviation of concentrations (ppm) for all reported elements from the geological source samples and artifacts were obtained from each method.

Multivariate statistical evaluations were employed on concentration values for trace element data from all three methods. The WDXRF concentration values for geological source samples along with known international geological standards were used

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[116] EDXRF Stationary machine in U.H. Hilo started collecting element values on barium later after most of the comparative assemblages across the main Hawaiian Islands had already been gathered. Also PXRF was not set up to gather barium.

[117] A series of smaller tests were run on samples that exhibited signs of phosphorus surface contamination. In some cases we washed portions in sonic baths, or on different sides of the specimen with visible and non-visible surface contamination. On some samples we cut, grinded, or used fragmented surfaces to see the differences in readings for weathered and contaminated surfaces. From these test trials SiO2 and MnO seem to be reliable indicators for surface chemical alteration from phosphates as their spectra peaks were blurred due to the matrix effect. Sample B.06533 was a good example that demonstrated the effects of weathering and phosphorus contamination. This sample had a thick white outer coat from bird fecal matter and the SiO2 went down significantly (to 3) indicating this surface contamination. UH0067 & UH0072 were also run with surface contamination and then we grinded of the outer layer to see the difference.

to calibrate methods through linear regression formulas. The StatistiXL program was used on excel to generate these calibrations and statistical evaluations on all three data sets. Evaluations were run using two different methods of multivariate statistics- (1) Principle Component Analysis (PCA); and (2) Discriminate Analysis (DA). Principal Component Analysis (PCA) is an analytical technique whereby a complex data set containing (*p)* variables is transformed to a (hopefully) smaller set of new variables, which maximize the variance of the original data set. The role of principal component analysis has been to reduce and simplify a large number of variables into fewer, simpler ones. Discriminate Analysis (DA) is an analytical technique whereby multivariate data set containing (*m*) variables are separated into a number (*k*) of pre-defined groups, using discriminate functions (*Z*) which are linear combinations of the variables. This analysis helps to detect the extent of differences between two or more groups of multivariate data using one or more discriminate function. In both cases, evaluations were run: (1) to discriminate between source materials at a local scale (Ni-MM); (2) to discriminate between source materials at an archipelago scale (Hawai‘i, Maui, O‘ahu, Kaua‘i); and (3) to determine potential overlap of artifacts at a local scale (Ni-MM); to determine potential overlap at a archipelago scale. The goals of these statistical evaluations were to identify at the finest possible geographic scale the origins of basalt artifacts that are non-local to NWHI.

Determining which elements were best in sorting the Nihoa and Mokumanamana samples was the first objective of the analyses. Nihoa and Mokumanamana source samples, then artifacts were first run through a series of low-dimensional scatter plots of elemental concentrations (Ni, Cu, Zn, Rb, Y, Zr, Nb, and Ba) to depict generally the

degree of discrimination among sources and artifacts in relation to each other. The scatter plots demonstrated that certain elements helped to distinguish the two sources better as they were not affected by surface contamination. In previous studies, Sr and Zr have shown to have the greatest analytical precision in sorting out more adze quarries and sources in Hawai‘i (Kahn et al. 2008; Kirch et al. 2012; Lunblad et al. 2008; Mills et al. 2008; Mills et al. 2010; Mills et al. 2011; Mintmier et al. 2012). For the Northwestern Hawaiian Islands samples however the best elements were Barium (Ba), Niobium (Nb), Rubidium (Rb), Yttrium (Y), and Zirconium (Zr), which were generally the heaviest and required the light from the x-ray to penetrate into the stone and away from the guano accumulations on the surface of the stone tools.[118] The close proximity of the adjacent clusters (for all bi-plot combinations of Ba, Nb, Rb, Y, and Zr) suggests that both islands occupy similar geochemical space. Together they represent a regional signature and have a continuous distribution of values.

The second objectives was to demonstrate the ability to differentiate local Northwestern Hawaiian Island sources from each other, and then determine whether artifacts that derived from Nihoa or Mokumanamana overlapped with geochemical signatures of its neighbor. Both the Principal Component Analysis (PCA) and Discriminate Analysis (DA) were run as independent evaluations in this process on both EDXRF and PXRF datasets. These data sets were kept separate due to the degree of uncertainty in previous studies in comparing the two (Craig et al. 2007; Pessanha et al.

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[118] These five elements were utilized from this stage forward for all multivariate statistical analyses since they had the best ability to sort and discriminate between Northwestern Hawaiian Islands samples. This was an important decision as it was a trade off to gain some degree of precision at the local scale, but some precision was lost (by limiting the amount of elements used) when expanding the analysis to the archipelago scale.

2009). A multivariate statistical run for each type of analysis was done for each artifact class for each island. Artifacts for Nihoa included: EDXRF data (n=6)- adzes and performs, hammerstones, debitage, sorcery cups, modified stone, unmodified stone, and ‘ili’ili pavements stones; PXRF data (n=2)- stone bowls, grind stones. Artifact classes for Mokumanamana included: EDXRF data (n=5)- Adzes and performs, awls & cutting tools, sorcery cups, modified stone, and ‘ili’ili pavement stone; PXRF data (n=3)- stone bowls, grindstones, stone images, and a stone perch. The results of both analyses showed similar patterns across both islands for each EDXRF and PXRF data sets. Nihoa EDXRF and PXRF data evaluations showed that most artifact classes were of local origin which included the following: sorcery cups, modified stones, unmodified stones, grindstones, and stone bowls. Other portable utilitarian and possible ritual items such as adzes and preforms, hammerstones, and debitage included individual artifacts that showed similar geochemical signatures to Mokumanamana. Mokumanamana EDXRF and PXRF data evaluations also showed most artifact classes were of local origin, including: awls and cutting tools, modified stone, iliili pavement stones, stone vessels, grindstones, stone images, and the perch. Other portable utilitarian and ritual items such as adzes and preforms, sorcery cups, and sinkers showed overlapping geochemical signatures to Nihoa. Despite these preliminary indications of possible interaction and transportation, the scope of the analysis needed to be expanded to the scale of the archipelago in order to rule out the possibility of these artifacts having geochemical signatures that match more than one source area.

Expanding the scope of evaluation to include the main Hawaiian group was the third objective. Again, the first step taken was to demonstrate the ability to differentiate

Nihoa and Mokumanamana sources from each other, and then from other island sources in the main Hawaiian group. The second step was then to determine whether any NWHI artifacts classes overlapped with island sources in the main islands. Comparative data could only be drawn from two main geochemical source databases for the Hawaiian Islands.[119] Sinton and Sinoto (1997) compiled WDXRF geochemical data on Hawaiian adze quarries, but the database was limited only a few representative samples from each of the major quarries (in Hawai‘i and Polynesia) and was not adequate for evaluation because the sample sizes were too small. U.H. Hilo has compiled their own EDXRF geochemical data on quarries based on EDXRF analyses to include larger source and artifact assemblages from each major island in the Hawaiian archipelago (Kahn et al. 2008; Kirch et al. 2012; Lunblad et al. 2008; Mills et al. 2008; Mills et al. 2010; Mills et al. 2011; Mintmier et al. 2012) (website: www.uhh.edu/uhh/faculty/lunblad/EDXRFandtheGeoarchaeologyLab.php). These source areas include Mauna Kea (Hamakua District, Hawai‘i), Pololū (Kohala District, Hawai‘i), Kilauea (Puna District, Hawai‘i), Kahalu‘u (Kona District, Hawai‘i), Haleakalā (Maui), Nu‘u (Maui), Waiahole (Ko‘olaupoko District, O‘ahu), Nualolo Kai (Na Pali District, Kaua‘i). A multivariate statistical run for each type of analysis was done for each artifact class for each island. Again, this drew upon the EDXRF data set, but did not include the PXRF data set since it could be assumed from the previous sets of analysis that the items were of local origin, and there was no comparative PXRF data for the archipelago sources. The archipelago scale results from both analyses showed certain sources overlapped or were clustered in close

[119] This study acknowledges that the comparative databases built for the Hawaiian Islands are based primarily on fine grain basalt suitable for adze production. The comparisons being made here are done from a wider range of artifact classes which is limited in its effectiveness.

proximity and could not be distinguished from one another. These included (1) Nihoa with Kilauea (Hawai‘i)-Waiahole (O‘ahu)-Nualolo Kai C (Kaua‘i); (2) Mokumanamana with Mauna Kea (Hawai‘i). Other sources such as Pololū (Hawai‘i), Haleakalā-Nu‘u (Maui) could be easily eliminated as possible sources for any of the artifact materials as their distributions on the plot graphs fell well outside the Nihoa and Mokumanamana clusters. This evaluation at the archipelago scale narrowed the plausible amount of transported basalt items from the main Hawaiian Islands down to 8 items. The rest of the basalt artifact assemblages proved to be of local origin.

Examining these individual items at a smaller scale to help differentiate potential overlap between sources and reduce the number of plausible matches was the last objective. Artifacts were run again using discriminate analysis, helping to rule out a number of quarry sources and in most cases identifying the most probably source of origin. In the end, 6 individual artifacts were identified as having strong probability of originating from outside the Northwestern Hawaiian Islands. For Nihoa, these artifacts include an adze (BM. 50-Nh-67.001) and a hammerstone (BM7446b) which might have come either from Nualolo Kai C (Hawai’i) or Kilauea sources (which themselves overlap). A “least cost” assumption is applied when dealing with the movement of items and materials and it is inferred that Nualolo Kai, Kaua‘i would be the easiest source given the distance over which it would have been transported. Both of these sites are habitation cave sites (50-Nh-59, -67) located on the east side of Nihoa. For Mokumanamana, these artifacts include two adzes (BM 6727; BM 456.036) that might have either came from Waiahole (O‘ahu) or Kilauea (Hawai‘i) sources (which overlap). Again a “least cost” assumption is applied when dealing with the movement of items and materials as

Waiahole, O‘ahu would be the easiest route of transportation. One sinker (BM 6518) matched geochemically with Nualolo Kai C (Kaua‘i). All of these items came from the Bowl Cave habitation site (50-Nk-40). The last artifact, a sorcery cup (UH0060) also was identified as an outlier, with no matches to known Hawaiian sources. This ritual item was recovered near the central upright of the central heiau on the island (50-Nk-12).

The final results of these series of analyses demonstrate that local stone sources from Nihoa and Mokumanamana were suitable for all types of artifacts and specialized crafts. Approximately 96.7% of the artifacts were derived from local island sources, while 3.3% were brought in from other island sources in the main Hawaiian group. The archipelago scale multivariate statistical analyses identified approximately 6 individual artifacts that fell outside the plot distribution of Nihoa-Mokumanamana source materials and overlapped with outside sources. Table 5.8 lists these individual artifacts and possible sources of origin. This evidence further supports the notion that multiple social groups used both Nihoa and Mokumanamana for ritual and purposes. All autonomous chiefdoms had vested interest in the role Mokumanamana played in the ritual cycle of the ‘aha and the process of establishing leadership. Islands with the closest proximity, such as Kaua‘i and O‘ahu were likely sources of origin, but islands located farther away such as Hawai‘i could not be discounted in these results. Adzes were primarily the items being transported and had both utilitarian and ritual significance, in carving and shaping woods that were being imported from the main Hawaiian Islands. Whether or not basalt materials and items were being taken off the island due to its ritual importance remains to be seen.

Table 5.8. Individual Artifacts and Possible Sources of Origin

Island	Item	Number	Ruled out	Provenience
Nihoa	Adze	BM.50-Nh-67.001	MM, Ni, Mauna Kea, Waiahole	(1) Nualolo Kai, (2) Kilauea
Nihoa	Hammerstone	BM0.7446b	MM, Mauna Kea Waiahole	(1) Nihoa (2) Kilauea
Nihoa	Flake	UH48.9	MM, Mauna Kea, Kilauea, Waiahole	(1) Nihoa
Nihoa	Flake	UH38.0012	MM, Maua Kea, Kilauea, Waiahole	(1) Nihoa
Mokumanamana	Adze	BM.06727	Ni, MM, Mauna Kea	(1) Waiahole (2) Kilauea
Mokumanamana	Adze	BM.456.036	Ni, MM, Mauna Kea	(1) Waiahole (2) Kilauea
Mokumanamana	Sinker	BM.06518	Ni, MM, Mauna Kea, Kilauea, Waiahole	(1)Nualolo Kai
Mokumanamana	Sorcery Cup	UH0060	Ni, MM, Mauna Kea, Kilauea, Waiahole	(1) Outlier

Implementing the Food Production Systems

The implementation of dry land agricultural food production systems that developed from the main Hawaiian Islands was a priority on Nihoa and Mokumanamana because the lack of food resources particularly starches and greens that were needed for long-term human survival (Apple 1973; Yen 1969). The absence of this dietary need ranked high in concerns for necessary resources to sustain life (Davies 2009: 78-86). On Nihoa, a majority of open space on the island that was not designated for habitation or

ritual purposes was put into food production. Agricultural terraces, retaining walls, and mounds in 9 areas covered approximately 650,000 m^2 (~10% of the land area) of the land area on the island. The rocky loam soil found on the island was enriched with organic material and bird guano. The best areas suitable for agriculture were located on the relatively flat plateau between Miller and Middle Valleys. Marginal sloped areas were heavily terraced with "fish scale" type terraces in an attempt to max out productivity. These terraces helped with soil retention creating more flat areas suitable area for ideal crop growth. On Mokumanamana, there was considerably less soil development and the exposure to bare rock did not provide for the same agricultural potential as Nihoa. Nevertheless, there were at least three areas on Mokumanamana situated in the protected saddle areas that totaled approximately 25 terraces (estimated total area of 7315 m^2). Soil studies on other major agricultural field system sites in the main Hawaiian islands has shown that dry land cultivation over a duration of time has the ability to leech soils of key nutrients for plant growth (Meyer et. al. 2007). To be sustained, soils must be replenished with essential nutrients either through fertilization or organic amendments (i.e. mulching, composts). On both remote islands however, the numerous seabirds that nest on both island increased both the nutrients and the acidity of the soils due to the overabundance of bird guano. The bird guano is commonly used as fertilizer, but it some cases it can also lead to oxidization and the acidification of the soil (Fox et al. 1991). In extreme cases, the effects of acid soils on agriculture can include nutrient and mineral deficiencies, stunted growth, and limited returns (Uchida and Hue 2000). The relatively thick vegetation and the absence of stress indicators on plants in these fallow production areas suggested that adequate nutrients exist on both islands.

Agricultural development and intensification on these islands was looked at carefully through the timing of the construction of garden terraces and their subsequent use, as well as soil analyses that looked at the measurement of resin-extractable Phosphorus (P), total element pools (C, P. N, cations, and Nb), exchangeable cations, cation exchange capacity, and percent basesaturation. Soils were collected from 0 to 30 cm below surface in areas designated as agricultural areas and plots on both island.

Approximately 1 gallon of soil was collected from each five agricultural sites on Nihoa (50-Nh-15,-24,-55,-80,-88) and three agricultural sites on Mokumanamana (Sites 50-Nk-16,-44,-45). The same provider and procedure has been used extensively in analyses of Hawaiian soils (Chadwick et al. 1999; 2003, Vitousek et al. 2004) and analytic precision consistently has been high (<5%).

Table 5.9 shows the results of the soil tests that demonstrate that both islands had soils that were nutrient rich in nitrogen (N) and phosphorus (P) which is key elements in sustaining soil fertility and promoting longevity of crop production. Percent base saturation which is defined as the percentage of cation exchange sites in soil that are occupied by Ca, Mg, K, and Na. This percentage has been an indicator of agricultural intensification as soils typically with <30% base saturation in the upper 30 cm generally does not display the agricultural infrastructure associated with intensive dryland cultivation, while those with > 30% base saturation generally have been farmed intensively (with at least 750 mm/yr of rain) (Kirch 2004; Ladefoged et al. 2010; Vitousek et al. 2004). In the case of Nihoa and Mokumanamana however, both soils were of high organic matter and these thresholds typically do not apply in these scenarios.

Nihoa and Mokumanamana soils appear to have been suitable for agricultural farming because of the nature of their soils being organic and the addition of the bird guano enrichment. Bird guano may have circumvented the issue of rainfall replenishment and provided a long-term renewable soil fertilizer. Typically, plant crops grow well in organic soils as long as they are not saturated and their nutrients are being replenished. Phosphrous (P) which was drained in other examples of dry land agriculture in the main Hawaiian Islands was sustained here (Kirch 2004; Vitousek et al. 2004). The archaeological dates recovered from two test plots on Nihoa in the middle of terraces in Middle Valley (50-Nh-24) and East Valley (50-Nh-55) that were dated at 1σ to cal A.D. 1648-1694, 1727-1813 (75.8%) and cal A.D. 1642-1684, 1735-1805 (81.2%). While these samples date the use of the terraces (and not the construction), they do suggest the relatively late use of these agricultural fields in the A.D 1725-1800. This interval allows us infer at best that inland construction of these terraced systems began as early as est. A.D. 1625-1650. This late development means that food production in regards to the much needed starches for dietary needs was not established in during the initial colonization phase of Mokumanamana and Nihoa. This is surprising because it means that more of the burden for food supplies was put upon voyaging to import and sustain the building of these islands, and to some degree its later ritual use.

Table 5.9. Soil Analysis of Samples from Nihoa and Mokumanamana Islands

Location	Site	Nb ppm	Zr ppm	SiO2%	Al2O3%	Fe2O3%	CaO%	MgO%	Na2O%	K2O%	Cr2O3%	TiO2%	MnO%	P2O5%	SrO%	BaO%	LOI%	Total
Nihoa 1	15.00	12.00	137.00	1.81	4.00	9.88	0.66	0.14	0.06	0.84	0.05	1.71	0.02	9.21	0.02	0.01	46.90	98.81
Nihoa 2	24.00	8.00	90.00	4.69	4.34	5.95	1.04	0.30	0.09	0.37	0.06	1.04	0.03	5.40	0.01	0.01	55.50	99.04
Nihoa 3	55.00	9.00	102.00	5.58	4.12	7.38	0.63	0.28	0.16	0.44	0.07	1.17	0.02	5.99	0.01	0.01	51.20	99.38
Nihoa 4	80.00	9.00	101.00	5.59	4.21	6.30	1.06	0.34	0.07	0.39	0.05	1.12	0.03	4.36	0.02	0.01	55.80	99.36
Nihoa 5	88.00	10.00	100.00	6.00	3.29	7.50	0.48	0.21	0.13	0.51	0.05	1.28	0.02	5.84	0.01	0.01	52.00	99.21
MM 1	16.00	25.00	240.00	2.96	3.42	12.00	2.76	0.43	0.22	0.48	0.06	2.58	0.02	12.48	0.02	0.03	30.30	98.75
MM 2	44.00	24.00	249.00	1.77	2.89	9.50	8.26	0.69	0.18	0.49	0.03	2.27	0.02	13.67	0.04	0.02	27.50	99.07
MM 2	45.00	27.00	244.00	1.91	3.95	14.16	1.01	0.28	0.35	0.45	0.12	2.91	0.01	13.24	0.01	0.02	28.80	98.91

Location	resin P	xK	xNa	xCa	xMg	cec	%BS<100	C%	N%	C:N ratio
Nihoa 1	371.79	2.97	0.72	12.95	1.98	61.72	30.16	21.22	2.45	8.68
Nihoa 2	535.57	4.06	1.58	14.82	3.10	76.81	30.68	24.46	2.42	10.09
Nihoa 3	742.61	3.41	3.03	5.94	1.53	85.69	16.24	23.93	2.34	10.25
Nihoa 4	424.51	5.22	1.18	11.00	1.77	80.81	23.72	23.48	2.11	11.11
Nihoa 5	337.00	3.19	3.39	6.25	2.55	78.84	19.50	21.86	2.52	8.69
MM 1	1720.01	4.07	12.04	8.40	2.58	37.68	71.88			
MM 2	1358.75	3.39	5.77	16.02	3.82	58.65	49.44	8.33	1.88	4.43
MM 2	5172.47	3.43	1.92	14.84	3.56	38.57	61.57	5.43	1.22	4.47

The introduction of the sweet potato (‘uala; Ipomoea batatas), a dry land crop from South America in A.D. 1300 revolutionized dry land agriculture allowing it to expand into progressively marginal areas in the leeward areas of the main Hawaiian Islands. The drought-resistance fast growing potato tuber was far better suited than other dry land crops, such as kalo (taro), uhi (yams), to growing in the arid areas of Hawai‘i. Islands such as Maui and Hawai‘i developed early methods of sweet potato agriculture that relied upon slash-and-burn clearing and shifting to swidden cultivation. This pattern of agriculture lasted for approximately 200 years. On Hawai‘i Island, dry-land field systems began at approximately A.D. 1200- 1300, with a later expansion and intensification happening from A.D. 1400-1800 (Viteousek et al. 2004). However in other areas, such as Kahiki Nui on Maui, swidden agriculture seems never to have been abandoned. The expansion phase of upland agriculture extends approximately A.D. 1500 to the early post-contact period, and encompasses establishment of permanent land occupation (Kirch et al. 2004). During the colonization phase of the Northwestern Hawaiian Islands from approximately A.D. 1400-1550, it is likely that irrigated wet land systems that were the dominant system of food production in the main Hawaiian Islands helped to subsidize the voyaging and interaction to the Northwestern Hawaiian Islands, a resource deficient environment. By the time the rain fed agricultural systems were developed at A.D. 1500-1600, this system was transferred and applied to Nihoa and Mokumanamana, smaller islands had environments that resemble these dryer leeward coastal areas of the main group. The development of these systems are regarded as signatures of Maui and Hawai‘i Island but were present on smaller scales on all of the main Hawaiian Islands. Dry land sweet potato cultivation on these islands helped to

provide additional food resources. The maximization of space and dedication of it towards food production would make a difference in allowing for longer and more frequent human presence on these islands.

Discussion

Environmental catastrophe and social deprivation as the outcome of island insularity often define the anthropological narrative of remote islands with severe resource limitations (Diamond 1985; Terrell 1986; Kirch 1988; Irwin 1992; Weisler 1996). The archaeological evidence provided here should challenge the inevitability of such narrative trajectories. "Mystery" islands or those located in remote areas present certain constraints for long term human occupation, but empirical study of their histories should replace speculations about their trajectory of abandonment and extinction. Environmental factors and geographic circumstances did pose challenges for colonists, but these were not always insurmountable obstacles. The goal of anthropological research into such islands should balance constraints with and understanding of the possible motivations and strategies colonists employed as they came to occupy and settle remote locations.

The settlement chronology for the northwest region of the Hawaiian archipelago indicates that colonization, expansion and the settlement of Nihoa and Mokumanamana began at approximately A.D. 1400 and was sustained through recurrent voyaging and occupational efforts for more than 400 years, well past European contact. This evidence should encourage archaeologists to reconsider the context of island settlement and abandonment, including strategies of occupation that relied upon voyaging and interaction. When long distance inter archipelago voyaging was ending throughout

Polynesia, it appears that Hawaiian long-distance inter island voyaging was just beginning. Hawaiian maritime practices at the local level expanded and drew upon the growing improvement of nautical skills of local navigators and sailors. Investment of effort included diverse practices and strategies including both the establishment of permanent settlement (i.e., construction of elaborated residential sites), local, specialized manufacture of stone objects (i.e., the highly crafted items such as stone vessels, ritual anthropomorphic images), recurrent use of ritual features, construction of terraces for dryland agriculture, and the development and maintenance of an intra-archipelago voyaging network that would have extended. This mobility allowed human movement and transportation of necessary resources as a condition of achieving a degree of "permanence" in a different way than is sometimes conceived by archaeologists. This was an important intentional strategy for countering issues of island insularity and marginality.

Occupation corresponds with what is described as a "commuter effect": islands that are too small to support a self-sustaining population but may nevertheless be inhabitable if the island is within commuting distance of another island or mainland offering additional resources (Keegan and Diamond 1987: 59). Human "commuters" include people who make seasonal use of small islands or who rely on trade with larger islands or the mainland for essential resources (e.g., Cherry 1985). Cherry (1985) suggests that in scenarios of insularity, selectively favored adaptations to risks of island life often include: very small dispersed group of people sustaining use and a high level of mobility (to import resources and reduce risk). In the Northwestern Hawaiian Islands, Mokumanamana was the primary socio-political attraction due to the role it played in

Hawaiian ritual power. Occupation of the island consisted of seasonal visitations of small parties of chiefly elites to commemorate the ‘aha ceremony as a process of determining and reinforcing Hawaiian leadership. Nihoa played the role of a support island, providing a much wider range of resources and support for these long voyages. By about A.D. 1650, the use and occupation of Nihoa evolved towards the establishment of a more permanent type of outpost on Nihoa. These efforts relied heavily on voyaging to provide a lifeline by moving people back and forth, as well as importing necessary resources (e.g., water, wood, basalt, food) to sustain local groups but also in support of groups who would have visited these islands to establish the timing for the annual ritual cycle. Over the course of many generations, Mokumanamana became a ritual center, and island temple through which esoteric knowledge (likely controlled by religious specialists), and power (to index or reinforce chiefly mana) were intertwined in the Hawaiian Islands.

Peer polity interaction occurred at an archipelago scale as social groups from amongst autonomous sociopolitical units converged on Nihoa and Mokumanamana for ritual purposes. Seriation of residential sites on Nihoa display more variation than can be accounted by a chronological arrangement in what seems to reflect intervals during which groups drawn from different areas of the main Hawaiian islands would have voyaged to Nihoa (and presumably MM). Members of these groups incorporated their “local” architectural designs to produce contemporaneous residential variants. At the same time, the continuity of design features represented in the residential site seriation suggests sufficient interaction across the archipelago with respect to the transmission of information regarding the appropriate design of such features.

