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The Structure of Settlement Space in a Polynesian Chiefdom: Kawela, Molokai, Hawaiian Islands

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ABSTRACT

A major settlement pattern study of a late prehistoric archaeological landscape on Moloka'i Island, Hawai'i, is summarised. The study focusses on the structure of settlement space within a 7.7 sq.km area situated along the south-central coast of Moloka'i, and encompassing two traditional land units (*ahupua'a*), Kawela and Makakupaia Iki. Intensive survey resulted in the discovery of 499 architectural features. These features were recorded using a standardised data-base system (designed for computerised analysis using SPSS) with 37 discrete and continuous variables, including environmental data, architectural attributes, metrical data, and the presence and density of surface cultural materials. Seventy-two structural features (14 percent of the total sample) were excavated; the total excavated area of 442.5 sq.m provides the largest subsurface data base associated with an intensive settlement pattern survey in the Hawaiian Islands. The late prehistoric and largely contemporaneous nature of this sample is indicated by 13 radiocarbon age determinations, ranging from A.D. 1650-1820. The possibilities for directly applying ethnohistoric models in the analysis and interpretation of this settlement pattern are enhanced by the proto-historic age of the archaeological landscape. The structure of settlement space at Kawela and Makakupaia Iki is examined from the perspectives of several paradigms, including environmental, social, economic, and semiotic. No single paradigm provides an adequate account of the variation and complexity of the settlement landscape; in consort, however, these varied perspectives contribute to an enhanced understanding of the structure of late prehistoric Hawaiian society.

Keywords: HAWAIIAN ARCHAEOLOGY, MOLOKA'I ISLAND, SETTLEMENT PATTERNS, ETHNOHISTORIC MODELS, AGRICULTURAL SYSTEMS, HEIAU, HOUSEHOLD CLUSTERS.

INTRODUCTION

The islands of Polynesia offer a varied and fascinating set of opportunities for studying the spatial structure of settlement landscapes among socio-politically complex, pre-state societies. This paper summarises the results of a major settlement pattern study of a late prehistoric archaeological landscape on Moloka'i Island in the Hawaiian archipelago. Earlier settlement pattern work in Hawai'i (e.g. Green 1980; Kirch and Kelly 1975; Tuggle and Griffin 1973) had focussed heavily upon the varieties of technological and agricultural adaptation to a range of local environmental constraints and conditions, in such contrastive settings as windward *versus* leeward valleys. In the Kawela Project, we attempted to build upon these important earlier contributions, while expanding our analyses to address the spatial structures reflective of Polynesia's most complex socio-political system, the late prehistoric Hawaiian chieftainship (Sahlins 1958; Goldman 1970; Kirch 1984).

An ancient and widespread pattern of land division throughout most Polynesian chiefdoms was that of radially segmenting an island into a series of territories, each running from the mountainous interior out to the coast and reef, thus cross-cutting the island's concentric ecological zonation. The resulting pie-shaped units, such as

the Futunan *kainga* or the Rarotongan *tapere* were frequently held by a corporate descent group, headed by a hereditary chief. In the Hawaiian Islands at contact, these radial land segments, termed *ahupua'a*, were the fundamental territorial units into which independent chiefdoms (*moku*) were divided. Each *ahupua'a* land section was under the direct control of a subchief, the *ali'i-'ai-ahupua'a*, who in turn owed allegiance to the chiefdom paramount. The study area chosen for the Kawela Project corresponds with two such territorial units, the large *ahupua'a* of Kawela, and the smaller, narrow *ahupua'a* of Makakupaia Iki on south-central Moloka'i Island. The Kawela Project thus provided an opportunity to examine the structure of settlement space within two major land units, known from early ethnohistoric documents to have functioned as political entities.