Additionally, paleo-botanical identification of charcoal remains from residential fire pits indicates that a number of small to large size woods are being imported to the island due to the lack of timber resources naturally occurring there. Over exploitation of resources and deforestation of these islands did not occur, as woods from small to large trees such as naio, ʻaʻaliʻi, ʻōhiʻa ʻai (mountain apple), ulu (breadfruit), kukui (candlenut), kauila, and even exotic pine and kiawe were being imported for fuel, construction, and ritual purposes. These woods come from a number of diverse habitats in the main Hawaiian Islands. The geochemical sourcing of basalt assemblages for both islands also suggest movement, as a small percentage (3.1%) of utilitarian and ritual stone items were being transported in from island quarry sources such as Nualolo Kai on Kauaʻi, Waiahole on Oʻahu, and possibly as far as Kilauea on Hawaiʻi Island. Nutrient analyses of soils derived from agricultural features on both islands were interpreted with radiometric dates from test pits demonstrating that agricultural efforts in this region were late (post. A.D. 1650). Nihoa had much more potential and area in cultivation and could have sustained a push towards more permanent settlement of that island in late historical stages. The timing of implementation of these food production systems however was probably dependent upon it reaching its full development first in the main Hawaiian Islands. Nihoa and Mokumanamana might have also played a small role as an economic satellite for avian resources and possibly even marine resources (i.e. features, dried meat, etc.), the use of these islands was primarily subsidized through importation of critical resources needed for long term survival. This was an important voyaging feat and a testament to the cost chiefly elites was willing to bear in order to have access to Mokumanamana for religious purposes.

CHAPTER 6

HAWAIIAN RELIGIOUS FORMATION AND MONUMENTALITY

Ritual power and religious formation were critical components of complex chiefdoms that were expressed through ritual architecture and increasing scales of "monumentality." Monumental architecture refers to large elaborated structures that consisted not only of the material forms of buildings but also encompassed basal features such as raised earthen or interlocked dry stacked stone foundations. Generally, monumental architecture includes structures whose physical scale and elaboration of construction exceeded the requirements of any practical function the structure was intended to perform (Trigger 1990). Monumentality is a signature that can be indexed to a wide number of socio-political domains in respect to their hierarchical elaboration and resource investment (i.e., centralization of power, rise of religious authority, increasing political scale, and establishment of relations). This scale can vary both spatially within and across social units. When it is accessed with respect to the dimension of time (e.g., sorting construction effort by units of time), monumental architecture guides our understanding of socio-political transformation, change, and evolution. In Hawai'i, the conspicuous size and positioning of heiau temples on the landscape led them to be the focus of many early archaeological studies (Thrum 1907, 1908, 1909; Emory 1921, 1924, 1928; McAllister 1933; Stokes 1991; Walker 1933; Bennett 1931). These studies, for the most part, were descriptive and in many cases the heiau were identified by Hawaiian informants.

Typically, monumental architecture is a signature of religious authority that exists within the framework of two competing explanatory models: (1) that of "competitive

advertising," which is also falls within a similar category as "signaling theory" (Bird and Smith 2005); and (2) a model governed by the principle of "conspicuous consumption" (Neiman 1997; Trigger 1990: 124), one version of which is referred to a type of energy expenditure called cultural elaboration or "waste" (Dunnell 1999; Graves and Sweeney 1993; Graves and Ladefoged 1995; O'Shea 1999; Shepardson 2006). In the "advertising model," monuments are looked at in the context of communication and status. The construction of massive structures is presumed to demonstrate the competitive ability of chiefs and a reflection of their capacity to recruit and secure labor investment and generate resource surplus. The occurrence of these monuments is thought to be a function of environmental diversity, scaling with resource production potential. Monumental constructions of varying sizes and degrees of elaboration correlate with increasing stratification between vertically organized social classes (Trigger 1990: 120), as elites were often glorified and commoners' labor reflected their tacit acceptance of this social structure and their support role in political (and other) affairs. In Hawai‘i, ritual human sacrifice and feasting have been associated with heiau construction in a complementary fashion, helping to direct social norms and legitimize elite control (Kolb 1994b; Valeri 1985). It is thought to be an indicator that the group is committed to long-term cooperative and responsive actions. In contrast, the "waste" model views these elaborated structures as the "superfluous expenditure of human energy." Superfluous, here, refers to traits or the physical scale of traits that are unrelated to human reproductive needs, such as shelter and food. The occurrence of monuments viewed from the perspective of cultural elaboration is a function of high risk and resource unpredictability, as communities' energies are diverted away from expansion and both labor and resources

are integrated and pooled. This stabilizes populations below carrying capacity (i.e., population dampening), and adds to the flexibility of pooled labor to shift to subsistence if needed. This model proposes increased long-term survivorship in areas of the greatest production variance where cultural elaboration is adopted.

Studies of ritual architecture and "monumentality" in Hawaii have shown an important trend in transformation of the socio-political landscape that moved away from the smaller shrines or heiau used for personal or local ancestral worship towards increasingly larger temples that marked the establishment of an institutionalized state religion (Kolb 1994a). These heiau temples were an expression of ali'i status and authority that demonstrated the labor obligations between elites and commoners as well as the enhanced group cooperation needed to complete these public works. As Hawaiian society grew in population size it evolved into a corresponding set of social units at varying levels and scales. This included a variety of cultural domains including temple designs, with the largest structures reaching an apex of structural engineering efforts and human labor investment in the middle of Hawaiian pre-contact history (est. A. D. 1600; Kolb 1992, 1994a, 1997). Hawaiian heiau temples were created through an evolving series of design systems, for a pantheon of deities, serving many functional categories (e.g., governance, resource productivity, etc.), creating a wide array of temple morphologies that are evident in the archaeological record. The labor requirements devoted to the construction and maintenance of these sites have been measured by several variables such as the number of construction sequences, size and modification of individual building components (e.g., blocks or masonry), overall scale of foundations, or the distance and energy involved in transporting building materials. By the time of

European contact in 1778, Hawai‘i had completed a fundamental transformation from complex chiefdoms to several large independent polities, governed by a paramount leader, and sharing a state religion that shaped all dimensions of social life in the archaic state society (Kirch 2010). All of the major polities were associated with a number of heiau used for various “state” functions that involved religious authorities.

Monuments (i.e, ritual sites) have typically been recognized for their “religious” function, but has largely been overlooked in their role in shaping ideology and promoting cosmological principals and moral codes that unify group identify and create social order. These belief systems helped to foster cooperative behaviors that were evident in marital unions, short term political alliances, and the sharing of resources from the late expansion period (A.D. 1400- 1650) to the late protohistoric sequence (A.D. 1650-1778). It was part of a cultural infrastructure that expressed the ideology of kinship. As the religious system was formed rapidly and coordinated over large areas, rituals helped to encourage consensus, cohesion, and group identity within and amongst political groups and across social classes. This type of stability was essential to the formation of complex polities throughout the archipelago. This research provides an alternative perspective on Hawaiian monumental architecture. It supports the proposition that organized labor and cooperative effort were required at different scales in the construction of the largest monuments (Kolb 1997; Kolb and Snead 1997). As such they required heightened cooperation, a greater degree of resource pooling, and social integration, to complete these temples (and to periodically rededicate their use). Rituals helped to advance ancient ideologies that encouraged a level of dedication, devotion, and self-sacrifice (altruism) for the larger good in the building of these monuments, as symbols of religious

achievement for the nation. Religious formation was the foundation that directed social norms towards a stable, efficient, and cooperative structure that was mutually beneficial to both elites and commoners in Hawai‘i and across competing social political lines. In short, cooperation was pursued alongside strategies that emphasized competition. In fact, as competitive relations came to characterize Hawaiian leaders in the late prehistoric and early historic period, cooperative actions likely occurred in tandem (Cachola Abad 2000; Graves et al. 2011).

The Island of Mokumanamana played an important role in traditional Hawaiian culture as a ritual center of power allowing chiefs to access the west and commemorate events that acknowledged the source of their birthright and authority. The ritual sites on Mokumanamana and Nihoa fall within the category of "monumentality" (as defined above) as the scale of investments can be measured across a number of important social dimensions, other than the size of individual structures. This chapter will investigate the ritual use of these islands and attempt to: 1) establish a ritual chronology for each island and the region; and 2) measure the various investments and effort that went into the construction and sustained use of heiau on these ecologically marginal islands. This will be done through a variety of archaeological methods in order to develop a precise ritual chronology using both ^{230}Th coral dating of offerings left on heiau (and incorporated into construction), associated AMS ^{14}C dating, and seriation as a relative ordering technique. An assessment of monumentality will also apply new variables to estimate the voyaging costs of employing specialists at sea, the amount of resources consumed "on-canoe" and "on-island," and the transportation of resources over long distances. Through these analyses it will be demonstrated that the greatest investment in religious structures did

not occur with the largest heiau temples in the main Hawaiian Islands, but rather in the cumulative 400 years of effort and sponsorship put into a maritime network and ritual based occupation of Mokumanamana (and Nihoa). The expenditure of energy towards supporting this long-distance ritual system required large amounts of labor output and resource procurement. It resulted however in the creation of a new type of sacred and secular leader who emulated the gods and an astronomically-based predictive annual calendar that gave them immeasurable power. This integrated system was a true measure of mana that would come forward collectively for Hawaiian chiefdoms.

Identifying Hawaiian Heiau

Hawaiian heiau are first defined by function, as a place of worship or sacrifice, and only secondarily defined by a demarcation of space and its physical structural attributes. For this study, however we are concerned here with physical structures (i.e., foundations) constructed out of earthen and dry-laid stone and which remain as part of the archaeological record. Most religious sites exhibit some physical contextual attributes that help to identify their function. The archaeological definition of a Hawaiian a ceremonial site was taken from Graves and Sweeney (1993) where it was described as:

> a partially or completely paved outlined court, usually raised somewhat from the surrounding surface of land, and often walled on one or more sides. These courts may be associated with an ahu (altar) placed on one end of the court and often stone uprights (or wooden posts or platforms) are placed by the altar in the court. Upright or tabular blocks of rock may also be used in construction of the platform or walls of court. (Graves and Sweeney 1993: 108)

Within the perimeters of the court there were additional features that are indicative of ritual, rather than domestic activities. Also, the outside the perimeters of these sites there may be dense concentrations of features and artifacts associated with rituals but no longer subject to use. The importance of Hawaiian heiau sites lay in its ability to mediate

between the ancestral deities and the living. As described previously, often heiau were situated in significant locations, being set apart from domestic areas by placing them in prominent areas, situated at higher elevations, open areas, by water drainages, or by cliffs (Graves and Sweeney 1993: 109); or associated with important view sheds or cardinal directions (Kirch 2004; Stephen and Graves 2006). They could also be placed near or adjacent to natural features, storied places, and with distant but visible features associated with land, sky, and sea. In addition to these physical attributes, Hawaiian heiau are also identified by the types of ritual offerings, typically coral pieces that are either incorporated within heiau foundation construction, on the surface, or placed on top of the ahu. Despite these commonly shared characteristics, Hawaiian heiau displayed a considerable amount of variation in a number of dimensions including: size, height, volume, orientation, method of construction, number of uprights, and overall design. All of these are important variables for archaeological analysis of Hawaiian heiau sites that cannot be perfectly captured in a single categorical definition.

The heiau temples on Nihoa and Mokumanamana have played a central (but unresolved) role in early Polynesian archaeology, as they were initially interpreted to reflect historical relationships based on a cultural historical framework and limited ethno-historical information. As part of a major documentation effort undertaken by the Tanager expedition in 1923-1924, the ritual sites on these remote and uninhabited islands amazed researchers because they did not seem to resemble any other temple forms seen in the main Hawaiian Islands. In fact, these religious sites were so different they were thought to represent a single archaic period of Hawaiian culture essentially holding the key to understanding the geographic origins of the Polynesians who settled the Hawaiian

Islands. The striking resemblance of heiau temples with the temple foundations seen in the Societies and Tuamotu Islands led Bishop Museum archaeologists Bruce Cartwright and Kenneth Emory to designate the all of Mokumanamana temples and four of the Nihoa temples (50-Nh-01, -10, -50, -51)[120] by the Tahitian term *marae* instead of heiau (Figure 6.1).

> Several names were suggested for these structures such as paepae heiau, but feeing that these were not house foundations or similar to Hawaiian heiau I decided on the use of morae. The word used by Captain Cook (sic) in describing (sic) similar structures in Polynesia. (B.Cartwright n.d.)

Emory (1928: 298, 301) suggested that this early temple style was introduced throughout Southeast Polynesia, and represented a wide spread archaic proto-Polynesian form that was largely displaced by later forms of heiau (as well as marae) temples. These Southeastern Polynesian stylistic affinities included a long narrow raised stone platform facing on one end of the rectangular court. Along the back facing of the platform stone uprights were placed standing in an uneven number. In some cases, the platform was absent and the uprights at the head of the court were planted directly into the pavement. The courts had an arrangement of uprights, as a single or pair of uprights was embedded centrally against the platform, while another single or pair of uprights was typically located away in the front of the court. The Mokumanamana and Nihoa temples were considered a next step in the evolution of ritual sites as they differed from their Southeastern Polynesian counterparts and became "Hawaiian-ized" through the following changes: (1) a consistent presence of a raised stone platform instead of the uprights at the

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[120] Emory (1928: 13-14) initially feels only one site (50-Nh-50) is of the Necker type marae; he later (1970:88-89) changes his view to include four Nihoa temples (50-Nh-01, -10, -50, -52) but confuses Site 52 with Site 51.

head of the court typically planted directly into the pavement; (2) a much greater number of uprights (n= 5-21); and (3) pairs of court uprights in each position instead of single uprights (Emory 1970: 87-89).

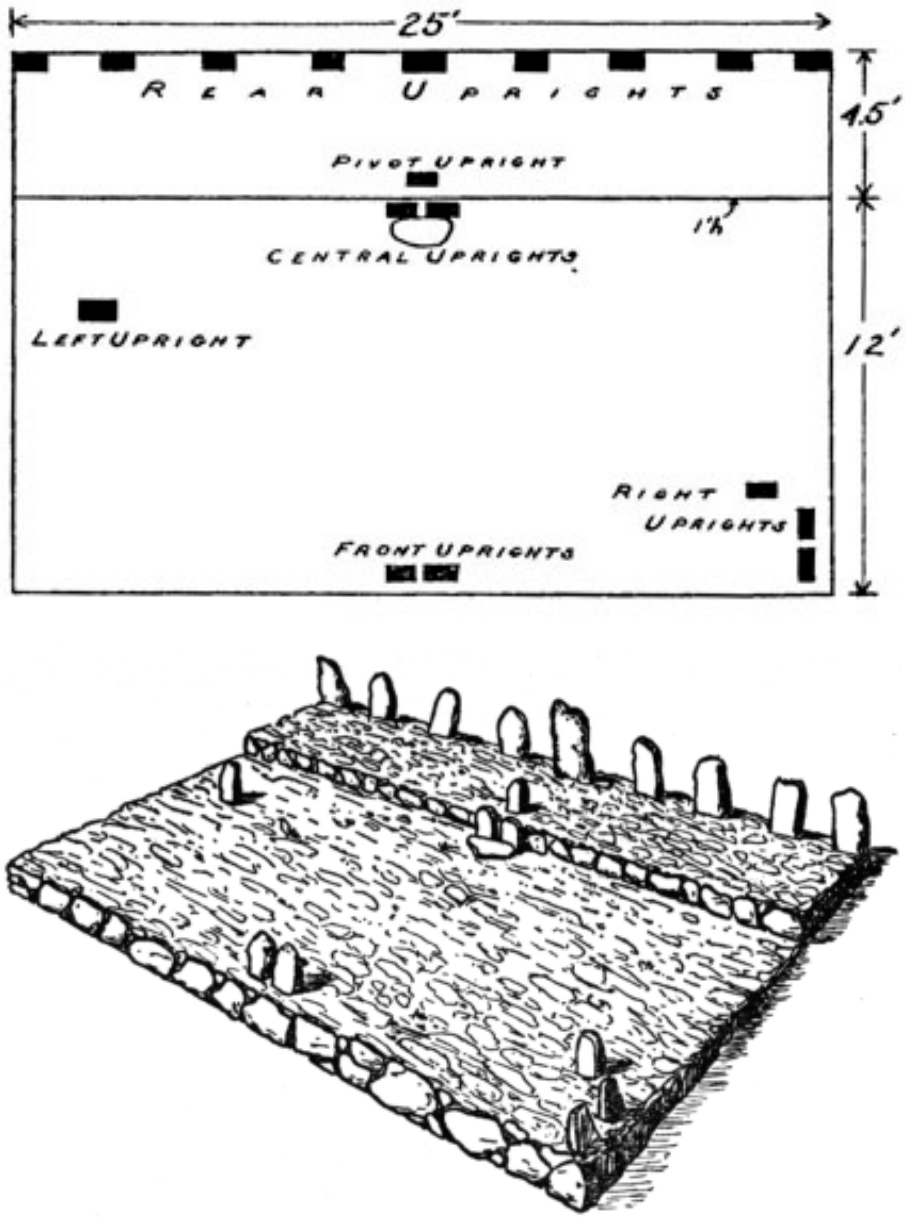

Figure 6.1. Example of Typical Layout of Mokumanamana Temple

The idea that Nihoa and Mokumanamana temples represented an earlier single archaic Hawaiian culture led early archaeological efforts in Hawai‘i to search for surviving “marae” type temples in the main Hawaiian Islands. Archaeologists surveyed, researched, and commented on any cultural features that were visibly similar on the islands of Kaua‘i (Bennett 1931: 96), O‘ahu (McAllister 1933: 60), and Maui (Emory 1921: 246, Plate XXII A; Walker n.d. 294). Additionally, anthropological scholars speculated that these archaic platform temple structures were traits of an “old Tahitian culture” (Handy 1930: 3) using their history as a social model to propose that the original Hawaiian people were the menehune of Hawaiian legends, since the cognate Tahitian term, manahune, referred to the commoner class in Tahiti (Handy 1930: 13). Buck (1938: 250; 1957: 531-532) also supported these hypotheses by assigning the marae type of temple platform to Hawai‘i’s original occupants, and suggesting the marginal and limited distribution of this temple form was due to later Polynesian immigrants who exiled and pushed out the original people from Kaua‘i, as castaways, onto the barren rock islets of Nihoa and Mokumanamana. All of these reconstructed behaviors and their outcomes were based upon linking assumptions and speculative ideas, none of which could be empirically demonstrated.

This research attempts to sort through many of the existing views to establish an empirical baseline, particularly for the construction design and chronology of heiau on these two islands. Archaeological fieldwork for this portion of the study spanned three field seasons for Nihoa Island from 2005-2008; and three field seasons for Mokumanamana Island from 2008-2011. These surveys were designed to be minimally invasive in respect of the cultural importance of the place and the heightened awareness

concerning the management of the resources there. On Nihoa 13 of the 14 heiau temples and 2 shrines were recorded in terms of their foundation size, location, and architectural attributes. This recording system was also employed on Mokumanamana for 33 of the 34 heiau temples. All temples were mapped with tape and compass, and locations were marked with Trimble GeoXT and Garmin GPS units. Additionally, intact pieces of branch coral were collected from a number of sites, primarily the ceremonial features, to date their construction(s) and dedication(s), as well as to possibly identify the species of corals and their origin. A total of 39 coral samples were collected as part of this fieldwork from at least 13 different ritual sites from both islands. These samples are critical in establishing a chronology for temple construction and religious use of both islands in pre-contact times.

Coral for Ritual Offerings and Chronometric Dating

A chronology of construction and ritual use was developed following a U-series method first applied to temple dating in Maui (Kirch and Sharp 2005), Molokai (Weisler et al. 2005), then Hawai‘i (McCoy et al. 2008). This method has been broadly applied to other areas in Polynesia including the Society Islands (Sharp et al. 2010) and Mangareva (Kirch et al. 2010). We applied ^{230}Th coral dating to heiau on Nihoa and Mokumanamana Islands with the aim of developing a high-precision chronology of temple construction for both remote islands. Similar to radiocarbon dating, ^{230}Th dating (or U-series dating method) is based on ratios of isotopes controlled by radioactive decay of a parent isotope; in this case, the decay of ^{238}U through ^{234}U to ^{230}Th (Kirch and Sharp

2005, McCoy et al. 2008; Weisler et al. 2009).[121] Heiau in the Hawaiian Islands incorporated various kinds of corals as ritual offerings left on top of the ahu (platform) or included pieces lodged into the construction material of the site. The religious function of coral as an offering is gleamed from ethno-historical accounts (Malo 1951; Handy 1927). This practice continues today when Hawaiians make offerings of living corals as an ideological component of traditional ritual and the sacred consecration of heiau space.

The approach utilized in coral dating of ritual sites first attempted to establish a link between the dated event (the death of the coral sample) with the target event (the construction of heiau temples) (Dean 1978). This was determined both absolutely and contextually through a process of interpreting temporal variability. In the past, coral heads were collected live and immediately preserved at these ritual sites through: (1) their use in the construction basal foundations as fill component; or (2) their use construction as fill within the courtyard of a site; or (3) their use as offerings on the surface of perimeter construction (e.g., walls). The first two situations allow archaeologists to infer that the date of the death of the coral as it corresponds to the construction of the site. The last situation however, typically correlates samples derived from surface contexts to ritual use rather than the actual construction of the site (Weisler et al. 2005). Despite these perceived differences, coral dates are still relevant as they provide a basis from which inferences can be made concerning both ritual use *and* construction- as the earliest date amongst the coral offerings can be used as a proxy for heiau construction. Given these conditions the date of final growth of the coral specimen should closely approximate

[121] This type of radiometric dating is typically used to date high-and-dry coral reefs and reconstruct the history of sea level change but has also been applied successfully towards archaeological research.

these target events, so long as the preserved coral surfaces are of near-zero age and the ^{230}Th- ^{234}U- ^{238}U System in the corals have remained closed. Finally, anomalous coral dates can be identified in this process by comparing whether they fit within the overall range of dates for both islands, and whether they correspond to the otherwise successful ordering of heiau within seriations (i.e., one that is anchored by other chronometric means).

Moving westward from the 'main Hawaiian Islands', coral samples left as ritual offerings were recovered from a number of ritual sites including: 2 shrines on Lehua islet (a smaller island off of Ni'ihau; 50-99-01-02 Feature 3 T-3 and 50—99-01-02 Feature 5 T-43; n= 2) (Carpenter and Yent 2009), 14 temples and 2 shrines on Nihoa (50-Nh-01, -06, -08, -09, -10, -11, -20, -21, -22, -51, -63, -89, -90; n=36) and 1 temple site on Mokumanamana (50-Nk-02; n= 2). Mokumanamana had noticeably fewer coral offerings than Nihoa, which was unexpected considering the island's important religious significance. Multiple corals were dated from 9 sites on Nihoa to assess the reproducibility of dates of each site and to potentially estimate the span of time over which a heiau was utilized. The largest numbers of coral samples were obtained from the largest heiau site (50-Nh-01), which is a likely indicator of the importance of this heiau temple for the island. All of the coral samples were collected from surface contexts (on top of the ahu or wall) on the sites, except for two specific sites from Nihoa- two samples from 50-Nh-22 and one sample from 50-Nh-51 were collected from the interior architecture that was exposed from fall and collapse. All samples were submitted to the Hawai'i Institute for Marine Biology (HIMB) and identified by Dr. Paul Jokiel and Dr.

Ku‘ulei Rodgers as cauliflower or rose coral (*Pocillopora meandrina*) an indigenous species of coral commonly found throughout Hawai‘i and the greater Pacific.[122]

U-series isotope measurements were made at the Radiogenic Isotope Laboratory, University of New Mexico. Subsample powders (50-200 mg) were milled with a computer-controlled drill, then dissolved in nitric acid and spiked with a mixed ^{229}Th-^{233}U-^{236}U spike. U and Th were separated using conventional anion-exchange chromatography. U and Th separates were measured with a Thermo Neptune multicollector inductively coupled plasma mass spectrometer (MC-ICPMS). All of the masses with the exception of ^{230}Th and ^{234}U were run in Faraday cup detectors using a mix of 10^{11} and10^{12} Ω resistors, and ^{230}Th and ^{234}U were measure with an ion-counting secondary electron multiplier (SEM) detector. ^{234}U was measured in a Faraday cup detector in some cases. All masses of each element were run in static mode following the method developed by the laboratory (Asmerom et al. 2006). The CRM-145 U isotope standard was measured with the samples, obtaining the conventionally accepted δ^{234}U value of -36.5. For runs in the SEM, CRM-145 and an in-house Th standard were used to control efficiencies between the SEM and Faraday cups. U and Th procedural blanks were in the range of 5-10 pg and therefore have no effect on ages. The analytical uncertainties are 2σ of the mean. The age uncertainties include analytical errors and uncertainties in the initial ^{230}Th/^{232}Th ratios. Initial ^{230}Th/^{232}Th ratios were corrected using an atomic ratio of 8.8 ppm, double the global crustal value.

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[122] Coralline algae were also collected from surface contexts from the ahu of heiau during fieldwork from sites 50-Nk-02, -20, -21, -26, -27, -28 because it resembled coral. University of Hawai‘i Department of Botany Professor Dr. Cecilia Smith and Ph.D. candidate Cheryl Squair explained that the process of identifying the last growth for these samples is somewhat difficult which would create a challenge for dating although this will be pursued in the future.

The ritual chronology for Nihoa and Mokumanamana are based on an assemblage of U-series dates that showed a continuous and narrow range of heiau construction and ritual use (as it relates to coral as ritual offerings) for Lehua, Nihoa and Mokumanamana islands (Table 6.1). The chronometric ritual chronology for Nihoa followed a logical stepping stone sequence that included Lehua islet, a smaller satellite located (to the south east and) offshore and adjacent to Ni‘ihau Island. Two small shrines on Lehua had coral samples that were dated to A.D. 1470 ± 7 y and A.D. 1478 ± 6 y. Nihoa’s chronology is based on thirty six ^{230}Th dates that span from a total of 110 years from A.D. 1496 ± 6 y to 1606 ± 7 y. These dates originate from both interior construction and surface contexts from 14 heiau temples and 2 shrines referencing building and use events. The ritual chronology of Nihoa appears later than the settlement of the island with ^{14}C dates ranging from A.D. 1425-1815 and with sporadic visits into the modern era. This supports the proposition that settlement and occupation played a primary role for the stating of recurrent ritual use of Mokumanamana, because of the difficulty of sustaining two-way voyaging in the face of shifting climate conditions over time.

Table 6.1. U-series Data for Hawaiian Corals from Lehua, Nihoa, and Mokumanamana Islands

Sample Code	Island	Site No.	Provenience	^{238}U (ppb)	^{232}Th (ppt)	^{230}Th/^{232}Th activity ratio	^{230}Th/^{238}U activity ratio	measured δ^{234}U (‰)	initial δ^{234}U (‰)	Base Date	uncorrected age Yr BP	corrected age Yr BP	Age (A.D.)
Coral LE001	Lehua		Surface	2410 ± 5	106 ± 40	400 ± 152	0.00572 ± 0.00006	147± 1.1	147.3 ± 1.1	2010	542 ± 7	540 ± 7	1470 ± 7
Coral LE001* (2nd)	Lehua		Surface	2397 ± 6	49 ± 40	839 ± 696	0.00559 ± 0.00006	146.7± 0.6	146.9 ± 0.6	2010	533 ± 6	532 ± 6	1478 ± 6
Coral A	Nihoa	50-Nh-01	Surface	2518 ± 6	99 ± 44	394 ± 178	0.00504 ± 0.00008	147.6 ± 0.7	147.8 ± 0.7	2007	481 ± 8	479 ± 8	1528 ± 8
Coral B	Nihoa	50-Nh-01	Surface	3035 ± 8	95 ± 33	464 ± 161	0.00477 ± 0.00004	146.3 ± 0.7	146.5 ± 0.7	2007	456 ± 4	454 ± 4	1553 ± 4
Coral C	Nihoa	50-Nh-01	Surface	2303 ± 6	138 ± 48	252 ± 88	0.00494 ± 0.00008	148.1 ± 0.9	148.3 ± 0.9	2007	470 ± 8	467 ± 8	1540 ± 8
Coral D	Nihoa	50-Nh-01	Surface	3310 ± 8	161 ± 71	309 ± 138	0.00491 ± 0.00007	151.9 ± 0.7	152.1 ± 0.7	2007	466 ± 6	464 ± 7	1543 ± 7
Coral E	Nihoa	50-Nh-01	Surface	2799 ± 8	370 ± 20	98 ± 5	0.00502 ± 0.00006	149.3 ± 1.2	149.5 ± 1.2	2007	478 ± 6	469 ± 7	1538 ± 7
Coral E-T*	Nihoa	50-Nh-01	Surface	2799 ± 8	617 ± 105	74 ± 13	0.00534 ± 0.00017	158.3 ± 1.0	158.5 ± 1.0	2007	505 ± 16	492 ± 17	1515 ± 17
Coral 0036-0039 D	Nihoa	50-Nh-01	Surface	2581 ± 6	40 ± 39	968 ± 939	0.00488 ± 0.00005	146.1±0.9	146.3 ±0.9	2010	465 ± 5	465 ± 5	1545 ± 5
Coral 0033-0035A	Nihoa	50-Nh-01	Surface	2589 ± 6	211 ± 42	204 ± 41	0.00543 ± 0.00005	146.8± 0.5	147.0 ± 0.5	2010	518 + 5	514 ± 6	1496 ± 6
Coral 0030-0032B	Nihoa	50-Nh-01	Surface	2435 ± 6	15 ± 49	2462 ± 8146	0.00489 ± 0.00006	145.8± 0.7	146.0 ± 0.7	2010	467 ± 6	467 ± 6	1543 ± 6
Coral 0039-0042 B	Nihoa	50-Nh-01	Surface	2301 ± 5	33 ± 51	1089 ± 1691	0.00513 ± 0.00007	146.8± 0.4	147.0 ± 0.4	2010	489 ± 7	488 ± 7	1522 ± 7
Coral F	Nihoa	50-NH-06	Surface	2604 ± 6	105 ± 45	377 ± 160	0.00500 ± 0.00007	147.0 ± 0.7	147.2 ± 0.7	2007	477 ± 6	474 ± 6	1533 ± 6
Coral H	Nihoa	50-Nh-08	Surface	2867 ± 7	499 ± 29	85 ± 5	0.00486 ± 0.00007	147.3 ± 0.5	147.5 ± 0.5	2007	463 ± 7	453 ± 9	1554 ± 9
Coral G	Nihoa	50-Nh-09	Surface	2872 ± 11	64 ± 22	659 ± 224	0.00479 ± 0.00004	148.0 ± 1.7	148.2 ± 1.7	2007	457 ± 4	455 ± 4	1552 ± 4
Coral 0044	Nihoa	50-Nh-10	Surface	2737 ± 6	20 ± 54	1976 ± 5197	0.00481 ± 0.00006	145.2± 0.9	145.4 ± 0.9	2010	460 ± 6	459 ± 6	1551 ± 6
Coral 0043	Nihoa	50-Nh-10	Surface	2518 ± 6	243 ± 59	173 ± 42	0.00545 ± 0.00007	146.3± 1.0	146.5 ± 1.0	2010	520 ± 6	515 ± 7	1495 ± 7
Coral 0045	Nihoa	50-Nh-10	Surface	2669 ± 6	13 ± 54	3051 ± 12322	0.00497 ± 0.00006	147.5± 0.3	147.7 ± 0.3	2010	474 ± 6	473 ± 6	1537 ± 6
Coral 0046	Nihoa	50-Nh-11	Surface	2590 ± 6	38 ± 32	1009 ± 849	0.00481 ± 0.00004	149.8± 1.1	150.0 ± 1.1	2010	458 ± 4	457 ± 4	1553 ± 4
Coral 0049	Nihoa	50-Nh-11	Surface	2894 ± 7	33 ± 31	1314 ± 1238	0.00488 ± 0.00004	148± 0.3	148.2 ± 0.3	2010	466 ± 4	465 ± 4	1545 ± 4
Coral 0047	Nihoa	50-Nh-11	Surface	2389 ± 7	55 ± 52	651 ± 616	0.00489 ± 0.00007	145.2± 1.0	145.4 ± 1.0	2010	467 ± 7	466 ± 7	1544 ± 7
Coral 0048	Nihoa	50-Nh-11	Surface	2894 ± 7	82 ± 49	523 ± 314	0.00483 ± 0.00006	146.2± 1.1	146.4 ± 1.1	2010	458 ± 7	456 ± 7	1554 ± 7
Coral I	Nihoa	50-Nh-20	Surface	2470 ± 6	92 ± 31	393 ± 134	0.00478 ± 0.00006	147.9 ± 0.4	148.1 ± 0.4	2007	456 ± 6	454 ± 6	1553 ± 6
Coral J	Nihoa	50-Nh-20	Surface	1845 ± 5	211 ± 59	132 ± 37	0.00493 ± 0.00011	148.5 ± 1.0	148.7 ± 1.0	2007	469 ± 11	463 ± 12	1544 ± 12
Coral K	Nihoa	50-Nh-21	Surface	2475 ± 7	185 ± 23	199 ± 25	0.00486 ± 0.00004	146.5 ± 0.9	146.7 ± 0.9	2007	464 ± 4	459 ± 4	1548 ± 4
Coral 0050	Nihoa	50-Nh-21	Surface	2804 ± 6	42 ± 31	1009 ± 737	0.00493 ± 0.00004	148.8± 0.5	149.0 ± 0.5	2010	470 ± 4	469 ± 4	1541 ± 4
Coral L	Nihoa	50-Nh-22	interior	3028 ± 7	123 ± 47	381 ± 145	0.00506 ± 0.00006	147.6 ± 0.6	147.8 ± 0.6	2007	483 ± 6	480 ± 6	1527 ± 6
Coral M	Nihoa	50-Nh-22	interior	1192 ± 3	55 ± 31	335 ± 191	0.00505 ± 0.00008	147.1 ± 0.5	147.3 ± 0.5	2007	481 ± 8	479 ± 8	1528 ± 8

Table 6.1 (continued). U-series Data for Hawaiian Corals from Lehua, Nihoa, and Mokumanamana Islands

Sample Code	Island	Site No.	Provenience	^{238}U (ppb)	^{232}Th (ppt)	^{230}Th/^{232}Th activity ratio	^{230}Th/^{238}U activity ratio	measured δ^{234}U (‰)	initial δ^{234}U (‰)	Base Date	uncorrected age Yr BP	corrected age Yr BP	Age (A.D).
Coral N	Nihoa	50-Nh-51	Surface	2633 ± 7	94 ± 30	394 ± 125	0.00459 ± 0.00006	148.1 ± 0.9	148.3 ± 0.9	2007	438 ± 5	436 ± 6	1571 ± 6
Coral O	Nihoa	50-Nh-51	interior	2897 ± 7	316 ± 57	135 ± 25	0.00483 ± 0.00007	146.8 ± 0.6	147.0 ± 0.6	2007	461 ± 6	454 ± 7	1553 ± 7
Coral P	Nihoa	50-Nh-63	Surface	2813 ± 7	92 ± 18	458 ± 91	0.00491 ± 0.00006	148.0 ± 0.6	148.2 ± 0.6	2007	468 ± 6	466 ± 6	1541 ± 6
Coral 0052	Nihoa	50-Nh-63	Surface	2905 ±8	66 ± 30	651 ± 296	0.00482 ± 0.00004	146.5±0 5	146.7 ±0 5	2010	460 ± 4	459 ± 4	1551 ± 4
Coral 0051	Nihoa	50-Nh-63	Surface	3224 ± 7	45 ± 47	1045 ± 1106	0.00475 ± 0.00005	145.7± 0.7	145.9 ± 0.7	2010	454 ± 5	453 ± 5	1557 ± 5
Coral 0055	Nihoa	50-Nh-89	Surface	2259 ± 5	13 ± 44	2247 ± 7653	0.00424 ± 0.00007	146.1± 0.6	146.3 ± 0.6	2010	405 ± 7	404 ± 7	1606 ± 7
Coral 0056	Nihoa	50-Nh-89	Surface	2331 ± 6	27 ± 56	1141± 2412	0.00425 ± 0.00008	144.4± 2.5	144.6 ± 2.5	2010	407 ± 7	406 ± 7	1604 ± 7
Coral 0054	Nihoa	50-Nh-89	Surface	2242 ± 5	62 ± 44	535 ± 377	0.00483 ± 0.00013	146.3 ± 1.3	146.5 ± 1.3	2010	454 ± 14	454 ± 14	1556 ± 14
Coral 0058	Nihoa	50-Nh-90	Surface	2771 ± 6	32 ± 38	1267 ± 1484	0.00482 ± 0.00005	147.3± 0.6	147.5 ± 0.6	2010	460 ± 5	459 ± 5	1551 ± 5
Coral 0057	Nihoa	50-Nh-90	Surface	2566 ± 6	28 ± 55	1258 ± 2445	0.00456 ± 0.00006	146.3± 1.1	146.5 ± 1.1	2010	435 ± 6	435 ± 6	1575 ± 6
Coral 0029* (3rd)	Mokumanamana	50-Nk-02	Surface	2742 ± 6	1122 ± 44	106 ± 4	0.01416 ± 0.00009	146.5± 0.6	148.2 ± 0.5	2012	1357 ± 9	1333 ± 15	677 ± 15
Hawaii-E4	Mokumanamana	50-Nk-02	Surface	2324 ± 2	14 ± 65	3211 ± 15136	0.0062 ± 0.0001	143 ± 1	144 ± 1	2011	594 ± 8	594 ± 8	1417 ± 8

* All samples were identified as cauliflower or rose coral (*Pocillopora meandrina*) and indigenous species of coral commonly found throughout Hawai‘i and the larger Pacific. Corrected ages use an initial 230Th/232Th atomic ratio = 1.0 ± 0 5 ppm. Years before present = yr BP. where present is AD 2007, 2010, or 2011. All errors are absolute 2σ. Subsample sizes range from 40 to 250 mg.

The chronometric ritual chronology for Mokumanamana remained to some degree uncertain because of the limitations in datable coral materials found in ritual contexts on the island. A total of two coral samples were located from a single ritual site which dated early to A.D. 677 ± 15 and A.D. 1420 ± 5. The A.D. 662-692 date is considered accurate as the sample was split and tested three different times for internal consistency. It is highly unlikely that a piece of coral could withstand and survive over 750 years of existence in a turbulent coastal environment and then placed in secondary contexts on a heiau ahu. While the Mokumanamana coral samples were eroded with no branches, studies in central Polynesia have demonstrated even shaped coral blocks had no difference in accuracy in relation to regular pieces that were left as ritual offerings on the ahu (Sharp et al. 2010). If the estimate for the specimen dated to the late 7th century A.D. is correct, as is suggested, one plausible interpretation is the coral piece was an heirloom item, possibly safeguarded in someone's possession as a keepsake. This would place its initial collection prior to Polynesian colonization of the Hawaiian Islands and its original location would therefore have been in one of the other archipelagos of east-central or western Polynesia. Considering this interpretation, the coral specimen would have found its way to Hawaii and was made as an offering on this particular site in the 14th or 15th centuries A. D. It is entirely possible that this could be an indicator of continuity with central Polynesia and oral traditions accounts of the original homeland "Kahiki." The second date of A.D. 1415-1420 from the same site corresponds closer to earliest phase settlement for the island based on a chronology from the main habitation cave (A.D. 1433-1501) and predates it by 13 years. This sample was also split and dated three times for internal consistency, with a weighted average used for the best estimated age value.

Despite this chronometric evidence, the next section assesses the validity of this date through combining seriation orders of heiau from each island and cross referencing their accuracy (along with secular open habitation seriations) across architectural classes. Overall, mid to late A.D. 1400 seems the best dated early estimate of ritual occupation of the Nihoa and Mokumanamana Islands.

Temple Seriations- Expanding the Chronometric-Based Chronology

Building an ordinal-based sequence of temple construction for both Nihoa and Mokumanamana was an important step to understanding the overall chronology of heiau construction and the evolution of architectural design over time. When relative sequences are used in tandem with chronometric dating as an integrated chronology, it becomes a valuable tool for understanding change through time and across all of the groups. In this case, a total of 33 temples for Mokumanamana and 12 temples for Nihoa were identified and documented based on archaeological inference from observed features on the landscape. The architectural traits of these temples were independently assessed in island assemblages using an archaeological method called seriation, one that is commonly applied to the relative chronological ordering of material phenomena. Seriation has recently been used for both secular and ritual architecture in Polynesia, including temple and house structures in Hawai‘i and marae temples in the Society Islands (Graves and Cachola-Abad 1996; Cochrane 1998, 1999; Kikiloi 2002; O’Connor 1998; Mulrooney and Ladefoged 2005; McCoy et. al 2011). In developing the heiau seriations, different sets of morphological and architectural attributes were evaluated for their chronological sensitively. Following the method outlined in Graves and Cachola-Abad (1996) occurrence seriation arranges heiau groups into a sequence, which then may be inferred

to represent a chronology. Each object, in this case heiau, was classified by the presence or absence of various traits or dimensions, most of which documented architectural choices. They were then placed in a relative order that maximizes presence and absent continuity across attribute dimensions. While the seriations produced separately for Nihoa and Mokumanamana could be combined and compared to other temple assemblages across the archipelago, this study was limited to building local relative chronologies for the two islands.

There were seven architectural traits for Mokumanamana and six architectural traits for Nihoa used in this analysis, most of which were taken and adapted from previous studies done on heiau of Oʻahu (Kikiloi 2002), Maui (Graves and Cachola-Abad 1996:23), and Hawaiʻi (Mulrooney and Ladefoged 2005). These eight architectural traits are: (1) Walls, (2) Walls on Retaining Walls; (3) Retaining Walls, (4) Flushed Perimeters, (5) Notching (Inverted Corners), (6) Interior Features, (7) Exterior Features, and (8) Raised Surfaces (Table 6.2).

Table 6.2. Attribute Descriptions for Hawaiian Heiau Architecture (Adapted from Graves and Cachola Abad 1996)

Dimensions	Class	Description
Perimeter Limited to boundary perimeters of the structure	Wall	Freestanding, horizontally and vertically elaborated rock alignment faced on two sides
	Wall on Retaining Wall	An elaborated walled rock alignment faced on two sides that rests directly on a retaining rock alignment placed against a sloping landscape.
	Retaining Wall	Horizontally and vertically elaborated rock alignment placed against a sloping landscape and faced on one side.
	Flushed Perimeters	Horizontally, but not vertically elaborated rock alignment faced on one or no sides
	Notching	Structure whose plan view shows an inversion of what would otherwise have been a corner, thus creating two additional sides.
Interior Limited to the interior of the perimeter	Interior Features	Relatively small-sized internal structures and features located within the perimeter either attached or separate. Includes small platforms, interior walled components, court uprights.
	Raised Surface	Two or more different surfaces of different grades in the interior of the structure.
Exterior Limited to exterior of the perimeter (detached)	Exterior Features	Relatively small-sized external structures and features located outside the perimeter either attached or separate. Includes small outside compartments, platforms, cairns, mounds.

All eight of these traits were consistently defined across both ritual assemblages (as well as secular) and occurred independently of each other, that is, one trait did not determine the availability of any other trait to occur with it. These traits fell within three structural dimensions: A) perimeter; B) interior; and C) exterior. Perimeter dimensions included: 1) Walls which are freestanding, two-sided, faced and both horizontally and vertically extended rock alignments; 2) Walls on Retaining Walls which are elaborated rock alignments faced on two sides (i.e., wall) that rests directly on a retaining rock alignment placed against a sloping landscape; 3) Retaining Walls which are horizontally and vertically elaborated rock alignments placed against a sloping landscape (against fill that extends the slope vertically for a flat surface be built); 4) Flushed perimeters which refer to a perimeter designation that had no elaborations and is flush with the natural topographic grade of the land; and 5) Notching which refers to an inverted corner of an otherwise four-sided (or more sided) perimeter. Interior Dimensions were combined to include: 1) Interior features that are relatively small-sized internal structures and features located within the perimeter of a heiau including but not limited to small platforms, walls, cairns, pits;[123] and 2) Raised surfaces which consisted of two or more different surfaces of different grades in the interior of the structure.[124] Exterior dimensions include: 1) Exterior features representing small-sized external structures and features located outside the perimeter of a temple and which could be distinguished as a separate unit from the

[123] Interior features did not include ahu or ahu uprights as these were present on almost every site and in fact were a condition in defining the site as ceremonial or ritual. Interior uprights found on the court or enclosure interior were included in the category of interior features.

[124] Raised surfaces were dependent upon the presence of two different levels of surfaces on the interior because the challenge in identifying this attribute lies in the changing reference point to what is the base surface. In some reiterations of these attribute categories this was called "multiple levels."

main structure.[125] This study recorded many more detailed architectural attributes beyond those that are described here. As architectural traits were examined, only some demonstrated temporal sensitivity. These traits were included but in some cases related attributes were combined into larger class-based units for these analyses.

Tables 6.3-6.4 show the best-fit seriations for Nihoa and Mokumanamana heiau, which attempts to maximize continuity of the architectural classes described above and minimize the gaps between classes. Finer descriptions such as the presence or absence of specific types of interior features, their position in the interior, and the location of exterior features are combined into more inclusive categories to ensure sufficient representation to create a successful arrangement. It should be noted that certain traits do not contribute to the successful ordering of heiau and hence do not reflect temporal change in their design. The class of "retaining walls" is an example of this, as it persisted throughout the ordering sequence for both islands due to the steeply sloping aspect of the islands' topography. This trait was kept in the seriation however for continuity because in a few cases it was the only attribute that could be discerned for these heiau temples. The ubiquity and persistence of this trait across all heiau temples on Mokumanamana and Nihoa drove early perceptions that these temples were uniform (showed little variation). The presence of retaining walls on all heiau foundations has led to their classification as platforms—structures raised above grade on two or more sides of the heiau foundations.

[125] Exterior features only referred to outside structures and components that were detached from the main structure. Attached features that were linked to the perimeter of the main structure were considered part of the main structure because it created a conflict as external features and inverted corners became codependent.

Table 6.3. Best-fit Seriation for Nihoa and Lehua Heiau

Nihoa & Lehua Heiau	Location	Size	Orientation	Island	Name	walls	walls on retaining walls	retaining wall	flush perimeter	inverted corner	interior feature	exterior feature	Chronometric Dating	TU	TU Cross Reference	Age Estimates
Lehua, Shrine A			unknown	Lehua									A.D. 1470 ± 7	1 (Middle-Late AD 1400)		Construction or Use: AD 1460-1485 (or earlier in the 1400s)
Lehua, Shrine B			unknown	Lehua									A.D. 1478 ± 6			
50-Nh-01	West-West Palm	120	West	Nihoa	Ninioa		●	●			●	●	A.D. 1490-1502 A.D. 1503-1532 A.D. 1515-1529 A.D. 1520-1536 A.D. 1531-1545 A.D. 1532-1548 A.D. 1537-1549 A.D. 1536-1550 A.D. 1540-1550 A.D.1549-1557	2 (Late AD 1400)	MM-TU2 NI HAB-TU2	Construction AD 1490-1500 (or earlier in the 1400s) Use: AD 1500-1560
50-Nh-10	West-West Palm	48	South	Nihoa			●	●	●		●	●	A.D. 1488-1502 A.D. 1495 ± 7 A.D. 1537 ± 6 A.D. 1551 ± 6			Construction AD 1490-1500 (or earlier in the 1400s) Use: AD 1500-1560

Table 6.3 (continued). Best-fit Seriation for Nihoa and Lehua Heiau

Nihoa & Lehua Heiau	Location	Size	Orientation	Island	Name	walls	walls on retaining walls	retaining wall	flush perimeter	inverted corner	interior feature	exterior feature	Chronometric Dating	TU	TU Cross Reference	Age Estimates
50-Nh-50	East Palm	115	North	Nihoa		●		●	●	●	●			3		
50-Nh-89	East Valley	21	South	Nihoa		●		●	●	●		●	A.D. 1556 ± 14 A.D. 1604 ± 7 A.D. 1606 ± 7	4 (AD 1525-1550)	MM-TU 3-4	Construction AD 1525-1550 Use: 1525-1615
50-Nh-20	Miller-Middle	128	South	Nihoa				●	●		●	●	A.D. 1544 ± 12 A.D. 1553 ± 6		NI HAB-TU 5-6	Construction AD 1525-1550 Use: AD 1525-1560
50-Nh-06	Miller-Middle			Nihoa		-		-	-	-	-	-	A.D. 1533 ± 6			
50-Nh-09	Miller-Middle			Nihoa		-		-	-	-	-	-	A.D. 1552 ± 4	4 or 5		
50-Nh-08	Miller-Middle			Nihoa		-		-	-	-	-	-	A.D. 1554 ± 4			

Table 6.3 (continued). Best-fit Seriation for Nihoa and Lehua Heiau

Nihoa & Lehua Heiau	Location	Size	Orientation	Island	Name	walls	walls on retaining walls	retaining wall	flush perimeter	inverted corner	interior feature	exterior feature	Chronometric Dating	TU	TU Cross Reference	Age Estimates
50-Nh-22	Miller-Middle	10	West	Nihoa				●	●		●		A.D. 1527 ± 6* A.D. 1528 ± 7*			Construction: AD 1525-1530
50-Nh-40	East Palm	22	South	Nihoa				●	●		●					
50-Nh-63*	East Valley	94	West	Nihoa				●	●		●		A.D. 1541 ± 6 A.D. 1551 ± 4 A.D. 1557 ± 5			Construction: AD 1520-1535 Use: AD 1535-1560
50-Nh-21	Miller-Middle	21	South	Nihoa				●	●		●		A.D. 1541 ± 4 A.D. 1548 ± 4	5 (AD 1525-1560)		Construction: AD 1520-1535 Use: AD 1535-1560
50-Nh-74&75	West-West Palm	112	South	Nihoa				●	●		●		A.D. 1551 ± 5 A.D. 1575 ± 6			Construction: AD 1520-1535 Use: AD 1535-1580
50-Nh-51	East Palm	100	North	Nihoa				●	●		●		A.D. 1553 ± 7* A.D. 1571 ± 6			Construction: AD 1545-1560 Use: AD 1560-1580
50-Nh-45	East Palm	21	South	Nihoa				●	●					6 (Pre AD 1650)		based on termination of flush perimeters on MM heiau

Table 6.4. Best-fit Seriation for Mokumanamana Heiau

MM heiau	Location	Size	Orientation	Island	walls	walls on retaining walls	retaining wall	flush perimeter	inverted corner	interior feature	exterior feature	raised surface	Chronometric Dating	TU	TU Overlap	Age Estimates
50-Nk-21	Flagpole	82	South	Mokumanamana			●		●	●				1		
50-Nk-32	Bowl	32	North	Mokumanamana		●	●		●	●				2 (pre AD 1500?)		
50-Nk-12	Flagpole	87	West	Mokumanamana		●	●		●	●						
50-Nk-18	Flagpole	86	East	Mokumanamana		●	●		●	●						
50-Nk-09	Annexation	21	South	Mokumanamana		●	●	●	●	●				3		
50-Nk-30	Summit	21	South	Mokumanamana	●		●		●	●				(4 & 5)	Ni-TU4	AD 1500-1550
50-Nk-33	Bowl	76	West	Mokumanamana	●		●	●	●	●						
50-Nk-14	Flagpole	117	West	Mokumanamana			●	●	●	●						
50-Nh-03	Annexation	89	South-East	Mokumanamana			●	●	●	●				6 (AD 1500-1550)		
50-Nk-29	Summit	107	East	Mokumanamana			●	●	●	●						
50-Nk-24	Flagpole	80	South	Mokumanamana			●	●	●	●						
50-Nh-01	Annexation	123	West	Mokumanamana			●	●		●		●				
50-Nh-02	Annexation	57	South	Mokumanamana			●	●		●		●	A.D. 1420 ± 5			AD 1415-25 (95%)
50-Nk-26	Flagpole	126	South	Mokumanamana			●	●		●		●		7 (AD 1500-1550)		
50-Nk-08	Annexation	35	West	Mokumanamana			●	●		●		●				
50-Nk-27	Flagpole	81	South	Mokumanamana			●	●		●		●				
50-Nh-07	Annexation	51	West	Mokumanamana			●	●		●	●	●		8		
50-Nh-06	Annexation	87	West	Mokumanamana			●	●		●	●	●				

Table 6.4 (continued). Best-fit Seriation for Mokumanamana Heiau

MM heiau	Location	Size	Orientation	Island	walls	walls on retaining walls	retaining wall	flush perimeter	inverted corner	interior feature	exterior feature	raised surface	Chronometric Dating	TU	TU Overlap	Age Estimates
50-Nk-19	Flagpole	122	East	Mokumanamana			●	●		●						
50-Nk-22	Flagpole	86	South	Mokumanamana			●	●		●						
50-Nk-23	Flagpole	100	East	Mokumanamana			●	●		●						
50-Nk-25	Flagpole	109	South	Mokumanamana			●	●		●				9 (AD 1525-1560)	Ni-TU5	AD 1550-1650
50-Nk-34	Bowl	162	South	Mokumanamana			●	●		●						
50-Nk-15	Flagpole	64	South	Mokumanamana			●	●		●						
50-Nk-17	Flagpole	98	East	Mokumanamana			●	●		●						
50-Nk-20	Flagpole	120	East	Mokumanamana			●			●						
50-Nk-28	Flagpole	71	South	Mokumanamana			●			●				10	Ni-TU9	
50-Nk-31	Bowl	156	East	Mokumanamana			●			●						
50-Nk-16	Flagpole	21	South	Mokumanamana			●									
50-Nh-05	Annexation	140	West	Mokumanamana			●									
50-Nk-10	NW Cape	42	North	Mokumanamana			●							11 (AD 1650-1850)		
50-Nk-13	Flagpole	54	West	Mokumanamana			●						A.D.1654-1810 (75%)			AD 1650-1850
50-Nk-11	Flagpole	2	North	Mokumanamana			●									

The seriations for heiau architectural construction for Nihoa sorted 13 of the 14 heiau into approximately six temporal units of ritual activity. This chronology was also expanded to include chronometric dates from associated sites with no architectural information. Overall, it illustrated considerable variability in architectural styles present (Table 6.3).[126] These architectural forms changed from highly variable to more simple structures in this ordering: a) Ni-TU1: this initial temporal unit was represented in the order by Lehua chronometric dates for two early dated shrines; b) Ni-TU2: platforms with walls on retaining walls, retaining walls, with flush perimeters, interior features, and exterior features; c) Ni-TU3: notched structures with walls, retaining walls with flushed perimeters and interior features; d) Ni-TU4: notched structures with walls (and with walls falling into discontinuation), retaining walls with flushed perimeters, notches fall into discontinuation), and interior features (with a single gap), and exterior features; e) Ni-TU5: platform structures with retaining walls with flush perimeter and interior and exterior features; f) Ni-TU6: platform structures with retaining walls with flush perimeters. In general, the seriation was robust with all six attributes demonstrating persistence of varying durations over time with two gaps present, one across interior features (temporal unit 4), and one across exterior features (temporal unit 3).