METHODS AND PROCEDURES

The Kawela Project was initiated in August, 1980, as a major settlement pattern survey and excavation program focussed on 7.7 sq.km of the southern, leeward region of Moloka'i Island (Fig.1). Since its abandonment in the early 1800s, shortly after widespread European contact, the Kawela area had been used only for low-intensity cattle ranching, leaving the archaeological settlement landscape virtually intact. During a year of fieldwork, the entire 7.7 sq. km study area was exhaustively surveyed, resulting in the discovery, plotting, and recording of 499 individual structural features or sites.

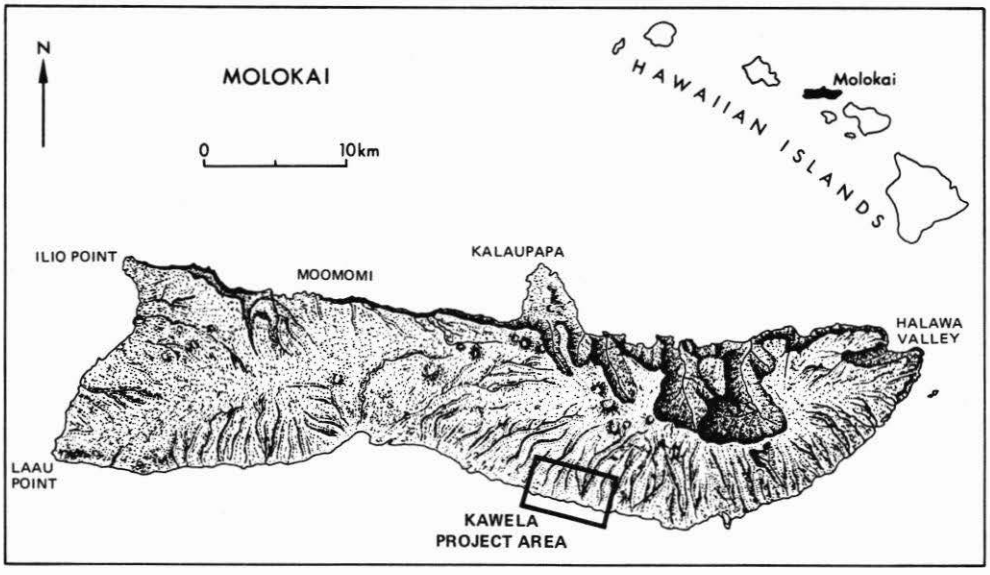

Figure 1: The island of Molokai showing the location of the Kawela Project area.

Hawaiian archaeological landscapes are dominated by dry stone masonry structures, varying considerably in size, material and construction technique, configuration, orientation, and spatial arrangement. A problem confronting efforts at settlement pattern survey in Hawai'i has been the lack of standardised site recording systems, thus hampering inter-site comparisons and synthesis. For the

Kawela Project, a standardised recording system was developed with 37 discrete and continuous variables, including environmental and locational data, a variety of architectural attributes (such as pavement type, construction technique, presence of uprights, hearths, storage cupboards, etc.), metric dimensional data, and data on the presence and density of surface midden, lithics, and artefacts. This recording system is in many respects similar to that developed by the SARG group for work in the American southwest (Euler and Gumerman 1978). Attribute data for all 499 archaeological features recorded in Kawela and Makakupaia Iki *ahupua'a* were entered into a computerised data bank utilising the SPSS system (Nie *et al.* 1975), thus facilitating cross-tabulations, statistical analyses, and other data-base retrieval and manipulation.

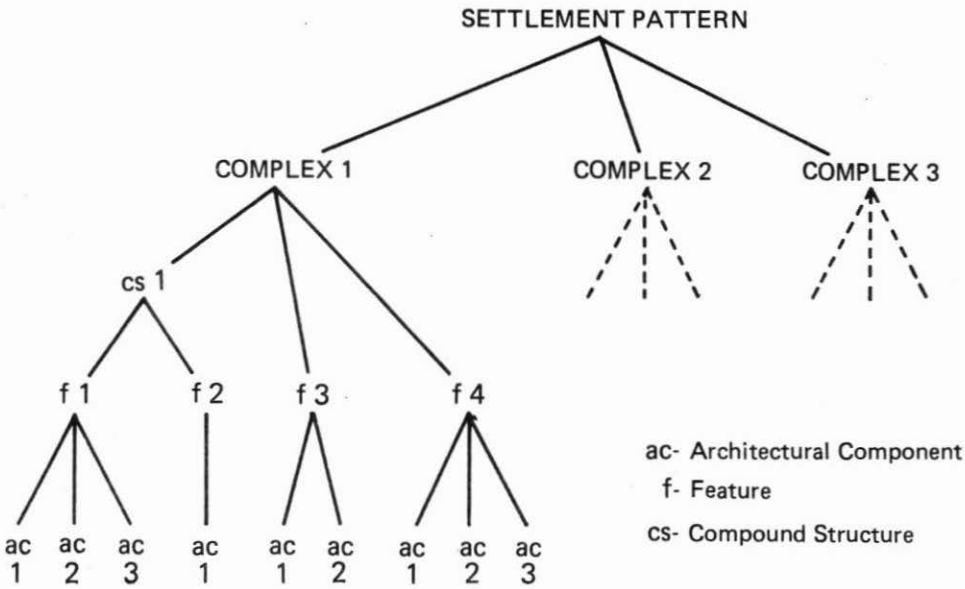

Figure 2: The hierarchical structure of settlement pattern components (see text for discussion).

The architectural complexity of prehistoric Hawaiian stone structures requires that settlement pattern analysis proceed at several levels. Rather than utilise the overworked and often ambiguous term "site" as the basic analytical unit, we conceive of the archaeological manifestations at Kawela as a hierarchical series, with a wide variety of possible combinations and permutations (Fig.2). At the lowest level in the settlement system hierarchy are individual architectural components, such as walls, pavements, uprights, postmoulds, and so forth. Architectural components may stand alone, but usually they are aggregated to form discrete *features*, which we define as spatially bounded clusters of architectural components. As an analytical unit, the "feature" is essentially identical to what Preziosi (1979) terms a "space cell"; in the computerised coding system developed for the Kawela Project, the feature is the basic unit of description and analysis. The 499 separate features recorded during the Kawela Project are summarised according to a generalised

classification in Table 1. Moving up the settlement system hierarchy (Fig.2), clusters of features form aggregates of two kinds: *compound structures* (as in the case of architecturally contiguous terraces and enclosures), and *complexes*. The latter are groups of archaeological features which are spatially clustered with respect to other features in a landscape, and which are presumed to represent a contemporaneous unit.

TABLE 1
DISTRIBUTION BY TYPE OF FEATURES EXCAVATED AT KAWELA AND MAKAKUPA'IA IKI, MOLOKA'I

Feature Type	Number Recorded	Number Excavated	Excavated Sample %
Undetermined	4	0	0.0
Stone mound	16	1	6.3
Ahu	19	1	5.3
Modified Outcrop	14	1	7.1
Alignment	2	0	0.0
Wall/Linear Shelter	42	2	4.8
Terrace	101	29	28.7
Wall Adjoining Terrace	15	2	1.3
Shelter – Any shape	149	16	10.7
Enclosure	26	7	26.9
Simple Platform	23	4	17.4
Multi-Step Platform	8	0	0.0
Sand Dune	1	1	100.0
Lithic Scatter	3	0	0.0
Midden-Lithic Scatter	7	2	28.6
Natural Shelter	20	2	10.0
Modified Natural Shelter	12	0	0.0
Water Diversion Wall	1	1	100.0
Agricultural Complex	9	3	33.3
Fishpond	5	0	0.0
Petroglyphs	11	0	0.0
Remnant Site	5	0	0.0
Wall Adjoining Platform	1	0	0.0
Hearth	1	0	0.0
Platform/Enclosure/Shelter	1	0	0.0
Platform Adjoining Terrace	1	0	0.0
Historic Well	2	0	0.0
Totals	499	72	14.4