The seriation of heiau for Mokumanamana classified 33 heiau into eleven temporal units of ritual activity and also demonstrated great variability in architectural styles (Table 6.4). Again the archaeological forms tend to have evolved from highly variable to more simple structures in this general order: a) MM-TU1: notched structures

[126] Nihoa sites 50-Nh-06, -09 (shrines) were left out of the seriation because it was not of the same category of structure as heiau temples. Also Nihoa site 50-Nh-08 (heiau) was left out because it was so badly damaged that architectural data gathered could not be considered reliable.

with walls on retaining walls, retaining walls with interior features; b) MM-TU2: notched structures with walls on retaining walls, retaining walls, with interior features; c) MM-TU3: notched structures with walls on retaining walls, retaining walls with flushed perimeters, and interior features; d) MM-TU4: notched structures with walls, retaining walls, with interior features; e) MM-TU5: notched structures with walls, retaining walls with flushed perimeters, and interior features; f) MM-TU6: notched platform structures with retaining walls with flushed perimeters, and interior features; g) MM-TU7: platform structures with retaining walls with flushed perimeters, interior features, and raised surfaces; h) MM-TU8: platform structures with retaining walls with flushed perimeters interior features, exterior features, and raised surfaces; i) MM-TU9: platform structures with retaining walls, with flushed perimeters, interior features; j) MM-TU10: platform structures with retaining walls with interior features; k) MM-TU11: platform structures with retaining walls. In general, the seriation was extremely robust with all eleven attributes demonstrating persistence of varying durations over time with only a single gap present across flushed perimeters (at temporal unit 4).

For both Nihoa and Mokumanamana Islands, the U-series dates along with the seriation provided a finer approach to understanding of ritual chronology for these islands. The chronology was created first through the ordering of architectural classes present in the seriation which form six temporal units for Nihoa; and eleven temporal units for Mokumanamana. Second, the intervals are further refined by the associated chronometric dates that represent construction and use events that span across the different classes. The precision of the dates helped to determine that certain architectural classes were contemporaneous and thus represented a single temporal unit (instead of

two). Also by employing associated coral dates or AMS dates for any given site, it allowed confirmation of the direction of the ordering. In some cases, comparisons could be made between architectural classes across Nihoa secular open habitation sites, ritual sites, and Mokumanamana ritual sites allowed a degree of cross referencing to occur that further refined the accuracy of each chronology. Finally, overall age estimates for intervals in both ritual seriations were derived from this cross referencing approach, as well as inference from their position in a sequence. All of these methods combined help to provide a high level of confidence towards the understanding of the duration of ritual occupation of both islands.

Following the same approach for Nihoa secular habitation sites, creating a ritual chronology for Nihoa relied upon the seriation orders combined with chronometric dates that referenced construction and ritual use events. Based on these combined methods of determining timing the following age estimates were formulated: (1) TU-1 references Middle-Late A.D. 1400 (in regards to ritual use of distant Lehua islet); (2) TU-2 references Late A.D. 1400 (the earliest construction dates of heiau); (3) TU-3 references Late 1400- Early 1500; (4) TU-4 references A.D. 1525-1550; (5) TU-5 references A.D. 1525-1560; (6) TU-6 references Pre-A.D. 1650. In regards to construction timing, available chronometric dates that referenced construction events were used to first secure the sequence to absolute time. Most of the construction related dates were present in the middle or later interval of the sequence (temporal unit 6). Representing a single architectural class and temporal unit it spanned from A.D. 1521-1535 (50-Nh-22 at A.D. 1527±6 and 1528±7) to A.D. 1546-1560 (50-Nh-51 at A.D. 1553±7). Together these

dates helped to provide an anchor for the middle to late portion of the chronology in regards to construction timing.

Based on this understanding, the U-series dates that referenced ritual use were included to provide additional context and accuracy in the timing within the hypothesized intervals. It also provided the basis for inferences in determining the timing of initial construction efforts and when such efforts ended. The earliest dates that reference "use" occurred at two heiau, sites 50-Nh-01(A.D. 1496 ± 6) and 50-Nh-10 (A.D. 1495 ± 7) both of which are located on the western portion of the island. Both sites are similar with the earliest coral dates ranging from A.D. 1490-1500; and both have coral offerings that continue as late as A.D. 1550-1560. The similarity of patterns and the fact that they do not overlap with the remaining offerings suggested that they both represent near contemporaneous construction events assigned to earliest Nihoa temporal unit. It can be inferred that initial construction of Nihoa heiau likely occurred in the late A.D. 1400's (pre A.D. 1490) and ended approximately A.D. 1550. Nihoa heiau was therefore constructed rapidly within a relatively short time frame of about 60 years. From this assemblage of coral dates, the chronology of ritual use, to the degree by which it is measured by the presence of coral offerings, spanned about 110 years from A.D. 1495-1606 (50-Nh-89 A.D. 1604 ± 7 and A.D. 1606 ± 7). Finally, when the ^{14}C AMS dates are included in the Nihoa heiau chronology, it extends well into the 17th and 18th centuries reflecting more sustained secular occupation and use, and to a lesser extent agricultural production efforts. The earliest settlement of Nihoa is reflected, in both habitation and ceremonial construction and use, was directly related to the development of its role in the ritual system that is also represented in the MM heiau.

Developing a ritual chronology for Mokumanamana Island presented a more challenging situation as there were no available U-series dates that reference either construction or use. Instead the chronology relied heavily upon the seriation orders and the cross referencing of chronometric dates from contemporaneous contexts on Nihoa that occurred across similar architectural classes that developed in similar arrangement. These contexts were then used to reference construction and use events. Based on these combined methods of determining timing the following age estimates were formulated: (1) TU-1 references pre-A.D. 1500; (2) TU-2 references pre-A.D. 1500; (3) TU-3 references pre-A.D. 1500-1550; (4) TU-4 references A.D. 1500-1550; (5) TU-5 references A.D. 1500-1550; (6) TU-6 references A.D. 1500-1550; (7) TU-7 references A.D. 1525-1560; (8) TU-8 references post- A.D. 1560 and pre-A.D. 1650; (9) TU-9 references A.D. 1550-1650; (10) TU-10 references approximately A.D. 1650; (11) TU-11 references A.D. 1650-1850.

In order to establish the timing of construction of Mokumanamana heiau, comparisions were made with in both the Nihoa heiau seriations and open habitation seriations. The earliest intervals of all three seriations are arranged in a manner that suggests they are all contemporaneous events. For the comparison between Mokumanamana heiau and Nihoa heiau seriations important patterns emerged such as: (1) “walls” and “walls on retaining walls” are traits that occur early and almost overlap in arrangement; (2) “flushed perimeters” occur for long durations from early to late in the sequence; and (3) “inverted corners” occur early but Nihoa are present for a shorter duration. These patterns can be used to infer that Mokumanamana TU1-2 roughly corresponds to Nihoa heiau TU-1-4. This indicates that Mokumanamana heiau are likely

to have started construction in the late A.D. 1400's and continued periodically across a longer time span than Nihoa. Additionally, Mokumanamana TU 7 is contemporaneous with Nihoa heiau TU 5, which dates it to approximately A.D. 1525-1560. The final interval for Mokumanamana heiau construction can be inferred through its position in the order in regards to the above date, and also confirmed through the site 50-Nk-13 date of cal A.D. 1654-1810 (75%). Based on these correlations, the construction of heiau on Mokumanamana spanned from late A.D. 1400'to early A.D. 1800's. Evident in this long sequence is the "pulsing" of time intervals that represents rapid and increasing construction, followed by periods where fewer were constructed. At least one of these pulses corresponds and overlaps with Nihoa heiau construction (A.D. 1490-1550).

The second comparison was made between Mokumanamana heiau and Nihoa open habitation seriation where additional patterns emerged that supported these interpretations: (1) "flushed perimeters" appeared early to late in the sequence (with Nihoa open habitation sites having this trait occur earlier than Mokumanamana); (2) "inverted corners" matched for the same duration in the sequence practically overlapping in time; (3) "raised surfaces" began earlier in the sequence for Nihoa and then discontinued there, and continued on Mokumanamana heiau. These patterns provide additional support that Mokumanamana TU 1 correlates roughly to the late A.D. 1400's.

Both seriation comparisions provided strong congruent evidence in helping to establish that Mokumanamana heiau construction spanned from late A.D. 1400's to early A.D. 1800's. Interestingly the late interval of ritual use suggests that even immediately after European-contact these sites were being visited for commemorative ceremonies perpetuating this ho'omanamana practice up until the time of A.D. 1815, closely

corresponding with the abolition of traditional Hawaiian religion (A.D. 1819). Finally, when the Mokumanamana ^{14}C AMS habitation-based dates were included into this chronology, they filled most of the gap in time between the inferred initial construction and termination dates. There remained however a gap of time for Mokumanamana that was not accounted for chronometically that spans from about A.D. 1525 through the A.D. 1600's.

In terms of ritual chronology, the combined evidence presented indicates that both Nihoa open habitation sites, along with Mokumanamana heiau, likely occurred (i.e., were built) earliest and were continued to be constructed over a substantial period of time. In early ca. A.D. 1400, ritual specialists and/or chiefly elites started construction of Nihoa open habitation to create spaces of residence for human occupation of both islands. The contemporaneous architectural design classes displayed in both these open habitation sites and Mokumanamana heiau strongly suggest that the same group of people had a hand in both building efforts (as observed in traits such as flushed perimeters, notching, and raised surfaces). Nihoa heiau also underwent construction soon after as they reflect similar architectural styles in some respect to the Mokumanamana heiau (as observed in walls, walls on retaining walls- which do not appear in the same arrangements for the residences). Nihoa heiau however had important differences as they have a much shorter interval of time associated with construction and use. This is evident in the overlap in arrangement of "flushed perimeters between all three seriations, with Nihoa heiau discontinuing first, Nihoa open habitation sites second, and Mokumanamana heiau spanning the entire duration to post European contact. These patterns suggest the two

islands were highly coupled, with the same mixture of social groups representing the construction of these sites.

In measuring spatial interaction, both islands displayed more stylistic variation in temple construction design than can be accounted for only by the passage of time represented. In the main Hawaiian Islands, heiau seriations are drawn from smaller areas (e.g., Maui Island or the Kohala District on Hawaii Island) and as a result the sequences represent temporal orders representing longer durations. In contrast, the diversity in heiau classes present on these remote islands occur over much shorter temporal scales of construction as verified by the chronometric dates for the sequences. This is consistent with a model involving a high degree of inter-group interaction across the archipelago, traveling to the NWHI over a short period of time, and involving different groups, probably from different islands or portions of islands. The geographic scale of this interaction sphere is clearly defined on the Northwestern Hawaiian island end, however it would have likely included the other main islands such as Kauaʻi-Niʻihau (based on proximity and sequencing of ritual coral dates), Oʻahu (based on the presence of "flushed perimeters"), Maui (based on the later presence of "inverted corners" abt. A.D. 1500-1600), and Hawaiʻi (based on the use of uprights in wall foundations). These spatial considerations would account for the short time durations and the diversity of classes represented. I interpret this as reflecting an era during which maritime voyaging to the NWHI came into play in the transmission of ideas across different social group originating from the main Hawaiian Islands.

A high degree of cultural transmission was evident across many of the architectural classes. Matching the persistence of traits over time across seriations was an

important means in which to infer temporal units as contemporaneous events. In some of these cases specific traits displayed important nuanced differences that in the way traits persisted over time- with the appearance and disappearance of attributes in a timed manner across space (i.e. inverted corners, raised surfaces, etc.). So when one trait would discontinue on one island, it would reappear on another, or across functional classes (i.e., ritual versus secular sites). These differences in design classes between the two islands were a clear indication that the seriation were not tracking same exact "local groups." These seriations exhibit a composite of stylistic attributes that were shared and integrated through the process of cultural transmission. These combined results support an interpretation of not only a very rapid and evolving ritual expansion phase into the NWHI but a collective one that likely originated from multiple island sources to accomplish this achievement within a short 110 year span. When tracked at the time scale in 50-100 year increments, it is evident that there was a "voyaging interaction sphere," that is, an inter-regional exchange system for the movement of people and resources that existed from late A.D. 1400 to A.D. 1550 during the construction phases of these islands.

Monumentality on Marginal Islands

Monumentality has traditionally been measured by the overall scale of construction at a single heiau and the energy investment that goes into the efforts to transport, modify, and built the structure's foundation. These investments are seen as key indicators of the elite's ability to organize and mobilize a labor force to complete these monuments. Cultural evolutionary models often view monumentality as a function of environmental productivity in insular landscapes. Under this scenario, more productive environments could support larger populations and thus the labor force to create these

monuments. A correlation has been suggested in Hawaii for heiau temples on Molokai (Kirch 1990: 217), Maui (Kolb 1994a), and Hawai‘i (McCoy et al. 2011) with environmental productivity. Following this model the distribution of monumental sites should co-vary with regions of high and rich resource production (Peebles and Kus 1977: 426; Sahlins 1958; Goldman 1955, 1970; Kirch 1990). In Hawai‘i, there are alternative evolutionary selectionist arguments that suggest the largest heiau temples were instead located and concentrated in districts with greater environmental perturbations and resource unpredictability, and this uncertainty led to strategies that diverted the expenditure of energy, resulted in to population dampening and overall stabilization (Dunnell 1999; Graves and Sweeney 1993; Graves and Ladefoged 1995). Nihoa and Mokumanamana temples together can be seen as meeting the expectations of a cultural elaboration model, as the temples are situated in a marginal area for greatest investment. They deviate from the model however in terms of their role in establishing the ritual calendar, which in turn helps to improve productively in the main Hawaiian islands, in particular this knowledge was important to large scale rain fed agricultural systems of Maui and Hawai‘i island chiefs.

Monumentality has typically been measured by estimating the cost of labor as it relates to heiau construction (Kolb 1991, 1994a, 1997). The scale of effort is usually determined by calculations regarding construction material volume and inferred days of labor. According to Kolb (1997) increases in temple foundation sizes needed to be as high as 500 m^2 to correlate with the introduction to polity-scaled centrally organized elite coordination and communal participation that required ‘corvee’ labor. Smaller temples 150 m^2 to 500 m^2 were of manageable sizes that only required ‘festive’ labor projects that

were organized at the local community level by local elites. Temples smaller than 150 m^2 were typically done at the scale of families. Mokumanamana and Nihoa can be viewed together as a compound expression of monumentality, and one that is a unique example of the collective and cumulative efforts concerned primarily with off-setting the risks of marginality of their isolated location. While the heiau temples located on these remote islands are much smaller in comparison to their counterparts in the main Hawaiian Islands, it should be remembered that they needed to be constructed to an appropriate scale given the available terrain and materials. In other regions, such as Western Polynesia this type of tight site clustering has been interpreted as an indicator of increased centralization, control, and social cohesion (Clark et al. 2008; Clark and Martinsson-Wallin 2007). The reduced scale of temple sizes in the Northwestern Hawaiian Islands meant smaller parties of labor were required to complete their construction. The cost per person however was likely higher given the ritual importance of these sites; top specialists who had specific types of knowledge were needed for overall design, coordination, and oversight of this ritual system. Thus, valuable time of these specialists (in comparison to general laborers whom were employed in the main islands) was diverted away towards sustaining use and maintains support for these islands.

Measuring the degree of investment in monumentality for Mokumanamana (and Nihoa) needs to factor in not only the physical scale of construction of the temple sites, but also the sustained use of the heiau for calendar-based rituals, and thus the energetic investments in voyaging to and from the main islands. The frequency that specialists traveled here can be inferred from the intervals of construction and use within the 400

year settlement chronology. Mokumanamana heiau were constructed (and sustained) throughout the entire duration of settlement in this region from approximately late A.D. 1400 to 1800. Nihoa on the other hand began construction at the same time, but ended earlier by A.D. 1650 and much of the building effort was contained within a single rapid episode (of 60 to 150 years). The coral dates from ritual offerings on Nihoa provide the greatest precision in understanding episodes of heiau use. Between A.D. 1490 to A.D. 1650, voyages occurred typically at 2-3 year intervals, sometimes extending to 5 years of time. Another line of evidence that supports a relatively high rate of voyaging can be found in the distribution of structural size classes (for both open habitation and ritual; large > 80 m^2 and small < 80 m^2) through time. Overall, the size of both secular and ritual structures increased in later intervals of time as is typical with monumental construction. However, this sequence is not unilinear; different-sized structures were built throughout the time interval for heiau and habitation sites. This may reflect a strategy to disperse labor in intervals and reduce risk associated with prolonged occupations of the islands. The intervals of annual (or near annual) to episodic five year visitations appear to follow general patterns seen in El Niño years (ranging 5 to 10 years), allowing larger amounts of labor (via larger double hulled canoes) to access the islands when those ideal sailing conditions emerged.

Sustaining voyaging interaction was in many ways the greatest cost of monumentality for Mokumanamana (and Nihoa) as it extends the duration of investments over a 400 year period. This represented an enormous amount of time, labor and resources needed to sustain the entire system for that length of time. In the initial stages of construction for Mokumanamana (and Nihoa) the seriations show that multiple social

groups accessed these islands and worked collectively. These groups would have likely originated from all the main islands, but Kauaʻi and Oʻahu undoubtedly had the most invested in a system that legitimized their power as the representatives of acknowledged senior lineages. These islands would have had the greatest resource surplus with the establishment of irrigated agricultural production systems early on that required less labor input and were highly productive.[127] The junior lineages of chiefs on the east islands of Maui and Hawaiʻi were likely motivated by power to attempt to usurp the senior chiefdoms. After A.D. 1650, Maui and Hawaiʻi achieved greater resource potential as the large scale rain fed agricultural systems reached full expansion and were intensified (Kirch et al. 2005; McCoy 2006; Ladefoged et al. 2009). Furthermore, these eastern main islands would have required greater dependence on dry land farming whose timing would have been directly affected by the ritual knowledge of correctly setting the calendar year.

Modeling the costs of monumentality associated with voyaging requires the expansion of proxies that account for human labor and resource use across new variables. Although calculations of these dimensions are just general estimates and not absolute, they can still help to model and structure our understanding of the potential scale of investments being made to construct and maintain the ritual system. This model assumes that voyaging would occur regularly ranging from an annual to five year intervals (20, 40, 80 voyages per 100 years) from all of the main islands (Kauaʻi, Oʻahu, Maui, Hawaiʻi). In the first 100 year interval, a greater emphasis would have been placed on the voyaging

[127] The earliest food production systems in Hawaiʻi occured on Kauaʻi and Oʻahu in the form of irrigated agriculture that appeared in the windward area of the islands beginning by A.D. 1200 (Allen 2001; McElroy 2007). Estimates for the potential of irrigated agriculture follow this order: Oʻahu (83 km^2), Kauaʻi (58 km^2), Maui (25 km^2), and Hawaiʻi (14 km^2) (Ladefoged et al. 2009).

interaction from Kauaʻi and Oʻahu (A.D. 1450-1550), while later phases there would have been a shift away from these islands towards Maui and Hawaiʻi which gained greater resource potential and voyaging incentive (A.D. 1550-1650). Over time, labor requirements would have increased and these are accounted for by conservative population estimates of 20, 40, and 80 people (which represent 1, 2, and 4 double hulled canoes per voyage). Also days on island would have increased and these are accounted for by conservative time estimates of 10, 20, and 30 days on-island. These trends are then measured against three variables that capture "monumentality" including: 1) distance traveled and time at sea for specialists; 2) the provisioning of groups with essential resources (in this case food measured in calories) to survive at sea as well as on island; and 3) the transportation of critical materials to these islands (in this case timber as fuel that is measured in weight). While this model does not account for all related costs to this system, it does give a general sense of scale of investments over time.

- **Labor Transportation**: In order to estimate costs associated with voyaging and the transportation of labor, the average round trip distances were first calculated between Mokumanamana and each of the main islands using conservative speed estimates from contemporary double-hulled canoe replicas with two masts. Using Hōkūleʻa as a basis for this, canoe speeds averaged a conservative 4 knots per hour (7.4 km per hour) (Finney2006:130; Anderson 2001: 26). Total distance to each of the main islands was calculated by the straight line distance (km.), then adding that same number multiplied by four (to include return distance created by tacking on the upwind). By including the upwind distance into the calculation this model accounts for the upwind

voyaging difficulty that would have been present on an order of magnitude by nature of each island's position from west to east in the chain. These round trip average distances were calculated as: Kaua'i= 5,570 km, O'ahu= 7,305 km, Maui =9,915 km, and Hawai'i = 10,480 km. In order to understand the scales of investment these numbers were multiplied by 20, 40, and 80 voyages over a 100 year period that reflected the range of annual to five year periodic visits. Additionally a weighted distribution (1.0, 1.1, 1.2, 1.3) was placed across the islands that show a 1.3 times increase in costs from one end of the archipelago to the other, at different periods (in an effort to account for shift of island resource potential over time). There was a general trend of "time at sea" being a function of distance, as islands west to east increased in difficulty regardless of shifts of investment costs for different ends of the chain at different periods.

- **Resource Use**: Estimates of food costs (calories) were measured for both "on-canoe" as well as "on-island" contexts. These numbers were based on "time at sea" and "time on-island" at realistic varying intervals of populations that ranged from 20, 40, 80 people and for periods of time ranging from 10, 20, 30 days. Caloric intake was calculated from conservative averages for a semi-active male of 2,500 cal. per day (Davies 2009). These population numbers provided a general understanding of how much costs were associated with a small range of double hulled canoes employed (1, 2, 4) as each canoe could minimally hold approximately 20 people. General trends of the modelings shows that "on-canoe" calories would generally increase from islands west to

east, as they are a function of time at sea. "On-island" calories were generally fixed as a function of number of occupants, days on island, and recurrent voyages.

- **Resource Transportation**: Estimates for resource transportation costs centered primarily on timber used for fuel as it was the most extreme example of physical materials that were imported and transported by canoes. This was measured by weight (kg) derived from an average estimate 0.5 kg per day (from a range of 0.1.-1.0 kg) of timber needed for fuel for cooking and survival (Davies 2009). These calculations were fixed as they were a function of number of occupants, days on island, and recurrent voyages. The estimated weights illustrate how much additional cargo canoes would have to take on for even small parties going to the Northwestern Hawaiian Islands in 1-4 canoes for a month's period of time. The more people, the more timber resources would need to be carried there. This does not factor in additional timber resources required for housing and temple construction or ritual uses such as carving images, nor does it consider the transport of agricultural products or the small quantities of basalt to the islands, as the various analyses indicated.