In addition to the comprehensive survey of two entire *ahupua'a* land units, the Kawela Project undertook extensive excavations in 72 structural features (14 percent of all recorded features). The total excavated sample of 442.5 sq. m is to date the largest subsurface data base associated with an intensive settlement pattern survey in Hawai'i. Our excavation strategy was directed towards the sampling and areal excavation of a wide range of structural types, so as to enable well-documented functional interpretations of specific features within settlement pattern complexes (Table 1). Of critical importance was the definition of relationships or correspondences between feature contents and structural form. Thus, we were concerned to delineate the minimum archaeological criteria needed to identify such ethnohistorically documented features as primary residences, temporary habitation shelters, cooking sheds, religious shrines and temples, and craft specialisation locales.

Another major thrust of our excavation program was to determine the chronology of settlement in Kawela and Makakupaia Iki *ahupua'a*. The age of a set of archaeological features across a landscape, including the question of contemporaneity, is often an intractable problem confronting settlement pattern surveys. In the present case, however, virtually the entire settlement landscape dates to a very short time span, centered on the period from about A.D. 1650 to 1820, i.e. the "proto-historic" period immediately preceding European contact and influence. Table 2 presents a series of 15 radiocarbon age determinations from a variety of residential and agricultural features distributed throughout the survey area. Three features—a coastal stream-beach midden and two stone residential features—were in use during the sixteenth to seventeenth centuries. All other features date to the eighteenth or early nineteenth centuries (terminal ages of no younger than *ca.* A.D. 1820 are indicated by the absence of European material culture). Kawela and Makakupaia Iki *ahupua'a* appear to have been abandoned shortly after European contact, perhaps in response to the major political currents associated with Kamehameha's conquests of Moloka'i and O'ahu Islands in A.D. 1795-1802. In sum, the short, restricted chronological framework and excellent preservation of the architectural features comprising the Kawela settlement landscape offer an unparalleled opportunity to analyse the spatial structure of a late prehistoric Polynesian chiefdom as it functioned immediately before European contact. It hardly needs to be stressed that this situation is also ideally suited for use of early contact-era ethnohistoric materials.

TABLE 2
KAWELA RADIOCARBON AGE DETERMINATIONS

Feature No.	Beta No.	Site/Complex Type	Age B.P.	Corrected Age A.D. (Michael & Ralph [1972])	Corrected Age A.D. (Klein *et al.* [1982])*
119	2274	Residential	<120	<1813	–
051	3362	Rockshelter	<120	<1813	–
110	3363	Residential	<120	<1813	–
113	3367	Residential	<120	<1813	–
122	2275	Residential	<140	<1793	–
321	2276	Residential	<140	<1793	–
296	2279	Res./Ag.	<140	<1793	–
114	3366	Residential	150±50	1749	1645-1950
264	2273	Coastal Mound	<160	<1744	–
414	3369	Residential	<170	<1734	–
248	3368	Residential	<180	<1724	–
297	2277	Res./Ag.	<180	<1724	–
408	3364	Residential	300±80	1572	1415-1675; 1710-1805; 1925-1950
431	3365	Residential	290±60	1528	1435-1665
264	2278	Coastal Mound	290±60	1528	1435-1665

* 95 percent confidence intervals

ENVIRONMENTAL AND CULTURAL SETTING

Moloka'i is an island of striking ecological contrasts, with large amphitheatre-headed, well-vegetated, and permanently watered valleys to windward, and

moderately dissected, arid flow slopes to leeward. Physiographic extremes range from the wet, cloud-shrouded Pepeopae Bog on the summit of East Moloka'i, to the shifting aeolian calcareous sands of the northwest desert strip. Whereas the windward valleys, such as Halawa, were the focus of early and continuous settlement (Kirch and Kelly 1975), the leeward coast was permanently occupied only late in the sequence of Hawaiian settlement (after about 1200 a.d.). The Kawela-Makakupaia Iki area, with its late prehistoric settlement landscape, typifies the more arid aspects of the leeward coast.