This model shows general estimates and patterns concerning navigational and maritime demands (mobility of labor to the construction site), resource consumption (during travel and on island), and transportation costs (of imported material) over a period of two intervals of a hundred years each (Table 6.5-6.6). It accounts for different rates or frequencies of voyaging for each island with an emphasis is skewed first towards Kaua‘i

and O‘ahu (A.D. 1450-1550), and then later towards Maui and Hawai‘i (A.D. 1550-1650). The frequency of voyaging increases from five year intervals, to two and a half year intervals, to finally annual intervals that would have been realistic voyaging times based on the nearly continuous distribution of chronometric and relative dates in the chronologies established for each island. In regards to labor-time units calculated by estimated “person days,” the model shows that increase in overall time at sea on an order of magnitude when the distance of travel increases (as you move east) and the frequency of travel increases. In the earlier periods of construction, individuals from Kaua‘i and O‘ahu would have had played a greater role with voyages with increases of 815 – 987 days at sea (20 voyages), 1630-1974 days at sea (40 voyages), and 3261-3948 days at sea (80 voyages). At this time, leaders of the eastern most islands of Maui and Hawai‘i would not have had the resources to sustain travel there on an annual basis, and their estimates reflect this. After A.D. 1650 however, as resource potential shifted towards Maui and Hawai‘i they would have the ability to sustain voyaging with increases of 1138-1534 days at sea (20 voyages), 2679-3068 days at sea (40 voyages), and 5395-6136 days at sea (80 voyages). These days at sea represents per person as the model accounts for the scale of participants to increase from 20, 40, and 80 people (which equals 1, 2, and 4 double hulled canoes). This represents a great deal of investment in time on the part of chiefdoms as specialist groups of varying sizes were committed towards the planning and building ritual sites of these remote islands over hundred year increments.

Table 6.5. A.D. 1450-1550 Estimations of Days At Sea, Resources Consumed On-Canoe and On-Island, as well as Transportation Costs of Materials for Mokumanamana (and Nihoa) Heiau Construction. Calorie calculations were based on an average of 2500 cal. per individual per day; while material transport weight (wood as fuel was calculated with an average of 0.5 kb per person per day).

Monumentality Measured in Voyaging Costs A.D. 1450-1550 (100 year interval) at varying frequencies						
		Kauai (x1.3)	Oahu (x1.2)	Maui (x1.1)	Hawaii (x1.0)	Total
5 year intervals	20 Voyages (km)	144,820	175,320	218,130	209,600	747,870
	Days at sea per person	815	987	1228	1180	4110
	Cal intake 20 people/ 1 canoe	40,750,000	49,350,000	61,400,000	59,000,000	210,500,000
	Cal intake 20 people/10 days on island	10,200,000	10,200,000	10,200,000	10,200,000	40,800,000
	Min fuel weight (kg) 20 people/ 10 days on island	100	100	100	100	400
2.5 year intervals	40 Voyages (km)	289,640	350,640	436,260	419,200	1,495,740
	Days at sea per person	1630	1974	2456	2360	8420
	Cal intake 40 people/2 canoes	163,000,000	197,400,000	245,600,000	236,000,000	842,000,000
	Cal intake 40 people/20 days on island	81,600,000	81,600,000	81,600,000	81,600,000	326,400,000
	Min fuel weight (kg) 40 people/ 20 days on island	400	400	400	400	1600
1 year intervals	80 Voyages (km)	579,280	701,280	872,520	838,400	2,991,480
	Months at sea per person	3261	3948	4912	4720	16,841
	Cal intake 80 people/4 canoes	652,200,000	789,600,000	982,400,000	944,200,000	3,368,400,000
	Cal intake 80 people/30 days on island	489,600,000	489,600,000	489,600,000	489,600,00	1,958,400,000
	Min fuel weight (kg) 80 people/ 30 days on island	1200	1200	1200	1200	4800

Table 6.6. A.D. 1550-1650 Estimations of Days At Sea, Resources Consumed On-Canoe and On-Island, as well as Transportation Costs of Materials for Mokumanamana (and Nihoa) Heiau Construction. Calorie calculations were based on an average of 2500 cal. per individual per day; while material transport weight (wood as fuel was calculated with an average of 0.5 kb per person per day).

Monumentality Measured in Voyaging Costs A.D. 1550-1650 (100 year interval) at varying frequencies						
		Kauai (x1.0)	Oahu (x1.1)	Maui (x1.2)	Hawaii (x1.3)	Total
5 year intervals	20 Voyages (km)	111,400	160,710	237,690	272,480	782,280
	Days at sea per person	627	904	1338	1534	4403
	Cal intake 20 people/ 1 canoe	31,350,000	45,200,000	66,900,000	76,700,000	210,160,000
	Cal intake 20 people/10 days on island	10,200,000	10,200,000	10,200,000	10,200,000	40,800,000
	Min fuel weight (kg) 20 people/ 10 days on island	100	100	100	100	400
2.5 year intervals	40 Voyages (km)	222,800	321,420	475,920	544,960	1,565,100
	Days at sea per person	1254	1809	2679	3068	8810
	Cal intake 40 people/2 canoes	125,400,000	180,900,000	267,900,000	306,800,000	881,000,000
	Cal intake 40 people/20 days on island	81,600,000	81,600,000	81,600,000	81,600,000	326,400,000
	Min fuel weight (kg) 40 people/ 20 days on island	400	400	400	400	1600
1 year intervals	80 Voyages (km)	445,600	642,840	951,840	1,089,920	3,130,200
	Months at sea per person	2509	3619	5395	6136	17,659
	Cal intake 80 people/4 canoes	501,800,000	723,800,000	1,790,000,000	1, 227,200,000	3,060,000000
	Cal intake 80 people/30 days on island	489,600,000	489,600,000	489,600,000	489,600,00	1,958,400,000
	Min fuel weight (kg) 80 people/ 30 days on island	1200	1200	1200	1200	4800

When comparing these voyaging estimates toward actually heiau construction in the main Hawaiian Island it becomes evident that this voyaging network to support Mokumanamana (and Nihoa) was on an equal if not greater scale of monumentality for each island. For Maui, Kolb (1991, 1994, 1997) calculates the amount of days of human labor that went into the construction of variously selected heiau throughout different districts on the island. Absent from these calculations were labor estimates and total amount of time (of construction and use) as costs can vary at different rates by the number of laborers employed over different intervals of time. In order to generate a relatively equal comparison of labor costs associated with Maui heiau construction versus the costs of NWHI voyaging, the total days of labor was translated into resource consumption (calories).[128] The comparative data drawn from Maui heiau focused exclusively on the category of corvee labor, with the amount of labor investment ranging from small heiau such as Lanikele (622 m^2) at 24,011 total labor days (equaling 7,700,000 cal.) to the largest recorded heiau Pi‘ilanihale (12,120 m^2) at 128,155 total labor days (equaling 358,834,000 cal.) (Table 6.7). When comparing these numbers to calculations of voyaging and “on island” food consumption, it appears that the cost of a single island could bear is either equal or greater to all scales of corvee labor employed in the main islands. Voyaging at a 2.5-5 year frequency for 20-40 (1-2 canoes) going up to the Northwestern Hawaiian Island over a hundred years would be the equivalent of building a medium sized to the largest monuments (> 500m^2 to < 13,000 m^2) in the main Hawaiian Islands (every 100 years). When the frequency increases to annual voyages to

[128] Using Kolb’s (1994) labor days estimates for Maui heiau, resource consumption estimates were generated using larger estimate of 2800 cal. per person per day. This average was increased (in relation to the calculation used for NWHI at 2500 cal.) because physical labor in many ways is more immediate and strenuous than voyaging on a canoe.

Mokumanamana, the costs per island vastly exceeds even the largest heiau construction costs (i.e., Piʻilanihale, Maui) by 3:1 for Kauaʻi and as much as 4:1 for Hawaiʻi Island (every 100 years).

Table 6.7. Estimations of Labor Days, Duration of Time and Resources Consumed for the Construction of Maui Heiau (Kolb 1991, 1994). Calorie calculations were based on an average of 2800 cal. per individual per day.

Maui Heiau	Size (m^2)	Labor (days)	Duration (years)	Resources (calories)
Piʻilani	12,120	128,155	500 years	358,834,000
Pōpōiwi	8086	53,537	650 years	149,903,600
Halekiʻi	5633	39,368	350 years	110,230,400
Loaloa	5115	21,462	350 years	60,093,600
Pīhana	4076	24,011	400 years	67,230,800
Lanikele	622	2775	unknown	7,770,000

Finally, the model also accounts for costs of transportation for resources were also calculated looking primarily at timber resources needed specifically for fuel (estimated 0.5. kg per person per day). Focus was placed upon fuel because it was a necessary requirement for human survival in these isolated landfalls. In general these calculations show that total weight of transported timber could have ranged from approximately 100 kg, to 400 kg., and possibly even 1200 kg when looking at rates of voyaging from 5 years, to 2.5 years, to annual visits. These represent conservative estimates as they do not factor in wood needed to construct the superstructure of larger temples and residences on

the islands. It also does not factor in weight of food surplus, possible water, and limited basalt stone tools used for subsistence and ritual activities.

Mokumanamana- Monumentality in a Ritual Precinct

> … the motivation must have been very strong, for this is no easy voyage from the main Hawaiian Islands—it must be made out of sight of land and with real risks in landing and embarking. (Emory 1970: 88)

Mokumanamana is one of the few places in Hawai‘i that falls within the category of a ritual precinct. The island has at least 33 heiau temple sites clustered within a small documented area with basal foundations ranging from 21 m^2 to 162 m^2. The temple sites are concentrated primarily on five hills and two saddles across a narrow ridge line crest, all of which extend across the island (Figure 6.2). Typically the sites have a large low court platform with a raised ahu on one side with standing uprights of odd numbers embedded at equal intervals in the ahu. On top of the court there are uprights (single and paired) along the ahu, in the front of the court and on both sides of the court. Medium to large sized stones were used to build the retaining walls and walls and small size cobbles were utilized for paving. These stones were procured locally from around the sites and preference was given to red stone as facing for the structures, which gave some of the heiau the appearance of being entirely red. The red stone used for these structures was only evident during survey when the rain waters cleaned the accumulation of bird guano off of the rock surfaces. Red was a symbol of sacredness and can be linked back to cosmological beginnings and chiefly associations with the sun and heat (i.e. kapu wela), as well as other important insignias and adornments worn by chiefs such as red feathered cloaks (‘ahu‘ula) and helmets (mahi‘ole).

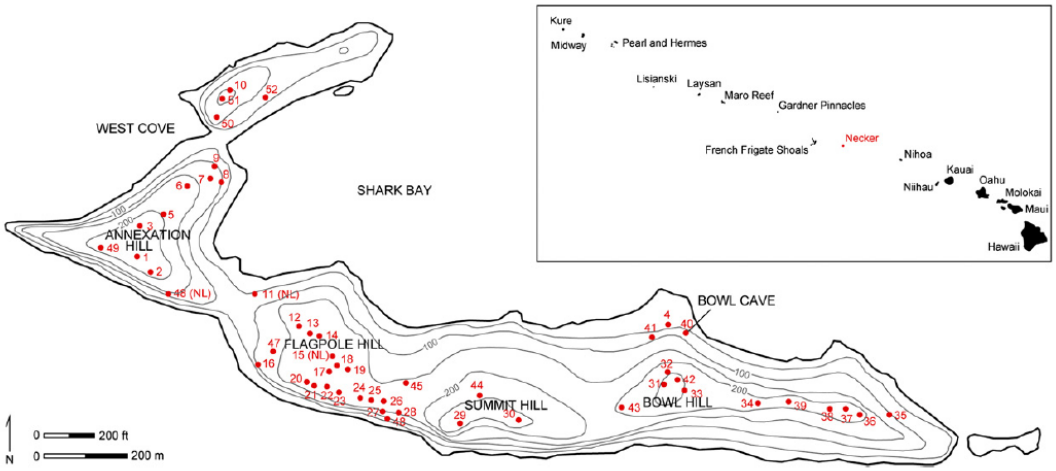

Figure 6.2. Mokumanamana Island and Archaeological Sites

The few available ethno-historical descriptions for Mokumanamana suggest that it was always considered a single island temple, rather than an island with 33 temples structures on it. Kalama, a native informant states: "Moku-mananana, he moku ki'eki'e malalo o Nihoa. He heiau nui kahiko maluna" [Mokumanamana, is a high island below Nihoa. A large ancient heiau is on top (of it)] (Kikiloi transl.) (Kalama in Kelsey BM Box 1.4: 79). This indicates that Mokumanamana functioned as a single temple island with interrelated features although being comprised of numerous individual structures spread across a landscape area of approximately 18.6 ha (186,155 m^2). For comparison, studies on Maui have shown that the many heiau temples were consolidated in the leeward district of Kaupō. Mokumanamana has more ritual features clustered within its tiny island landscape than that entire leeward Kaupō district of Maui (Kolb 1999a; Kirch 2010). In fact, when the total area of the island is measured as single functioning site or ritual precinct, it ranks amongst the largest ritual temples in the Hawaiian archipelago

(Table 6.8). This view of monumentality is further supported when the ranking of effort is calculated into the cost of building and maintaining the Mokumanamana heiau, including: the distance involved in transporting labor and supplies, the work needed to generate the resource surplus to stay in this remote area for any duration, and the administrative capacity needed to organize and coordinate these periodic journeys.

Table 6.8. The 13 Largest Heiau Temples in Existence Today in the Hawaiian Archipelago. Adapted from Kolb (1999).

Heiau	Area (m2)	Earliest Age	Location
Mokumanamana	186,155 (landscape)	Ca.1400	NWHI
Pi‘ilanihale	12126	Ca. 1400	East Maui
Kapalama	10133	Unknown	Kohala, Hawai‘i
Malae	8226	Unknown	Puna, Kaua‘i
Popoiwi	8086	Ca. 1300	East Maui
Kānekauila	7714	Ca. 1400	East Maui
Pu‘u o Mahuka	7254	unknown	Waialua, O‘ahu
Haleki‘i	5683	Ca. 1500	East Maui
Ha‘elelani	5200	unknown	Kona, Hawai‘i
Loaloa	5115	Ca. 1500	East Maui
Polihau	4750	Unknown	Puna, Kauai
Hikinaakalā	4570	Unknown	Puna, Kauai
Pihana	4076	Ca. 1300	West Maui

The celestial value of Mokumanamana was an important motivation for ritual expansion into the Northwestern Hawaiian Islands. The position of the island's ridge on an east-west axis allowed occupants to take advantage of and build heiau temples that aligned with the rising and setting of the equinox and solstice solar positions. In contrast to other islands in the archipelago that possess high mountains, Mokumanamana benefited from an elevation sufficient to provide an unobstructed view shed that spans the entire horizon in 360^{o} from atop its rounded crests. Only the saddles in between the crests have obstructed views (Figure 6.2). An initial analysis of azimuth orientations of Mokumanamana temples showed preferred orientations with both summer solstice and winter solstice pathways. This demonstrated that not only were these structures purposefully placed but they worked together as a celestial observatory (Liller 2000). It also suggests that multiple voyages within a year could have been undertaken or that in alternating year's winter and summer voyages were made. Additional data was gathered here through fieldwork surveys that showed a majority of the heiau temples (n=17) had an east-west orientations. East temple orientations had a range of 85^{o} to 110^{o}, suggesting that these temples might be aligned towards the sun rise during times of the equinox and summer solstice. West temple orientations had a much wider range of 225^{o}-310^{o}, suggesting that they might have been aligned towards the set during times of winter solstice, equinox, and summer solstice. Another group of heiau (n=13) had southern orientations ranging from 175^{o}-210^{o} for an unknown purposes, perhaps tracking the movement of some other stars related to voyaging or migratory homelands. Orientation was not recorded on two sites (50-Nk-10, -11) as there was no ahu on the feature that could be used to orient the view plane (Figure 6.3). The old name for Mokumanamana

was Hāʻena and in the Kaiʻaikawaha genealogy of names is it called Hāʻena-mau-hoa-lālā-iā-(Ka)hiki, or Hāʻena that secures the diverging branches to Kahiki. The predominate heiau orientations could reflect the symbolic association of these sites with Kahiki in the northwest, and also the original Kahiki in Central Polynesia (i.e., the original ancestral homeland).

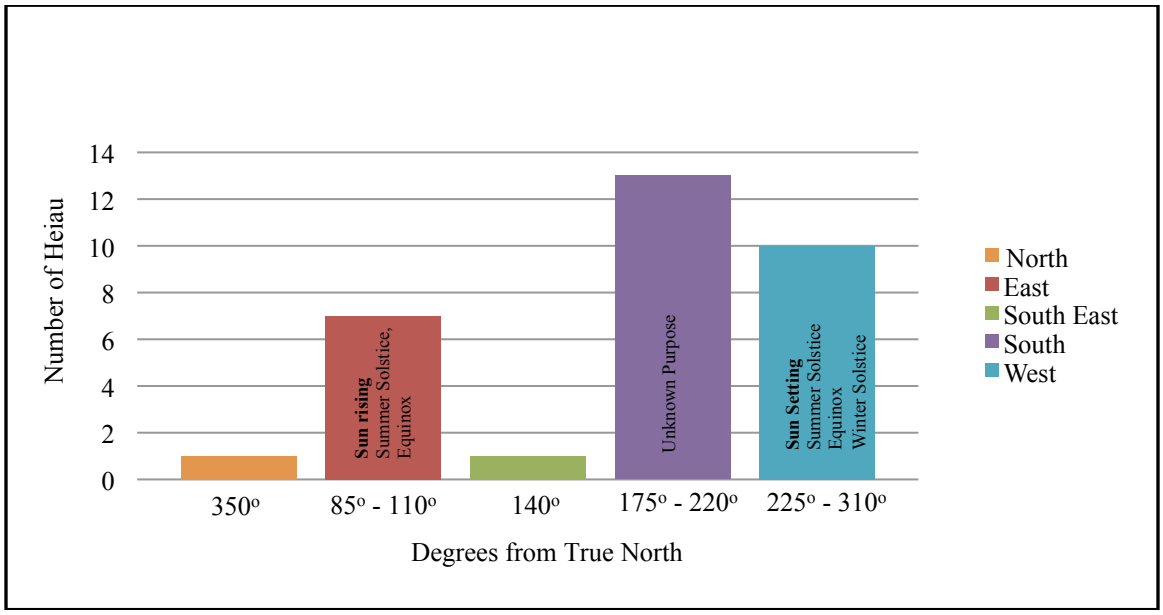

Figure 6.3. Mokumanamana Heiau Temple Orientations and Alignment to Solstices

The location of Mokumanamana on the Tropic of Cancer (Ke ala nui polohiwa a Kāne) is clearly important in its ritual elaboration. Its latitude position is also the annual culmination of the sun's incremental movement northward from the vernal equinox, spring, where it is above the equator, to the summer solstice (the longest day of the year, typically June 21st) when the sun appears to "stand still" directly above Mokumanamana. Likewise, chiefly ʻaha rituals associated with the NWHI were likely presented as

petitions to the ancestral gods for conformation for the right to rule. Another secondary benefit however of making these travels to Mokumanamana was gaining the ability to accurately calibrate calendrical time and thus to effectively predict the changing of seasons and rainfall. Understanding the timing of these seasons was critical as they varied each year due to the inexact nature of the rotation of the earth. The movement of the sun into the northern hemisphere marked the beginning of spring and summer, the two seasons most important for resource production and food cultivation. The ability to predict the shift in weather patterns and time the preparation of fields, propagating cultivars, and planting fields, all were predicated on the ability for the elite to monitor this annual cycle through the ʻaha ritual that centered on the sun. Thus, the surplus invested into maintaining the ritual based occupation had important secondary benefits: increasing predictability and agricultural productivity, and providing surplus returns to an expanding population in the main Hawaiian Islands.

Nihoa- A Staging Island for the Priesthood

Nihoa Island played a crucial role in developing support for Mokumanamana. The ritual chronology shows that at about the same time that construction of heiau on Mokumanamana began, Nihoa was also established both as a habitation location and for a separate array of rituals. Nihoa was of sufficient size and resource capacity to provide the labor force needed to its settlement and also to stage more recurrent ritual occupation of Mokumanamana. The island of Nihoa has approximately 14 heiau temples with basal dimensions that range from 10 m^2 to 120 m^2, and 4 smaller shrines that range about 2 m^2. They are mostly located mostly at the base (makai end) of each of the five valleys and ridgelines and some were placed on prominent points and peaks (Figure 6.4). Nihoa

heiau temples range from larger walled enclosure type structures to medium and small sized open platforms. Unlike Mokumanamana, Nihoa had a large number of closed habitation and residential sites that were well sheltered. It also had a more consistent supply of water and lands suitable for establishing agricultural terraces to sustain the island's population.

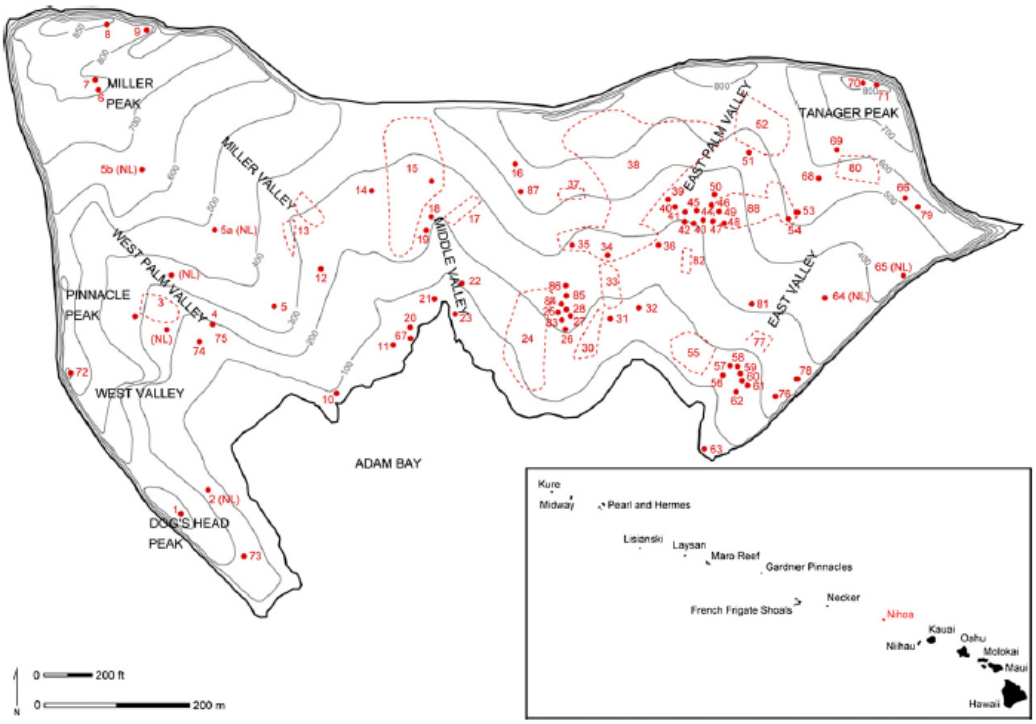

Figure 6.4. Nihoa Island and Archaeological Sites

Ethno-historical descriptions regarding Nihoa Island show that it was associated at one point with a specific priesthood class. The island was sometimes referred to in chants as Nihoa-kuhikuhipu‘uone, with the term kuhikuhipu‘uone referring to priests who that were trained in the planning (i.e. picking the location and organizing labor for

construction) of heiau temples, in this case Mokumanamana. A native informant Kaha gives his thoughts on the name of the island: "niho ʻia- toothed- would be one representing the lesser, or lay order of the priesthood, who did the actual work of the temple, as well as possessing the "teeth" that are parental kapu (taboos)" (Kaha in Kelsey n.d.). Niho as the term tooth can also refer to a large interlocking stone that is laid down in the base foundation in stone masonry that helps to lock and stabilize the foundation (Pukui and Elbert 1986: 266).

Another native informant from Kauaʻi, Keo (1835) gives a statement supporting the hypothesis that priests traveled to take up post on these remote islands:

"O Ninioa ka heiau i Nihoa aia ma ka aoao komohana, he pali e pili ana me ke kai i luna o ka waa e hoalu ai ka waiwai a ke akua, ke kanaka, ka puaa, ka maia, ame na mea a pau e pili ana i na hana o ka heiau.

O ke kiai o keia heiau o Kahiupewa, he mano o ke kaikaina o Kamohoalii ame Kuhaimoana. I ka hiki ana mai i ke au o na kanaka oiaio Kapulauki e noho alii ana no Kauai nei, ua hoouna aku ia ia Kapu i Kahuna no ia Heiau, a oia ke kahuna kanaka mua o ia Heiau. Pau ka Heiau o Nihoa."

"Ninioa was the heiau at Nihoa located on the western side, on a precipice near the sea. It's on top the canoe that the treasures of gods, a man, pigs, bananas, and all the things concerning the activities of a heiau were brought together.

The guardian of this heiau was Kahiʻupewa, a shark and younger sibling of Kamohoalii and Kuhaimoana. When men settled on Kauaʻi during the reign of Kapulaukī[129] he sent Kapu to be be it's officiating priest for that heiau. He was the first priest of that heiau. This is all the heiau of Nihoa."

This account along with the archaeological evidence indicates that there is an increasing degree of independence amongst priests (i.e., kāhuna) in the management of

[129] Kapulaukī is described as the daughter of Kealohikanakamaikaʻi (w) and Kāneiāhaka (k). Her older brothers become intermarried into the Oʻahu chiefly genealogies and she eventually marries Kainaaila (k) a grandson of Hawaii Island paramount Lonoikamakahiki (k)- estimated to be at Generation temporal unit 18 (A.D. 1625-1650; based on range of 20-25 year count per generation) (Fornander 2: 293-294; Cachola Abad 2000).

ritual affairs and specialized social groups and religious activities. In this case, the priests were likely assigned to Nihoa to manage these sites (along with the island temple Mokumanamana) for their spiritual value to the chiefs. From this description, Nīnīʻōʻā (lit. to pour and mix)[130] heiau corresponds with archaeological site 50-Nh-01, which is a large ceremonial site located on top of "Dog's Head" on the most western portion of Nihoa island. This heiau is located on the western cliff edge near the sea and the many sea caves at the bottom of the cliff would be suitable caves for the shark gods described here. This heiau is oriented towards the west and is in line of sight with the Middle-East Palm Ridge shelter complex and also the East Palm Valley Residential Complex. The spiritual importance of this site is evident in the amount of coral heaped up on the west wall and north-west ahu. Combined it has well over fifty coral heads and branch fragments. ^{230}Th coral dating (n=10) of this ritual site shows the longest single individual chronology for any one temple on either island from A.D. 1496-1553. Also, the reference to Kapulaukī, a chiefess of Kauaʻi, links her to as a contemporary of the Oʻahu high chief Kahoʻowahaokalani, who is assigned to generation 18 in the chronology of chiefs developed by Cachola-Abad. This would extend the ritual use of this heiau until at least A.D. 1625-1650, based upon an extrapolated dating estimate for generation 18 within the chronology (Cachola Abad 2000; Fornander 6:315).

It should be noted that monumentality was also expressed in Nihoa residential sites which exhibited a high degree of investment in construction and appeared similar in some respects to temples. In some cases their construction produced open low platforms, and in other cases they were built as large platform structures with high retaining walls in

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[130] Nīnī same as nīnīnī, to pour. (PPN lingi.); ʻōʻā vs. mixed, as of colors in a lei or as blood.

one section and an attached side compartment. Emory (1928) misclassified some of these residential structures as temples based on the presence of dike stones embedded into the foundations of these structures. Many of these long embedded dikes acted as support columns as part of the engineering of the residential sites. Nihoa's slope was a defining characteristic of the island, which was remembered in the traditional saying "he pu'u kolo i Nihoa," or "Nihoa is hilled for crawling" (Tava and Keale 1989). Strategies were developed to cope with building on this slope including: (1) building retaining walls to counter the slope; (2) placing one section of walls directly on top of hard dike rock that ran across the island as foundational support; and (3) utilizing long pieces of broken dike rock as support column that were embedded directly and deeply into the foundation of the structure, and in some cases directly into the front facing of the retaining wall and extending backwards, as means to prevent structural collapse. Examples of these columns can be seen in residential sites 50-Nh-28, -41, -42, -43; and heiau temple sites 50-Nh-40, -45, -51. The residential sites provided suitable level living spaces for habitation needed in an environment dominated by open-ocean and transitory movement on canoes.

Nihoa as a staging location essentially enabled the continued use of Mokumanamana in a number of important ways. First, it reduced the overall distance of travel both to and from the main Hawaiian Islands. Without Nihoa, the distances would be as follows: Hawaii (2096 km.), Maui (1823 km.), Oahu (1461 km.), Kauai (1114 km.). With Nihoa, distance is diminished creating an intermediate stopping point for provisions and reducing risk associated with long distance voyaging for travelers: Hawaii (1534 km). Maui (1252 km), Oahu (888 km.), Kauai (541 km.). Having a staging point was most beneficial for travelers from Hawai'i and Maui islands because they would have had

the longest distances to travel. Without access to Nihoa, the overall travel distance to the eastern islands of Maui and Hawai‘i was comparable to the sailing distance to East Central Polynesia (est. 2500 km.). This does not include the constraint imposed on sailing to the Northwest Hawaiian Islands that would have involved tacking back and forth against the wind and increasing the return distance four fold. Second, Nihoa provided some of the food provisions in the form of crops grown in its agricultural fields, bird and marine resources that were readily available, extremely limited timber resources that existed (i.e. *Pritchardia sp*.), but most importantly a stable source of water. Third, the island provided a stopping point for rest and planning. As its nearest neighbor, Nihoa provided much needed time off the canoe for travelers to stop, rest, and plan the voyaging leg to Mokumanamana. While on Mokumanamana the ruggedness and exposure of the island and lack of shelter areas do not provide much in the way of protection or resources. Therefore, ceremonies and ritual planning must have been planned ahead of time in order to achieve religious goals in the short amount of time Hawaiians had to spend on Mokumanamana. Material support provided by Nihoa must be factored into the estimates of and in discussions about the scope of monumentality for Mokumanamana.

Ritual Development in the Main Hawaiian Islands

A more recent cultural-historical sequence for Hawai‘i (Kirch 1985; Fig. 239; Kirch 2010: 126-128) places conservative estimates of the colonization of the Hawaiian Islands somewhere from A.D. 800-1000 and spans four major periods: (1) Foundation (A.D. 1000-1200); (2) Early Expansion (A.D. 1200-1400); (3) Late Expansion (A.D. 1400-1650), and Proto-historic (A. D. 1650-1700). The Late Expansion Period from about A.D. 1400-1650 is the approximate interval in which all of the major dry land field

systems in the leeward coasts in Hawai‘i and Maui were established and expanded to near their limits (Ladefoged and Graves 2008). The introduction sweet potato provided a better suited staple for expansion of agriculture into progressively marginal lands. This is also a time when some of the key transformations of Hawaiian society likely took place (Kirch 2010: 127). Whatever else, the surplus of food generated by both dryland and irritated agriculture across the main Hawaiian Islands supported the increases to population and sustained the labor needed for massive construction of heiau in the main islands and also the development of Mokumanamana as a ritual center. Kirch (2010: 174) states that the variety archaeological evidence points to the period from the late A. D. 1400's until about A.D. 1650as the crucial phase during which the Hawaiian archaic states first emerged out of earlier sociopolitical formations of a more classic Polynesian form. The expansion of ritual use into the Northwestern Hawaiian Islands falls within the end of the Early Expansion period and goes through the Late Expansion periods, with recurrent use likely happening on an annual ritual cycle well until the time of European contact.

Heiau were constructed on all of the main islands and archaeological research has provided some understanding of their chronology even though they are rarely excavated. Radiocarbon dates for heiau construction on O‘ahu are limited to two temples- (1) Kāne‘aki in Makaha, Wai‘anae that has been traced through six successive architectural phases from A.D. 1200 to its final rebuilding just prior to European contact (Ladd 1970: 30; Green 1980: 63, 75-76). A ^{13}C adjusted ^{14}C date of 405±95 bp was reported for Kāne‘aki that calibrates to about A.D. 1319-1660 (Kolb 1991: 207); and (2) Pahua in Maunalua, Kona (Honolulu) has been documented to A.D. 1400-1600 (Davis 1985: 16).

A ^{13}C adjusted ^{14}C date of 270±50 bp is reported for Pahua calibrates to A.D. 1480-1995 (Kolb 1991: 207). Finally, one date was reported for Hale o Lono heiau at Waimea, Waialua. This sample of marine coral had an adjusted 14C date of 840±40 bp and calibrates to A.D.1436-1540. These studies however were completed before archaeologists came to identify short-lived taxa for use in radiocarbon dating and thus the age estimates could include an inbuilt age error. Heiau seriation research on O‘ahu (Kikiloi 2002) has demonstrated that its 45 documented heiau could separate into three social groupings ranging across 6 to 8 temporal units of time. These phases of ritual construction and use matched the sociopolitical histories of chiefs for O‘ahu Island, following patterns of alliances and cooperation, as well as conflict and war (Kikiloi 2002).

Maui Island has produced the most comprehensive data for temple development in the Hawaiian Islands. Kolb (1992, 1997, 1999a) noted an important shift in temple construction on Maui Island based on seventeen ^{14}C dates revealing progressive changes that occurred in three centuries from open temples – A.D. 1400 to large platform temples-A.D. 1500, and finally the addition of small enclosed temples –after A.D. 1600. An additional ninety charcoal samples were dated through regular ^{14}C and AMS dating from stratified levels of basal deposits or foundations. Only twenty-eight (31%) of these samples were identified by short lived wood taxa leaving some degree of uncertainty of inbuilt age. The earliest calibrated dates range from about A.D. 1275-1550, but the overall sequence of temple construction followed four phases between A.D. 1200- 1800 (Kolb 2006). Kirch and Sharp (2005) reported eleven ^{230}Th coral dates from near-surface coral dedicatory offerings taken from seven temples from the political district of

Kahikinui, Maui and an additional temple from the neighboring island on Molokai. All of these dates fell within a very short interval of 60 years (A.D. 1565-1638). One could begin to interpret this sequence as a shift (or co-occurring focus) where priests organized heiau construction and used coral in both construction and as ritual offerings. Nihoa (along with Lehua islet, as possibly Mauna Kea) date to the early portion of this effort, with other locations following. Weisler et al. (2005) also supports this notion as the combined two ^{14}C and two ^{230}Th coral dates to show Molokai temple followed this same time frame (A.D. 1604-1650). The sequencing of these dates give plausibility to the notion that priests were learning these practices in the Northwestern Hawaiian Islands and then expanded these teachings (as indicated by the use of coral) elsewhere in the main islands.

On Hawai‘i Island, McCoy et al. (2008) added two more ^{230}Th coral dates from ritual sites to a suite of radiocarbon dates from eight excavated sites to support the proposition that the Mauna Kea Quarry ‘industry’ spanned a period of approximately 700 years, between c. A.D. 1100-1800 (McCoy 1990: 92-93). Craft specialization was identified by the associated ritual investment in the manufacturing process (McCoy 1977, 1981, 1990, 1991). The two coral dates came from Keanakāko‘i rockshelter (50-Ha-G28-2-R6) and a shrine (50-Ha-G28-3-S1; State Site no. 50-10-23-16206). The shrine dated to AD 1438-1444 and the rockshelter to A.D. 1436-1442 (McCoy et al. 2008: 453-455). Also research in Kohala, Hawai‘i (Mulrooney and Ladefoged 2005; McCoy et al. 2011) demonstrated a sequence of temple changes associated with the Kohala dryland field system that reflect strategies to employ ritual authority to help manage agricultural production in this area. Mulrooney and Ladefoged (2005) identified five temporal phases

of religious activity based on morphological attributes of eight heiau and changes in ahupua‘a boundaries within the late expansion of the Kohala dryland field system (A.D. 1550-1800). McCoy et al (2011) subsequently refined the classification and ordering of 19 heiau into four temporal units and styles: A) temples with platforms, with additional traits such as courtyards, terraces, and upright stones (A.D. 1474-1522); B) temples with courtyards, terraces, and upright stones (A.D. 1522-1647); c) temples with courtyard and terraces with upright stones and notching (A.D. 1647-1680); and d) temples with terraces (A.D. 1680-1819). All three examples show the formalization of rituals and the integration of these practices within industries of tool manufacture and food production from the at least the 15th through the 18th centuries on Hawai‘i Island.

The ritual chronology of heiau temples developed here for Nihoa and Mokumanamana adds to this body of knowledge on monumental architecture in Hawai‘i. The ^{230}Th coral dates for Lehua islet, Nihoa, and Mokumanamana provide a fine resolution temporal chronology for this region of the archipelago. During this period the use of coral as a ritual offering was established as a common practice across ritual sites on all the main islands and extending as far north and west as to Mokumanamana. The standardization in use of coral as ritual offerings in construction and use could suggest the centralization of religious practices, authority, and power exhibiting the first signs of stable growth towards state religious formation (Kolb in Kirch 2010). In particular the symbolic significance of using heirloom coral on Mokumanmana links this heiau system and ritual practices to “life-generative” processes outlined in the early Hawaiian cosmological stories concerning the emergence of first life (i.e. coral polyps). The appearance and then the abandonment of this particular practice of using coral as ritual

offerings suggests that this may have been the original site of commemoration, honoring the origins of Hawaiian people. It is proposed here that these heirloom corals are indicators marking the beginning of the expansion of ho‘omanamana religion throughout the main Hawaiian Islands (where we begin to see coral occur frequently at ritual sites on all islands).

In Hawaiian society, monumental architecture was a symbol of competitive power and chiefly authority, which is presumed to be a function of the ability of elites to recruit labor and invest in construction. Throughout the archipelago temples were being constructed as early as A.D. 1200-1300[131] and grew increasingly complex with the largest structures reaching an apex of investment efforts by A.D. 1600. Currently, the best and earliest evidence for monumentality and temple fluorescence can be found only in the Northwestern Hawaiian Islands, well before its wide spread appearance in the main island. By early A.D.1400 (and perhaps even earlier) this region began to be occupied for ritual purposes, as Mokumanamana heiau construction started by the late A.D. 1400's and this effort lasted approximately 300-350 years. Nihoa heiau construction started soon after Mokumanamana, but occurred at a much more rapid pace that was completed within a 60-150 year period. Monumentality was expressed as the total cost and investment that took into account all dimensions of voyaging and sustaining ritual use of the islands without actually settling them. The establishment of this center of ritual power was likely endorsed by the senior lines whose power would have been legitimized in this process. Kaua‘i and O‘ahu chiefs represented the senior genealogies of Hawai‘i and

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[131] According to Kolb (1991: 247-249) there are no religious monuments that are built prior to A.D. 1000. A review of existing studies on heiau however shows that there are very few heiau that can be reliability dated to earlier than A.D. 1300.

likely had the most investment in accessing this island, although the seriations point to multiple social groups across many islands involved in initial construction. With the passing of time however, more emphasis was placed on the recurrent ritual use in an effort to continually synchronize the annual ritual cycle shared across all the islands. The knowledge gathered from this calibration fine-tuned the knowledge regarding the timing of seasons and greatly enhanced agricultural production, particularly rain fed agriculture located on the eastern islands of Maui and Hawai‘i. With growing knowledge of the westerlies and seasonal wind patterns Maui and O‘ahu had the most to gain from this knowledge and access to the island and its power.

During this maritime expansion and development of a ritual center in the northwest, important events were occurring in the main Hawaiian Islands. Irrigated systems in windward valleys on Kaua‘i, O‘ahu, and Molokai were developed as early as A.D. 1200 with intensification beginning by A.D. 1400. Kaua‘i and Oahu Islands’ chiefs would have had the greatest access to Mokumanamana and also the highest food yields with the lowest labor inputs. The Kaua‘i chiefdom had an organized administrative structure in place early on, with the O‘ahu chiefdom following shortly later. Simultaneously on Maui and Hawai‘i, efforts were underway to increase the exploitation of mountain resources for the manufacture of adzes for canoes in Mauna Loa (A.D. 1410-1490) and Mauna Kea (A.D. 1560-1640). Also agricultural expansion and intensification into progressively marginal lands happened soon after on Maui in leeward areas such as Kahikinui (ritual intensification beginning at A.D. 1560-1640 and agricultural expansion from A.D. 1500- European contact), and in Hawai‘i in Kohala (A.D. 1300-European contact; Ladefoged and Graves and 2008) and Kona (AD 1400-European contact). These

rain fed agricultural systems utilized the newly introduced sweet potato and eventually were more productive than the irrigation-based agricultural systems of O‘ahu and Kaua‘i. given their large spatial scale Dry land field systems however would have depended more heavily upon knowledge regarding the calendar years, seasons variation, and forecasting changes in weather, particularly rainfall. Thus, Maui and Hawai‘i leaders had the most to gain in both social-political power and resource production in accessing Mokumanamana. It should be no surprise then that the maritime expansion of ritual occurred across the archipelago as the knowledge gained from Mokumanamana had reciprocal effects in stabilizing food production systems, that in turn, led to of further societal change. These developments spanned the two ends of the Hawaiian living world from Hawai‘i Island as far north and west as Mokumanamana, a distance of more than 1000 km.

Discussion

The level of socio-political development in Hawai‘i was exemplified by chiefly institutions and the building of religious monumental architecture. Heiau temple monuments were viewed as indicators of the relative amount of power exercised by chiefs through time, and the power was generally a function of surplus produced through economic or subsistence development. The Northwestern Hawaiian Islands, specifically Nihoa and Mokumanamana were part of a ritual expansion into the west to follow their ideological pursuits of maintaining communication with the ancestors in the afterlife, and also ritual commemoration of important historical transformations in mythologies and stories of their primary founding forefathers. These ideological beliefs helped to fuel this maritime expansion and sustain efforts to build and use Mokumanamana as a ritual center of power. Nihoa played an important role as stepping stone and staging point for priestly

planning, giving them shelter at well established elite residential areas at East Palm Valley Residential Complex, and the East Valley Rock shelter Complex. This staging point helped to reduce the risk and cut down the overall distance of open- ocean to Mokumanamana.

The pooling of labor and resources was a critical component to this story as the construction of monumental architecture here may have symbolized the underlying structure of strong social relations in the 'main' Hawaiian Islands. Voyaging long distances to marginal islands, and taking on large engineering efforts during periods of conflict and resource uncertainty seems unlikely thus these efforts must indicate the level of sociopolitical integration that was occurring. Idea of resource pooling and integration across territories of differential productive potential as mechanisms for the predominance of large ceremonial construction efforts in marginal areas, and in this case marginal islands (Graves and Ladefoged 1995: 167). Here, monumental architecture did not occur as a positive function of environmental productivity. A massive surplus must have been developed as upfront investment for these maritime voyaging efforts for recurrent ritual use. Island chiefdoms assumed large costs that were invested into voyaging in transporting labor, resources, materials and tools. This is evident in the archaeological record with the early construction of residential sites on Nihoa, then heiau temples on Mokumanamana (and then soon after the rapid burst of heiau construction on Nihoa), persisting for different durations. Agricultural production only occurred late on these islands at 1σ for 50-Nh-24 at cal A.D. 1648-1694, 1727-1813 (75.8%); and 50-Nh-55 at cal A.D. 1642-1684, 1735-1805 (81.2%). This late occurrence suggests that island resources were only needed at intervals of time where voyaging costs were increasing

(i.e., shift towards Maui and Hawai‘i) that the production of local food resources on island may have been largely a safety precaution to reduce risk, while the bulk of the surplus was being provided from the ‘main’ Hawaiian Islands. As outlined in the previous chapter, this also applied to timber resources, some stone resources, and perhaps even fresh water. The periodic intervals devoted to constructing heiau and their increasing scales in size over time also suggest a sense of urgency and motivation, but recognizing rising costs and investments in sustaining monument construction and ritual activities.

The cross referencing of seriations along with the two independent chronometric dating methods helped to establish a fine resolution ritual chronology for Nihoa and Mokumanamana heiau construction and use. The considerable variation amongst the temple sites on both islands, and the numerous temporal units that emerged from the ordering suggest the long term construction and use of Mokumanamana, with a rapid period of construction on Nihoa that likely ended by A.D. 1650. This ritual chronology correlates well with the settlement chronologies of both islands as the earliest ^{14}C AMS habitation dates that only seem predate the ritual sites by less than 50-60 years. The burst of heiau construction during the period of A.D. 1490-1550/1650 over a span of 60- 150 years corresponds closely to other ritual coral dates throughout the archipelago and likely represented an era of socio political stability in the main Hawaiian Islands. This standardization and wide spread use of coral represents the first signs of a unified state religion and linked such offerings to ideas of cosmological creation and the earliest life forms emerge in the world.

Monumentality was redefined for this study within the context of cultural elaboration and social integration through a long, sustained period of heiau construction and ritual events on Mokumumana Island. This is the only known example from Oceania of such extensive labor organization, and costly transportation of people and resources, through a long-term voyaging network in order to support the use of an ecologically marginal satellite island for ritual activities. Ultimately, this demonstrates the collective motivation and drive of Hawaiian chiefdoms towards greater spiritual unity focused on a common set of outcomes. It commemorated birthright, authority, and power originating in the west. It also provided a new pathway to power through the celestial knowledge and integrated religious system of ho‘omanamana. This religion linked together all islands in the ritual process and cycle called the ‘aha. This establishment of Mokumanamana as ritual center was an enormous undertaking to sustain this overall network and was a concrete statement of the collective power of Hawaiian chiefdoms.

CHAPTER 7

RESEARCH CONCLUSION AND IMPLICATIONS

Hawaiian ritual power and the formation of a state religious system were the primary factors that contributed to socio-political development in the late expansion phase of history (A.D. 1400-1650). The phase was a critical interval of change that had far reaching implications ultimately leading to the emergence of complex chiefdoms and "archaic states" (Kirch 2010). At the end of this transformative period, Hawaiian society crossed a qualitative divide separating two different sociopolitical organization schemes. The most important distinction of this transformation was the enhanced power of the ali'i as their positions shifted from a "kinship" to a "kingship" model that legitimated by state cults with a formal priesthood. It marked a progression towards greater centralization of authority as chiefdoms formerly organized around small scale ancestral worship practices were transformed into several large independent polities with a shared an institutionalized state religion distinct from the rest of Polynesia (Kirch 2010; Kirch 2012). At the beginning of this transformation (ca A.D. 1400), independent chiefdoms displayed levels of competitive growth and social integration across the archipelago as their kinship ties served as a reminder of their descent from a common ancestor and the long-term benefits of competitive, as well, as cooperative behaviors. Rituals were a central part of the formation of a state-sponsored religious system, as they produced "a kind of patterned activity oriented towards the control of human affairs, primarily symbolic in character with non-empirical referent, and as a rule socially sanctioned" (Fifth 1951: 222; Verhoeven 2011: 116). Rituals helped to stimulate habituated actions and direct social norms within the independent polities, essentially building a common group identity

through a complex metaphysical world view and strong ideological framework. The concept of mana served as a unifying force, creating a sense of order within and across the greater Hawaiian society.

The practice of rituals evolved to display a type of power stabilizing society as chiefs negotiated and perpetuated ideologies that legitimized an authoritative structure of leadership. These were necessary requirements of an evolving society, and were not necessarily "coercive" types of practices or acts of "forced obedience," imposed upon the people by the chiefs. Oftentimes Hawaiian chiefs have been portrayed as being primarily self interested, who ignored their kinship obligations to their people. The relationship between chiefs and commoners however was one of common Polynesian familial origin, as chiefs often times took assumed the leadership role of the older sibling and the people took on the role of subordinate younger sibling, supporting elder siblings. Rituals reinforced these notions and reminded people that the ali‘i represented the best of their island lineages possessing legitimate mana to lead in governance and religious dimensions of society. In addition to establishing a degree of social order, rituals were also an institutionalized means of sorting out competing leadership claims in the face of increasing social stratification and rise in numbers within the ali‘i class. This established ritual system reinforced the authoritative structure and power of Hawaiian leadership which was a necessary requirement for mobilization of labor, and to produce the necessary surplus to support an administrative and religious hierarchy. This system created a sense of order that negotiated power between elites and commoners, as "governing" and "consenting" groups. Ritual practices evolved with increasing investments and "sacrifices" required to support this system including: (1) the

construction, reconstruction, and increasing investments along various dimensions of ritual architecture (i.e., monumentality) (Kolb 1991, 1994a, 2006); (2) the intensification of rituals shifting from episodic occurrences to a set annual frequency, the elaboration of required rites, and the rise in consequential offerings and petitions (Valeri 1985); and (3) the expansion of ritualization, meaning the spread of "patterns that were imbedded in social dimensions that derive their significance from the interplay and contrasts of other practices" i.e., aspects of Hawaiian social life that were indirectly tied to the ritual cycle (Bell 1993; Malo 1951; Kamakau 1992). Ritual power became a repetitive strategy that reified mana and ideologies rooted in a complex metaphysical worldview within the Hawaiian religious system.

This closing chapter offers a brief overview of the implications of this study. The results of this research is divided into three areas: (1) an evaluation of the methodology of using both ethno-history and archaeology for understanding the Hawaiian past; (2) an integrated summary of the findings of this study in regards to ritual power and ideological production in regards to: (a) increasing frequency and intensity; and (b) scales of expansion; and finally (3) implications of this research for understanding the sociopolitical development of Hawai‘i.

The Effectiveness of Ethnohistory and Archaeology

This research demonstrates the value and efficacy of a more holistic anthropological approach integrating multiple lines of inquiry and independent data sets. This integration is often referred to as the "direct historical approach" a research methodology that broadly combines aspects of linguistics, archaeology, ethno-history, and comparative ethnography whenever appropriate. This approach has been attempted

on a number of occasions in Hawai‘i and the greater Polynesia (Hommon 1976; Kirch 1984; Kirch and Green 2001; Cordy 2000; Kirch 2010). The analytic power of combining methods can have reciprocal benefits when each informs on different aspects of the socio-political realities of the past. Each perspective must be internally valid and when they are they open a world of the past not accessible to a single discipline's methods. Kirch and Sahlins (1992: 25-26) point out that there has been few attempts to bring the full methodological rigor of both ethnohistory and archaeology to bear upon a particular locale. Archaeology models that have been influenced by ethnohistorcal approaches but are often seen as problematic for their selective use, and portrayal of history as a "timeless past," and one that is universally applied across the Hawaiian Islands. Ethnohistory however, can be supplemental to archaeology as it can add details (i.e., motivations) regarding human behavior not discernible in the material record.

Ethnohistory and archaeology share common theoretical goals in their attempts to interpret and understand social and cultural "processes" through reconstructions based on different types of historical records (i.e., documentary versus artifactual). In this research, the ethno-historical record encompassed descriptions of behaviors or practices that were founded on some set of knowledge or values. These accounts were transmitted over successive generations and across groups, based on oral renderings and learning. It is a record that was purposefully remembered, recorded, and at times recited that can access underlying meanings in both behaviors and practcies. This approach requires an exhaustive and systematic use of written texts and documented oral accounts to make qualitative interpretations that outline the contours of cultural structures and patterns. Ethnohistorical approaches expand the possibility of interpretation of the historical

record, including those developed from archaeological materials, linking such interpretations to a contextual cultural framework that gives life and meaning to the material record. It has the advantage of developing historical contexts in which particular individuals acted and in identifying some of the recorded actions of those individuals, which in turn helped to establish persistent cultural and social change out of which long term processes and developmental sequences can be synthesized. Typically ethno-history is useful in creating narratives and identifying individuals in a relative (or ordinal) time dimension, but in Hawai‘i the genealogical lineages of chiefs recorded and memorized by specialists form a more precise and in some ways absolute structure of time (Cachola-Abad 2000). For instance, individuals from different islands who are remembered to have married are therefore contemporaneous with each other and serve to "lock in" the genealogies of chiefly lineages from their respective islands. Chiefs or other individuals encountered by European voyagers in the late 18th century are "dated" by such associations.

In contrast, the archaeological record is the physical material culture preserved from past human behavior and that still exists today in tangible form as features, structures, artifacts, and ecofacts distributed across and beneath landscapes. It requires the application of scientific methods and techniques towards generating qualitative and quantitative data. In this research, I was able to employ inferences and generate interpretations to understand, describe, and explain cultural events and processes. The archaeological data provided the basis for inferences about behaviors and activities, related to one another in a temporal dimension and across social units. It also demonstrated the potential of assessing the accuracy of its inferences, the precision of its

dating, and the reliability of the materials used in reconstructing the past. Archaeology proved to have less success when attempting to make inferences regarding meaning, motivation, and the deeper cultural values that shape human activities. It was unable to identify specific individuals in the archaeological record, but rather it worked at the scale of multiple social groups, aggregate behaviors, and longer term processes. Overall, archaeology provided a means to access aspects of history that are largely unattainable by archival sources, e.g., individuals whose histories were never recorded in documents or other memory systems. Because archaeology is directly related to the processes of human material interaction with the environment (including other humans), there are no inherent human biases (only limitations that accompany our identification of behaviors from artifacts and the effects of preservation of different forms of materials).

The research presented here on the history Mokumanamana and Nihoa has provided an ideal setting for the application of this multipronged approach. In this research, ethno-history and archaeology proved to be a powerful combination that showed convergent and parallel lines of evidence, most of which were in relative historical agreement. In particular, the ethnohistorical approaches applied in this study helped to explain the nature of the ritual system and why people believed so strongly in these ideological and material components of religion. It demonstrated how the location of Mokumanamana, was the primary the reason and motivator for the construction and elaboration of it as a temple precinct that sustained the mana of chiefs and provided the basis for reckoning an annual calendar system on which ritual and other practices depended. Important individuals were identified in the cosomological histories that represent for example the first Hawaiian male to emerge from primordial darkness.

Subsequently his prodigy descendant commemorated his forefather's power through the construction of a massive island temple on Mokumanamana. These events show a continuum of genealogical relationships across time and space, as well as highlighted the value of ritual reoccurrence in evaluating historical mytho-praxis transformations. Archaeology, on the other hand answered questions concerning the events that took place based on the material record. Settlement patterns and sequences of occupation and ritual use that were established allowed us to understand the motivation and level of human energy commitment that was physically evident in habitation and ritual structures, as well as tools and ritual implements. Ultimately through this research I was able to strike a balance between the usual praxis orientations of archaeology by making available complementary or alternative sets of structural interpretations based on the archival analysis. This allowed me to reconstruct a more complete picture of what occurred in this northwestern region of the archipelago, although I will identify the limits of inferences, where more information would have been helpful, and instances in the historical and archaeological sources do not agree.

Hawaiian Ritual Power and Religious Authority

The rise of the religious authority of chiefs is believed to be a key characteristic of sociopolitical complexity in Hawaiian and Polynesian societies (Earle 1987: 289). Complex institutions are those that display growing centralization of power and the development of specialized set of leaders (both chiefs and priests) within a hierarchical framework of power and resource relations. In Hawai‘i, ritual power and the formation of a state (or broadly shared) religious system aided in this development by creating a ritual mechanism (i.e., ceremonies and expressions of power) that established

authoritative order across all of the ranked male leaders through a complex web of competing genealogical birthrights. It was a process by which leadership evolved in response to the problems associated with an expanding population and the growing ranks of ali'i within the elite class of this increasingly stratified society. The construction of temples and the investments in other larger scale operations were key indicators of how much labor chiefs could command and demonstrated their ability to create consensus for communal work. It was a path that effectively limited the ali‘i class entitlements and challenged them to demonstrate chiefly behaviors (i.e., garnering support of the people) in order to enhance their chiefdom and leadership over it. The maka‘āinana also had power in this relationship in their ability to agree to, or cause internal dissent (or emigrate outside the territory) that potentially undermined the realization of chiefly-initiated projects, effectively limiting the scope and scale of a chief's power.

Ritual is an important component of religious authority because of its nature as a repetitive and habituated set of actions that reinforced and maintained ancient ideologies. It was a power that stabilized society by balancing the interests of power with that of ideological production in an effort to avoid internal conflicts, elite factions, and emergent classes (Earle 1987: 298). The ritual system in Hawai‘i was wide spread and affected all aspects of society. It was based on an annual calendar that divided the year into two seasons – makahiki and kauwela. Within the dichotomy of these seasons were two contrasting ceremonial cycles that structured the actions of chiefs and the people, involving a shorter resting renewal period of peace and a second longer culmination period of industry and competition (Earle 1997: 170). During the season of kau wela, there was wide spread competitive efforts as people were drawn into public works

projects and the building of infrastructure such as agricultural food production systems (i.e., irrigated and rain-fed systems), aquacultural production systems, production of stone tools, management of fisheries, protection of upland forests and watersheds, and the building of temples. While the two periods of the year are recognized across the main Hawaiian Islands, we should recognize that much of the information and emphasis on makahiki rituals comes from observations made by early western explorers, especially with regard to their performance on Hawai‘i Island. Thus, discussions of religious authority has typically been centered around the degree of planning integration that went into sustaining these efforts. Together these periods and associated activities encompassed the totality of the state religion, connecting these economic dimensions to the annual calendar in a process of ritualization. One of the main conclusions of this research is that this structural scheme was centered upon a remote island named Mokumanamana (along with its neighbor, Nihoa) uniquely located in the middle of the archipelago. This island's position helped to calibrate an astronomically-based predictive ritual calendar that provided a sense of stability and regularity to all annual activities. The maintenance of this center was the ultimate expression of mana as elites' gained the predictive power of forecasting climate and weather variability.

The authority of chiefs existed because of their genealogical position in a sacredly charted world order (i.e., birthright), as well as through their ability to achieve power through activities that demonstrate their leadership of the people. Both of these paths to power came together with concept of the braided cord (‘aha) as a conceptual centerpiece and a metaphor of social integration and direct transfer of metaphysical power between ancestors and descendants, across the continuum of islands from east to west in the

archipelago. The birth of La‘ila‘i (w) and Ki‘i (k) as the first Hawaiian woman and man to emerge from primordial darkness marked the earliest sociopolitical transformation that brought man into the world of the living. Mokumanamana was valued as an important commemorated site for high chiefs that acknowledged this place of origin and it as the source of chiefly status, religious authority, and spiritual power. These ideological beliefs were the foundation of the religious system that helped to build a common identity and a greater sense of cohesion amongst the people. The commemoration of this historic event helped to reify the power in the male ranking system (i.e., through genealogical approximation to the senior line) that derived from it. According to Earle (1987: 298) “in complex chiefdoms like Hawai’i… the chiefs were gods whose rule as part of the natural order.” In many respects, man controlled gods because they were brought into being by the consciousness of man at this very location, thus they were susceptible to being controlled through the utilization of anthropomorphic images (ki‘i) to fetch the spirit and petition them. The use of ki‘i (or anthropomorphic images) in Hawaiian ritual practice is documented earliest on Mokumanamana, as there were a number of stone images recovered from ritual contexts. All of these images were identified as being male through the presence of erect penises on them and had strong symbolism associated with characteristics of the god Kāne. The recovery of only male images from this island is an indicator that the activities that took place there were primarily centered on male authoritative power. These images likely served as a reminder of the struggle of Ki‘i and Kāne (who were both identical twins) commemorating of this first sociopolitical transformation of Hawaiian history- the birth of the senior line and the origins of ritual power.

The authority of chiefs was also demonstrated in their ability to lead the people and accomplish important ritual tasks and larger public works. The roots of these rituals can be traced back to a period of transformation during the late cosmogonic period when explanations are given concerning how the temple system developed and the degree to which it became widespread. Mokumanamana again is an important locale as it represented the axis between the world of the living and the world of the afterlife and an important pathway to petition the ancestral gods for support and the authority to rule. Mokumanamana (and Nihoa) became the ritual center of power that locked in the northern limit of the sun's annual movement and helped to calibrate the timing of the annual calendar and its shifting seasons. The construction of temples and other structures on these islands occurred for different durations but represented a monumental effort and cost as the costs included not only the actual building, but also the resources that went into sustaining a voyaging network and employing full time elite specialists for this occupation. After this center was completed, occupation was sustained over a period of four hundred years, and it became part of a system that included all the main Hawaiian Islands in a ritual cycle. Chiefly lineages from each island were braided into this annual cycle as the sun moved incrementally northward during spring and reached zenith over each islands sequentially from Hawai‘i, Maui (with Kaho‘olawe, Lāna‘i, and Moloka‘i), O‘ahu, Kaua‘i, Ni‘ihau, Nihoa, and then finally Mokumanamana. Mokumanamana represented the culmination of this process which occurred on the summer solstice (the longest day of the year marking the beginning of summer), when the sun was directly over head at noon and took the appearance of "standing still." That day was the most important day of the year of maximizing mana and petitioning the realm of the afterlife

for legitimacy to rule as sanctioned by their ancestors. The summer solstice was part of the season of kauwela, which represented a time when the annual calendar was reaching its culmination. The elaboration of temples across the archipelago was a critical component of this cycle and represented the dimension of competitive growth and interaction. It was established as a primary dimension of the larger integrated institutionalized religion.

Increasing Frequency and Intensification of Investments

Socio-political development in Hawaiian chiefdoms can be measured by the frequency and continual intensification of ritual investments (i.e., "sacrifices") that went into accessing and maintaining power and ideological production. This was achieved through annual rituals that commemorated the origins of Hawaiian chiefly status, religious authority, and spiritual power; and legitimized new leaders that could successfully garner the support and sacrifices needed to reify this power structure. Mokumanamana represented the hallmark achievement as the center of this complex ritual system, which identified the importance of this strategic island early in the voyaging exploration of the archipelago. This emergent religious system took into account the position of this island within the span of the entire Hawaiian archipelago, its relationship in tracking the migration of the sun, and the reciprocal relationship that manifested across space between that of living chiefs with their deceased ancestral gods in the afterlife. While the ʻaha is first mentioned as a council early during the reign of Maui chief Haho (ca. A.D. 1225-1330), the actual materialization of this ritual practice as associated with temple construction can only be verified by somewhat conservative chronometric dates that place the settlement and construction of Mokumanamana (and

Nihoa) to a later period. These dates were generated from fieldwork that did not always explicitly target construction events and therefore may not have represented the earliest portion of the historical sequence. Mokumanamana represents one of the earliest examples of monumentality in the Hawaiian Islands as the actual construction of this island temple began no later than A.D. 1490, and was sustained over a 400 year period. Ritual practice intensified as it shifted from a set of timed occurrences to one that was directly aligned with the annual cycle. From A.D. 1400 to 1800 there were at least 16-19 generations of Hawaiian chiefs who reigned during this period (Cachola Abad 2000: 225). If based on an annual cycle, there were at least 400 ritual intervals that occurred in pre-contact times and until the abolishment of the religious system in A.D. 1819. The effort required to sustain this ritual system would have increased over time and intensified in the elaboration of rites. The success of ideological reproduction in these earlier periods relied upon this frequency and regularity of ritual acts to reduce or manage the amount of intra elite competition within and across territories, essentially providing greater stability and a more efficient Hawaiian society. In the latest intervals of the protohistoric period however, competition and warfare became incessant suggesting that chiefs were willing to go to even further extremes to obtain power.

Together Mokumanamana and Nihoa islands represented an aggregate complex that demonstrated elite settlement patterns reported for Hawaiian royal centers. Typically royal centers are comprised of both a ritual precinct and an adjacent to elite residence complex (that are also built on a grand scale) (Kirch 2010:75).[132] Mokumanamana

[132] Other examples of royal centers include Waipiʻo Hāmakua, Hawaiʻi Island, which is associated with the chief Līloa (A.D. 1550-1570; Cordy 2000: 196-201); Hōnaunau, Kona, Hawaiʻi Island, which is associated

functioned as a ritual precinct that was dedicated to specialized ritual activities and ceremonies associated with its numerous heiau temples. Settlements patterns show that ritual activities were the primary force behind this occupation as there was almost a 3:1 site ratio between ritual and secular use; and a 25:1 ratio between areas dedicated to religious versus habitation purposes on this extremely small resource deficient isolate. The occupation of this island occurred as early as A.D. 1433 and lasted for the entire sequence until A.D. 1815. The best available data for labor investment in heiau construction and use comes from a ritual sequence that occurs no later than A.D. 1500 and is maintained continuously into the early A.D. 1800's (with sporadic visitations going even as far as the modern era A.D. 1876-1918).

Nihoa functioned primarily as an elite residential annex and staging ground for the planning and construction of the Mokumanamana ritual sanctum. The Nihoa settlement patterns shows a focus on considerable labor investment towards habitation in the form of open residential platforms involving and closed habitations caves that date to ca. A.D. 1425-1800. Nihoa, also had its own ritual sequence however that was of close secondary importance and temples were rapidly constructed from A.D. 1495-1650 (approximately 70 years after initial settlement). Settlement patterns for Nihoa exhibits residential trends of a 1:1 ratio of dedicated area between ritual and secular use. Investments were made early to establish a more permanent presence on this adjacent satellite because of its larger size, and available resources, and closer proximity to the main islands. The energy expenditure that went into the construction of large permanent

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with Keakealaniwahine (w) (A.D. 1660-1680; Cordy 2000: 265-266); and Pi'ilanihale, Hana, Maui Island (A.D. 1400 Kolb 1991: 38).

residential housing was an indication of elite status and the degree of social stratification present in terms of differential access to these islands. Overall, Nihoa has many more habitation sites (in both absolute numbers and relative measures of site areas to the main Hawaiian Islands) than does Mokumanamana, suggesting a push towards an actual settlement phase to its pre-contact history. This shift over time towards more permanent settlement is further supported by the late appearance of dry land agricultural systems covering a considerable area on the island, appearing no earlier than A.D. 1650 (with dates of use documented from A.D. 1727-1813). The ethno-historical accounts explain that priests were placed on this outpost during this period to establish a more permanent ritual presence in the region (Keo 1835). Over time greater investments were required to sustain the frequent and recurrent use of Mokumanamana, which placed greater pressure on Nihoa for support.

Mokumanamana and Nihoa functioned together as ritual center and an expression of Hawaiian monumentality. Both the ritual sites on Mokumanamana and the residential sites on Nihoa have similar sequencing and patterning in construction over for a long duration occurring as early as ca. A.D. 1400, with construction of open habitation sites ending at A.D. 1650, and with the regular use of Mokumanamana ritual sites extending until post contact, after A.D. 1800. The cost and effort that was invested into these sites cannot only measured by the outright labor assigned to construction, but should also factor in the continued use, maintenance, and resource support needed to sustain these ritual activities over a long period of time. The importance of these islands in the ritual system was evident from the relatively early and rapid appearance of temples on these islands (in association with their open habitation site counterparts). This regional

chronology consists of some of the earliest and most persistent array of reliable chronometric and relative dates gathered from ritual contexts for the Hawaiian archipelago (Kolb 2006; Kirch 2010). The intensified period of temple building for Mokumanamana and Nihoa corresponds closely with patterns observed in the main Hawaiian Islands with monumentality reaching its apex during a period of A.D. 1500-1650 (Kolb 2006). In later intervals, heiau undergo "diminish monumental grandeur" with overall sizes and designs being scaled down to different degrees across the main Hawaiian Islands. Likewise, many royal centers emerge early only to be eclipsed later by other centers. Mokumamanamana however, is the only documented ritual precinct that has evidence of sustained ritual effort throughout the entirely of the historical sequence. Overall these chronologies challenge our understanding of settlement in the Hawaiian Islands, as these remote islands were sustained for longer durations and higher frequencies than many other places in the Hawaiian archipelago.

Increasing Scales of Expansion

Socio-political development in Hawaiian chiefdoms can be measured though spatial consideration regarding the ritual expansion into the Northwestern Hawaiian Islands. The long-term occupation of these two islands represents one of the best examples of sustained interaction across long-distances. According to Kirch (2010: 50) the Hawaiian system of government was highly decentralized and mobile, often times exhibiting a dispersed settlement pattern of traveling from one royal center to the next. Building and sustaining Mokumanamana (and Nihoa) as a ritual center also falls within this framework of understanding through evidence that supports the notion that a number of elite groups consented and converged towards this island to participate in ritual

activities. All chiefdoms and their genealogical lineages had interest in accessing this power in the northwest as the ʻaha process integrated each island sequentially into the ritual cycle through the progression of the sun as it moved northward. The maritime expansion into the northwest was an indicator of the growing scale of integration across the archipelago, as a regionally organized system. Monumentality was also expressed in the scale of investments (i.e., mobilization of labor and resources) placed into sustaining an intra-archipelago voyaging network. Evidence based on reconstructed climate and weather shows that exploration likely occurred before A.D. 1300, as ideal sailing conditions existed for the safe exploration upwind into the northwest and return downwind back to the main Hawaiian Islands. In fact, the earliest coral date from Mokumanamana was A.D. 650, suggesting that this object was from an earlier non-local context that could have pre-dated the colonization of the Hawaiian archipelago (Wilmhurst et al. 2010, Reith et al. 2011). It effectively made its way to Mokumanamana by A.D. 1400 from east-central or western Polynesian sources and could have represented ancestral links to the original Hawaiian homeland of "Kahiki." Prior to A.D. 1300 there was an exploration phase that expanded into this region that either has not yet been archaeologically identified or did not include occupation or settlement of these remote islands.

Following this period (post A.D. 1300), climatic shifts created a wind reversal that would have made maritime voyaging to this area much more dangerous and time-consuming. Sailing would have required longer period at sea and the return voyages would be upwind from Mokumanamana and Nihoa to the main islands. Despite these growing challenges, elites continued to push to occupy these two islands, as the benefits

derived from building and maintaining this ritual precinct outweighed the voyaging challenges that were posed by these climatic conditions. Mokumanamana was established as an important location for calibrating the annual ritual calendar (because of its location in respect to the summer solstice). The knowledge gained from these ceremonies became increasingly important in regards to the climatic changes that affected the Hawaiian archipelago and destabilized overall resource production. Interestingly, as terrestrial investment in agriculture (especially dry-land production systems in marginal areas) in the main Hawaiian Islands increased, so did the need to support frequent and recurrent occupation of Mokumanamana and Nihoa, so that a sense of reliability could be re-established in annual calendar (as it relates to weather forecasting and predictions). Thus, major shifts in climate variability led to a greater need to reinvest in voyaging.

Several lines of evidence suggest that an interaction sphere developed for Mokumanamana and Nihoa that included all of the main Hawaiian Islands. Relative chronologies of building sequences for both ritual and secular architecture on both islands were done that included considerable stylistic variability, some of which could not be assigned to temporal differences. Rather, it appears a number of distinct units reflect the presence of geographically dispersed but interacting social groups converging on these islands primarily for ritual events. The construction evidence includes a substantial amount of variation suggesting that a number of different local groups contributed to the building of these architectural structures. For instance, when the heiau on both Mokumanamana and Nihoa are compared to assemblages in the upland Leeward Kohala Field System (LKFS) or Kahiki Nui, assemblages from Maui Island, or assemblages from

O‘ahu Island, they show more variability than even these areas that are much larger sometimes by a factor of 10:1000 (Kikiloi 2002; Graves and Cachola-Abad 1996; Kirch 2010; Mulrooney and Ladefoged 2005; McCoy et al. 2011). There are specific design features that are present in both Mokumanamana and Nihoa heiau and house sites that share similarities with other locations in the main Hawaiian Group such as: (a) uprights which are characteristic of Mauna Kea shrines, and also agricultural heiau in the LKFS (McCoy et al. 2008; McCoy et al. 2011); (b) inverted corners (notches) that are associated with Maui heiau (Graves and Cachola-Abad); and (c) flush perimeters which are associated with O‘ahu heiau (Kikiloi 2002). The relative chronologies also show a pattern of construction that suggests larger heiau (which required more labor and resources) were increasingly built over time on Mokumanaman , but their construction was interspersed with smaller temples. This pattern could potentially match with the episodic rhythm of small-scale climatic oscillations that correlate to voyages and labor/resource transportation to subsidize these efforts.

Voyaging provided a means to transport critical resources to Mokumanamana and Nihoa and to keep populations mobile to and from the main Hawaiian Islands. Non-local wood taxa that occurred in charcoal and macro-botanical assemblages from both islands indicated that many types of timber resources were transported for fuel, construction materials, and ritual activities. These materials come from an array of habitats that range from wet and/or upland forest (‘ōhi‘a ‘ai), cultivated materials (breadfruit, gourd), and coastal beaches (driftwood pine). Additionally, there is limited evidence for the transportation of fine grained basalt resources from the main Hawaiian Group. Following a “least cost” assumption, most of these materials likely originated

from the Kauaʻi and Oʻahu. From Nihoa, a finished adze and a hammerstone have high probability of originating from Nualolo Kai sources (Kauaʻi); while from Mokumanamana, two finished adzes have high probability of originating from Waiahole (Oʻahu), and a sinker from Nualolo Kai sources (Kauaʻi). Both paleo-botanical and geochemical lines of evidence support the notion of multiple social groups using both Nihoa and Mokumanamana for ritual purposes. While the islands of closest proximity have more direct evidence of interaction, more distant islands such as Maui and Hawaiʻi cannot be excluded from these results. These islands and their lineages represent the youngest and latest in the genealogical aliʻi pedigree. At the same time however, they had the most to gain from the ritual knowledge that derived from the timing of the summer solstice on Mokumanamana. History supports this by the fact that these chiefdoms were ultimately the victors at the end of the protohistoric period and would have had to access this ritual power in order to accomplish this feat. The development of extensive dry land agricultural systems on Maui and Hawaiʻi (A.D. 1300- 1500) drove socio-political dynamics, first internally, and then across islands late in the late prehistoric and early historic sequence. The appearance of similar dryland crop production complexes on Nihoa and Mokumanamana (ca. A.D. 1650) is viewed here as physical evidence of its spread and the reciprocal advantages that were being benefited from a voyaging interaction network that connected this archipelago from Hawaiʻi to Mokumanamana.

Significance to Our Understanding of Hawaiian Society

> At some point in its past, through seemingly impossible, Nihoa was inhabited as numerous ruins of house platforms and agricultural terraces can attest. Necker island, knowledge of which had been lost to Hawaiians, is little more than a barren rock… the pose an archaeological problem as intriguing as any which exists in Polynesia, the solving of which would go far towards the unraveling of the past of the Hawaiians. (Emory 1970).

At the end of the proto-historic period in the late 18th century Hawai‘i had developed into one of the most complex societies in Oceania with respect to hierarchical organization, economic differentiation, and scale of production (Kirch 1990: 331; 2000: 300). Throughout our pre-contact history (i.e., from the “time of Wākea”), the archipelago was broken into autonomous and competing kingdoms that have been described as “chiefdoms” or “archaic states” (Hommon 1986: 55; Kirch 2000: 300). Although they were politically independent, their ruling dynastic families were interrelated through genealogy, marriage, and alliances (Cachola Abad 2000). To understand the evolution of chiefdoms to “archaic states” is to understand a balancing of interests between a dependent, supportive population and an emerging aristocracy. Earle (1987: 298) states that “up until the industrial revolution the primarily limit to production (and economic bases) appears to be labor.” Therefore the ability to mobilize labor was of primary importance, one that required the papa ali‘i (elite class) to retain consensus and respectability amongst the lāhui (people). This was accomplished through ideological production and proficiency in rituals and through the rigorous process of measuring leadership by the chiefs’ ability to successfully complete the required ceremonies and gain favor from the ancestors.

Hawaiian ritual power was clearly a local development that occurred after the inter-archipelago voyaging period had ended for the Hawaiian Islands. Archaeology (and ethnohistory) have been dominated by assumptions that outsider “Kahiki” chiefs were primarily responsible for innovations regarding religious formation that occurred approximately A.D. 1225-1330 and then later at A.D.1310-1390. These accounts reference two particular migrations that were thought to have been important in

introducing innovations to Hawaiian religious practices but also supplanting traditional chiefs of Hawaiian ancestry based on primogeniture models of succession. The outcome was thought to be the complete kinship based separation of chiefs and commoners and the creation of more "open systems." This however could not be further from the truth as models of succession were still relatively closed and based on varying degrees of genealogical distance from primary ancestors. The first accounts tells of the arrival of southern immigrants and a priest named Pāʻao, who was a navigator from the Society Islands that brought with him a chief named Pili Kaʻaiʻea (G-2 A.D. 1225-1330). Pāʻao is credited with introducing new war god (a form of Kū) and also human sacrifice into the fold of ritual practices (Dye 1989: 3). Additionally, other southern migrants such as the chief Laʻamaikahiki (for Oʻahu and Kauaʻi; G-4 A.D. 1275-1370) was also given credit for introducing a new god (a form of Lono) as well as temple drums (larger pahu) that were used in ceremonies. Early efforts on the part of archaeologists to track these introductions were never successful in demonstrating a corresponding shift in heiau design (Stokes 1991). The ethnohistorical information and archaeological chronologies presented in this research indicate that the hoʻomanamana religion as part of a formal institutionalized temple system did not develop until after A.D. 1400. Following the establishment of this center at Mokumanama, temple construction on the main islands undergo intensified stages of building at A.D.1400-1500, then reached its apex atthe end of A.D. 1500-1650. Mokumanamana therefore, played an important role in integrating these temples into a single system. In a very general sense, all of these temples derive from archetypes that were universally found in Polynesia, but it is clear that heiau were a

specific type of temple that was later adapted to a Hawaiian setting and used in the tracking of time.

The evidence from both the ethno-historical and archaeological data suggests that the development of the ʻaha ritual system had far reaching implications throughout the chiefdoms in the main Hawaiian Islands. Together these heiau temples in the main islands represented an integrated system that was linked directly to Mokumanamana (and Nihoa) as the center of ritual power and source of ideological production. The construction and maintenance of these islands was a massive undertaking required enormous amounts of resources and specialized labor to support these initiatives. It required cooperation between chiefdoms and across social classes. Cachola Abad (2000: 225) documents a shift in authority from one where chief's assumed nominal control to one in which chiefs exercised more administrative control. This shift is thought to have occurred sometime between A.D. 1430-1510 (using a 20 generation count). These dates roughly correspond to the overlapping interval of time with the earliest settlement dates for Mokumanamana and Nihoa (ca. A.D. 1400) and their early construction phases (late A.D. 1400's to early A.D. 1500's). These dates align with chiefly genealogies in the following order for the main islands: 1) Hawaiʻi Island: Kahaʻimoeleʻa to Kalaunuiʻōhua (G 7-8); Kauaʻi Island Kūkona to Manokalanipō (G 8-9); 3) Oʻahu Island: Haka to Maʻilikūkahi (G 9-10); and finally 4) Maui: Kakae to Kakaʻalaneo (G 11). During this period, religious transformations corresponded with shifts towards more administrative control as chiefs are offering greater guidance over secular matters (e.g., resource production, inter-group interactions) for an increasingly complex society. This authority was gained through knowledge of the environment and the ability of chiefs and priests to

accurately predict cycles of nature and the role the sun plays in the changing seasons. This power was reified through a state sponsored religious ideology and an expanding ritual system.

One of the earliest stories of competition and integration across the archipelago, comes from an early account that describes the voyaging expansion of the Hawai‘i Island chief Kalaunui‘ōhua. This chief is widely known as the only other chief prior to Kamehameha in coming close to successfully unifying the archipelago under one rule. He comes close to accomplishing this by ascending up the archipelago and conquering each island chiefdom and subsequently taking their paramount chief hostage. With an enterprising warlike nature and a growing resource base (Cachola Abad 2000: 305-308), he embarks on an archipelago wide military campaign. He first defeates Kamalu‘ōhua of Maui Island (G-7), then Kahōkū‘ōhua on Moloka‘i, then Huapoleilei on O‘ahu (G 8), but was finally defeated by Kūkona of Kaua‘i and Kalaunui‘ōhua himself becomes taken hostage in this defeat. Kalaunui‘ōhua gains fame from having the god Kāne-nui-ākea who enters his right hand as the sun is about to set in Hawai‘i Island, and this is marked by cloud signs (Malo 1951: 251-; Kamakau 1992). This description of the god Kāne (who represents the sun) entering Kalaunui‘ōhua’s right hand could be a coded reference to the ‘aha ceremony, the voyaging expansion into the northwest, and the sun playing an increasingly important role in ritual and warfare. Kalaunui‘ōhua is the first chief (with Kūkona of Kaua‘i being the second chief) that shifts to a more authoritative administrative structure, and this would have garnered him the support and resources to accomplish not only a campaign of conquest, but the push towards increasingly larger expressions of power (i.e, construction of temples in remote locations). Regardless, ritual

power at this time seems to be captured symbolically in the bodies' right hand (lima ʻakau) with palms up and fingers (manamana) also playing a significant role as a gesture associated with the power of the sun.

The true "mystery of these islands lies in their remote nature distantly located from the main Hawaiian Islands. This isolation enhanced the mystique of Hawaiian ritual practices and the chiefs' control over esoteric knowledge. The construction of Mokumanamana and Nihoa as a ritual center was one of the most labor intensive efforts and ritual achievements of Hawaiian society. The scale and intensify of investments (i.e. maritime voyaging, dedicated specialized labor, and resourcing) increased over time with groups located from greater distances migrating seasonally to these islands. Chiefs needed to demonstrate their efficacy with respect to mana and this was partly mediated by priest specialists. In the process they demonstrated and reified the power structure that helped create a level of consensus, integration, and cohesion amongst their people- this was critical for fulfilling labor requirements and resourcing public works and ritual initiatives. The distance allowed a degree of separation to occur with the public, and kept these ritual practices located in seclusion far away from view. This spiritual separation allowed the center of the ritual system and the origin of power to remain protected with its sacred integrity. On the main islands, the knowledge obtained from these rituals provided more accurate and reliable calendric information ultimately helping in competitive growth, economic development, and agricultural surplus. The abolishment of the religious system occurred in A.D.1819 and it marked the end of the voyaging network and use of the ritual center. As a result, this highly guarded secretive chiefly

source of knowledge was one of the first parts of Hawaiian history to be lost and forgotten by the people.

The Northwestern Hawaiian Islands, with Mokumanana and Nihoa, represent a mystery that has finally been solved after 150 years of curiosity and wonder. Kinship and genealogy were the foundation of Hawaiian ritual power as it provided a focus on which commemorative practices were centered. In the late expansion period (A.D. 1400-1650), the motivations of chiefs were intent on commemorating the origins of their authority and power. This was accomplished through the expansion of temple construction, large and intensified scales of ritual activities, and a level of social integration unparalleled elsewhere in Polynesia. This research traces the roots of traditional ritual power and religious authority and shows that they were expressions of power that increased in scales and intensity over time in the Hawaiian Islands. This system was organized around an ancestral-based world view and was part of an ideological conviction that helped strengthen Hawaiians, chiefs as well as commoners alike. It documents the dynamic cultural commitment towards a type of determination and resiliency that is starting to re-emerge today in our Hawaiian people.

Table 7.1. Shift in Administrative Governance from A.D. 1430-1510 Corresponding with Mokumanamana (and Nihoa) Earlest Construction Phases (transition period in bold) (Cachola Abad 2000)

		Kauaʻi	Oʻahu	Maui	Hawaiʻi
A.D. 1430-1510 (20 year count)	7	Luanuʻu	Lauli a Laʻa (Kona) Kaʻulaʻulaokalani (Koʻolau) Lākona II (ʻEwa, Waianae, Waialua)	Kamaluʻohua (Maui) Wakalana (Windward)	**Kahaʻimoeleʻa**
	8	**Kūkona**	Kahuʻoi	Loʻe (Maui) Alo (Windward)	**Kalaunuiʻōhua**
	9	**Manokalanipō**	Kahuʻoi (Kona) Moku a Loʻe (Koʻolau)	Kahakuʻōhua (Maui) Alo & Luakoʻa (Windward)	Kūaiwa
	10	Kaumaka a Mano	**Haka** **Māʻilikūkahi**	Kaʻulahea I Luakoʻa & ʻEleʻiʻo (Windward)	Kahoukapu
	11	Kahakuakāne	Kalonaiki	**Kakae (Maui & Lanaʻi)** **Kakaʻalaneo (Leeward & Lānaʻi)** Kalāʻehaʻeha (Windward)	Kauholanuimāhū

APPENDIX

RADIOCARBON DATE CALIBRATION GRAPHS

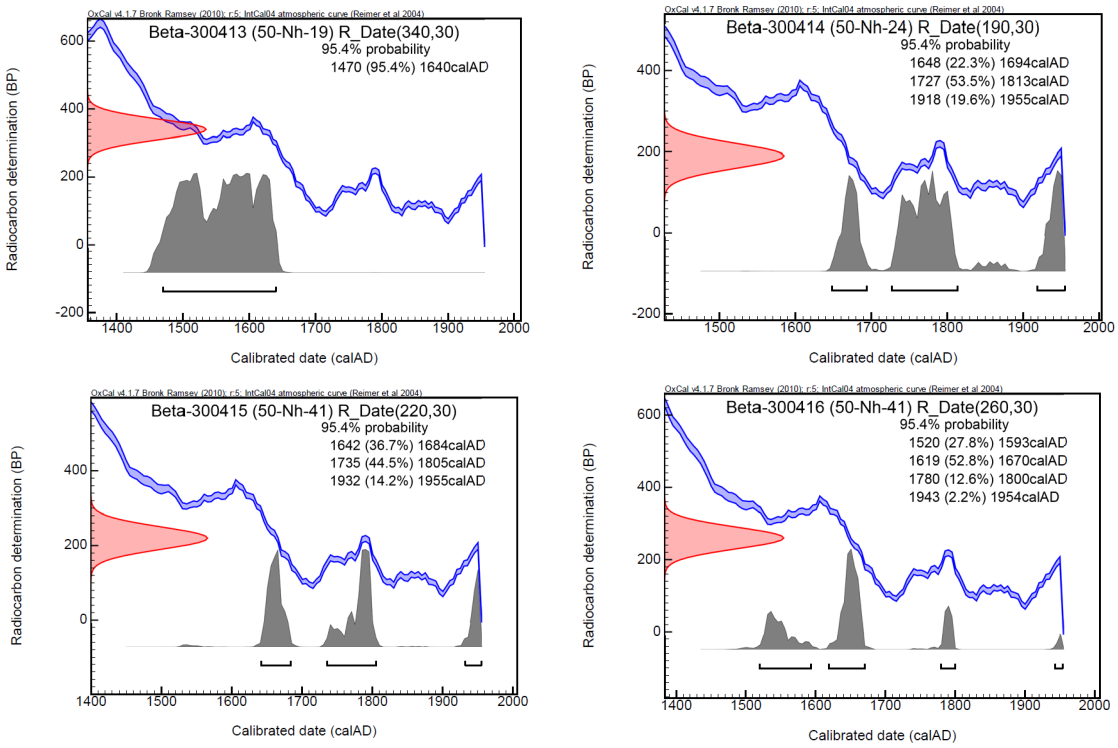

Figure A.1(a). AMS Radiocarbon Determinations for Nihoa Island. Calibrations were calculated with OxCal 4.1.7 using atmospheric data from the IntCal09 curve. Additionally Hunt's (1992) single radiocarbon date, and Rainwater's (1958) single date is also calibrated and included in these figures.

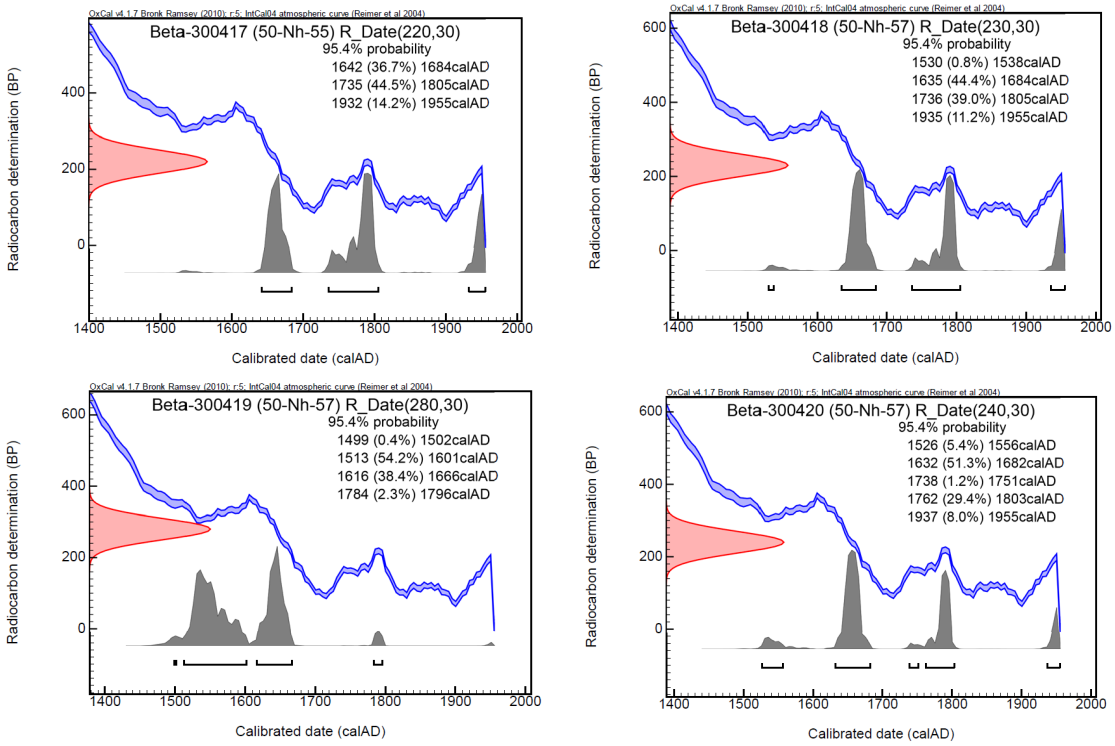

Figure A.1(b). AMS Radiocarbon Determinations for Nihoa Island. Calibrations were calculated with OxCal 4.1.7 using atmospheric data from the IntCal09 curve. Additionally Hunt's (1992) single radiocarbon date, and Rainwater's (1958) single date is also calibrated and included in these figures.

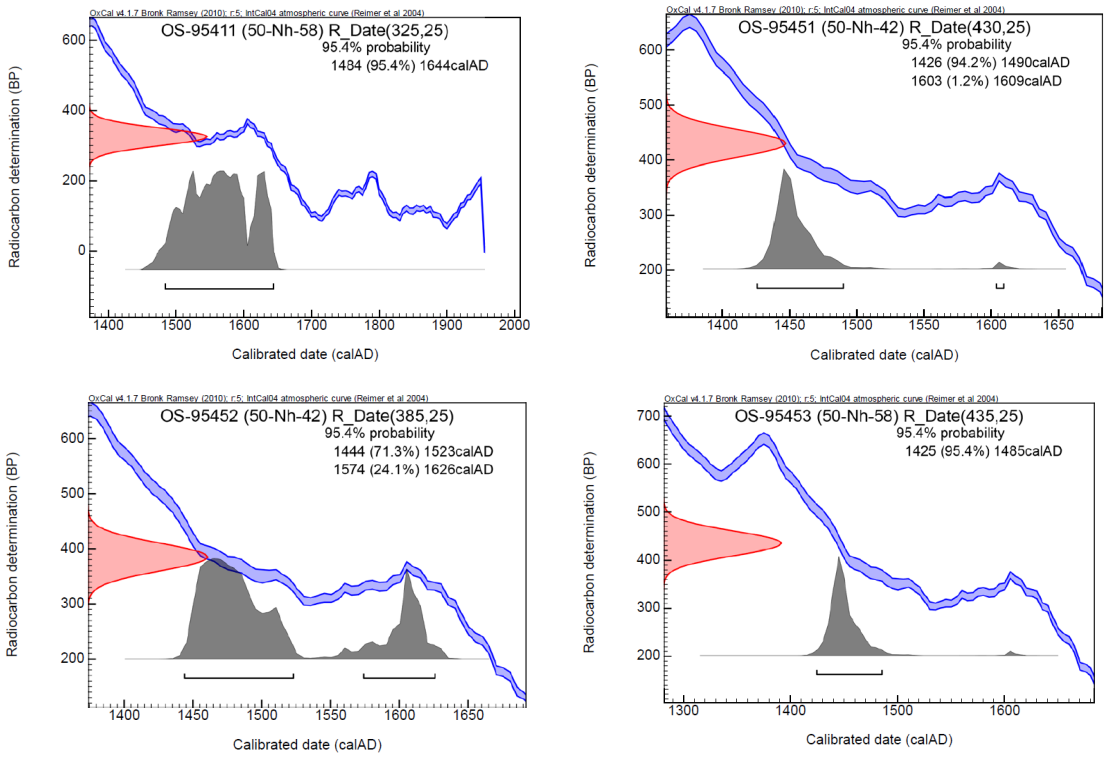

Figure A.1(c). AMS Radiocarbon Determinations for Nihoa Island. Calibrations were calculated with OxCal 4.1.7 using atmospheric data from the IntCal09 curve. Additionally Hunt's (1992) single radiocarbon date, and Rainwater's (1958) single date is also calibrated and included in these figures.

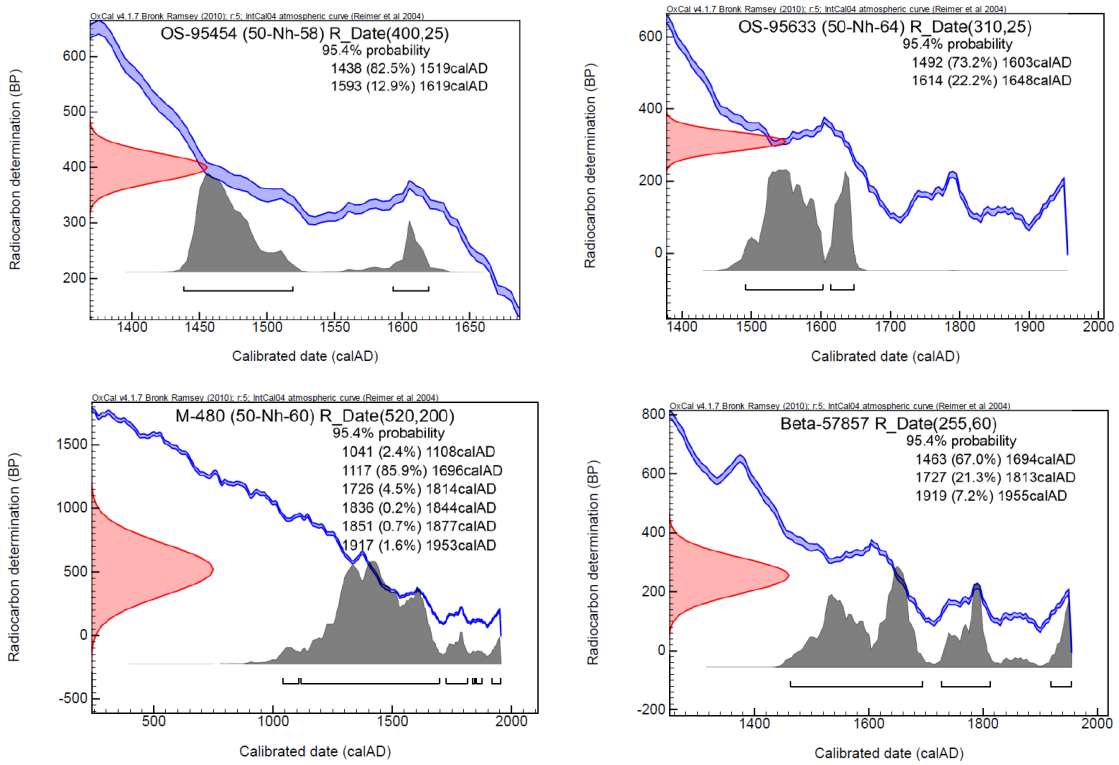

Figure A.1(d). AMS Radiocarbon Determinations for Nihoa Island. Calibrations were calculated with OxCal 4.1.7 using atmospheric data from the IntCal09 curve. Additionally Hunt's (1992) single radiocarbon date, and Rainwater's (1958) single date is also calibrated and included in these figures.

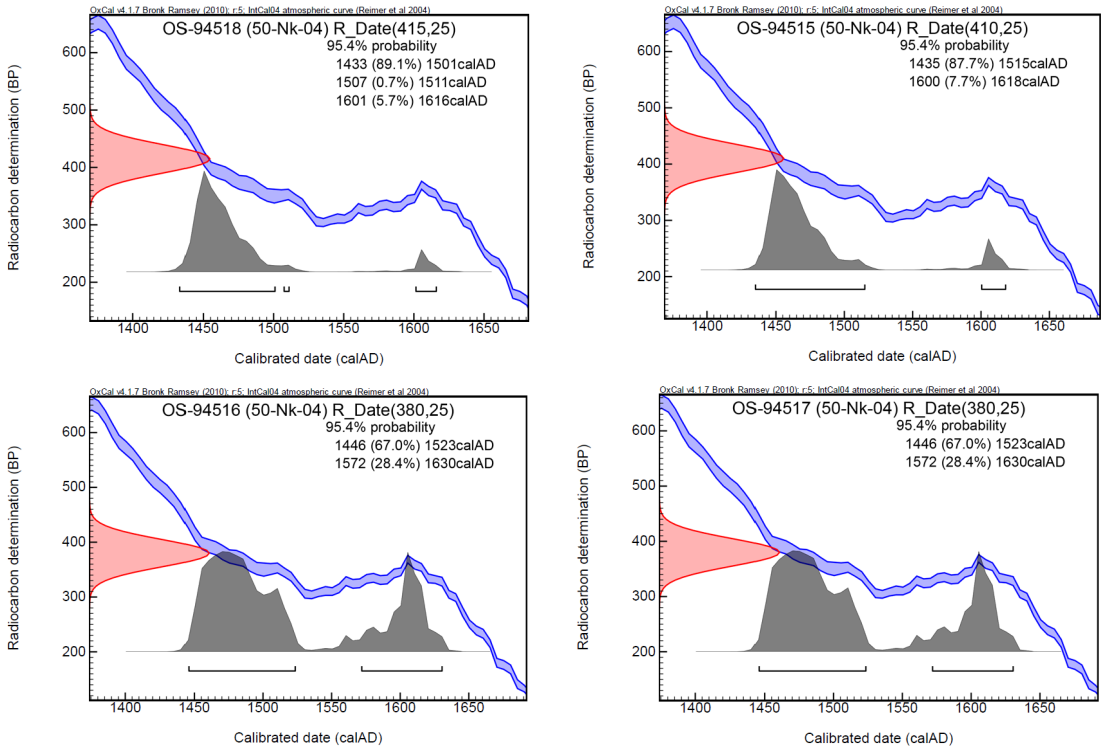

Figure A.2(a). AMS Radiocarbon Determinations for Mokumanamana Island. Calibrations were calculated with OxCal 4.1.7 using atmospheric data from the IntCal09 curve. Additionally Libby's (1954) two dates are also calibrated and included in these figures.

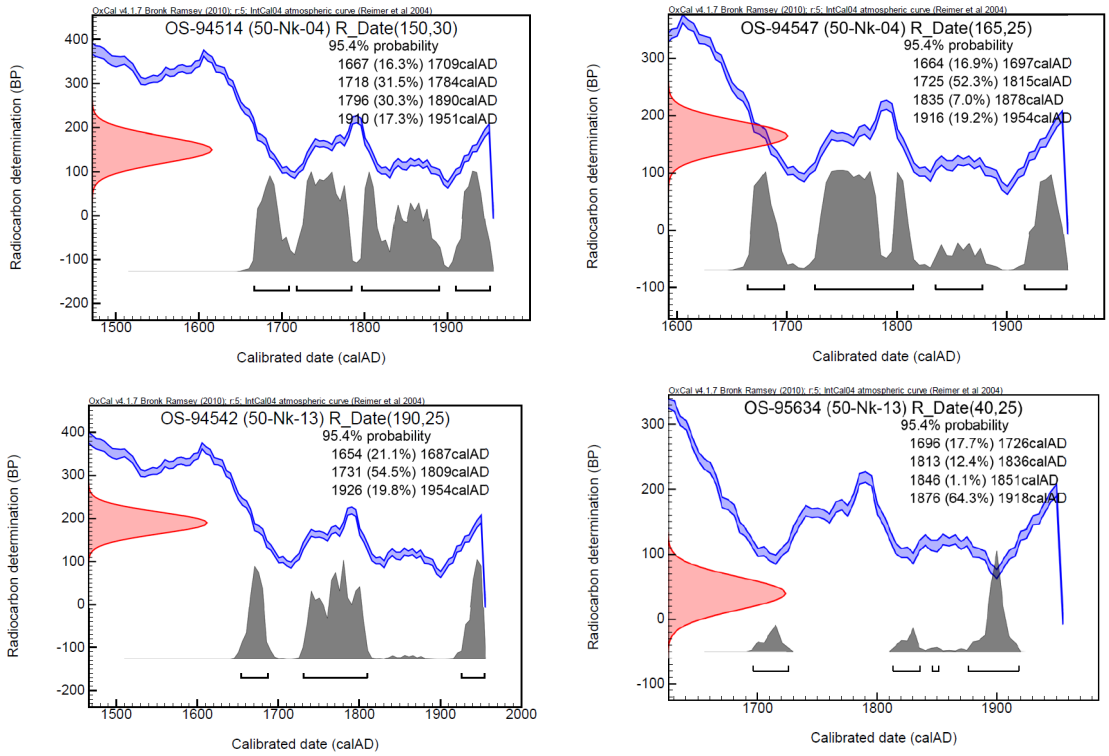

Figure A.2(b). AMS Radiocarbon Determinations for Mokumanamana Island. Calibrations were calculated with OxCal 4.1.7 using atmospheric data from the IntCal09 curve. Additionally Libby's (1954) two dates are also calibrated and included in these figures.

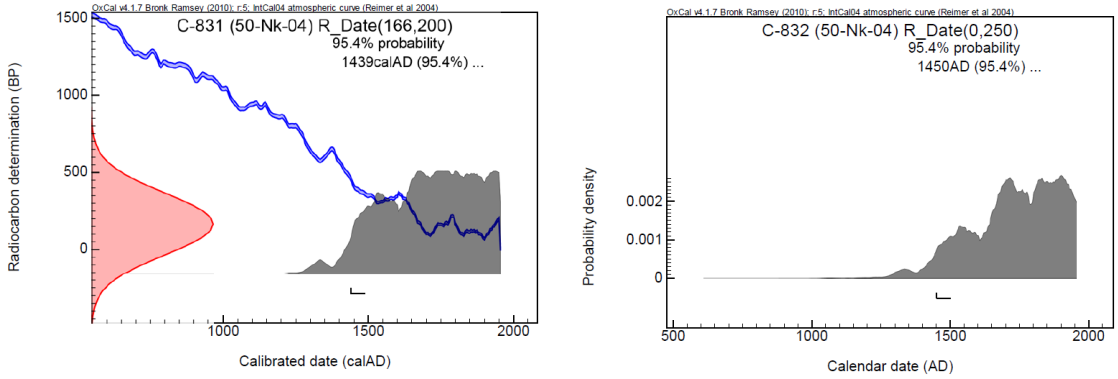

Figure A.2(c). AMS Radiocarbon Determinations for Mokumanamana Island. Calibrations were calculated with OxCal 4.1.7 using atmospheric data from the IntCal09 curve. Additionally Libby's (1954) two dates are also calibrated and included in these figures.

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