The dominant physiographic feature of the study area is Kawela Gulch, the only watercourse with permanent streamflow in late prehistory. Beginning some 8.5 km inland, its waters head at high elevation swamps, then flow seaward carving narrow box canyons through Tertiary lava flows, exposing and depositing basalt boulders on its banks (material which, significantly, was favoured by prehistoric stone adze makers). With streamflow exceeding 0.25 cu. m/second during the wetter months (Lindgren 1903), stream sediment loads have transformed a formerly narrow coastal strip into a broader alluvial plain suitable for crop production. Although Kawela Gulch is the main source of potable water, other smaller gulches such as 'Onini, flow intermittently during seasonal rains. Issuing along the coastal margin, basal springs—both on land and submerged offshore— provide an additional source of fresh water (Stearns and MacDonald 1947:56) and allowed the formation of Kakahaia and Uluanui fishponds.

The placename Ka-wela (literally "the heat") appropriately describes the arid climate. The coast and lower slopes receive about 350-500 mm of annual precipitation, mostly from November to March, but rainfall is unpredictable (Taliaferro 1959). During nearly a year of fieldwork, we experienced but a single afternoon's rainshower.

Soil types within the study area fall into two general classes: upland slope and alluvial plains. Classified as "rockland" by Cline *et al.* (1955), the upland slopes have poorly developed soils with outcrops covering a substantial portion of the land surface. A thin A_1 horizon, low in organic matter, is irregularly developed. The present character of Kawela soils undoubtedly reflects 150 years of serious sheetwash erosion due to overgrazing by introduced herbivores. Prehistoric agricultural features on the uplands suggest the presence of formerly better edaphic conditions prior to this major phase of sheet erosion initiated in late prehistory—presumably by shifting cultivation and other forms of human-induced burning—and accelerated during the historic period by overgrazing.

The alluvial plain seaward of Kawela Gulch has excellent agricultural soils and produces high yields under irrigation (Cline *et al.* 1955:592). These young, stream-deposited Kawaihapai clay loams are very friable, almost free of large stones, and are up to 2 m deep. It is not surprising that the majority of indigenous land claims made during the early Hawaiian Kingdom (*ca.* 1848) were concentrated on these bottom lands, and that this area was the agricultural productive core of Kawela *ahupua'a* in late prehistory (see below).

Local vegetation reflects human modification of the Kawela landscape, especially during the past 150 years, and the availability of basal groundwater. Prehistorically, the Kawela area was probably dominated by a xerophytic parkland vegetation with low stature endemic trees, shrubs, and grasses (McEldowney ms.). Present floral dominants reflect the effects of feral ungulates (Lindgren 1903:23-4), erosion, and fire, all of which increased the area's aridity.

The broad fringing reef along the southern Moloka'i coastline was of prime importance to prehistoric fishing groups, providing abundant shellfish, seaweed, octopus, and fish. Extending almost 1 km offshore, this gradually sloping coastal shelf with freshwater springs issuing along the beach, provided an ideal setting for the construction of walled fishponds, an aquacultural innovation unique to the Hawaiian Islands (Kikuchi 1976). Four such ponds are situated along the Kawela coastline (Fig. 3), while two inland ponds, Kakahaia and Uluanui, are located just east of Kawela Stream. Both coastal and inland ponds provided artificial ecosystems for the husbanding of mullet (*Mugil cephalis*) and milkfish (*Chanos chanos*), as well as seaweed and crustacea.

THE ARCHAEOLOGICAL LANDSCAPE

The several hundred structural features and complexes that make up the archaeological landscape of Kawela and Makakupaia Iki *ahupua'a* may be broadly grouped into several functional classes, including: (1) features associated with agriculture and production; (2) residential features and complexes, both temporary and permanent; and (3) special purpose features, especially those used for ritual activities. These broad categories provide a convenient basis for discussing the range of variation and spatial patterns exhibited within the study area. The general settlement pattern of Kawela and Makakupaia Iki *ahupua'a* is illustrated in Figure 4.

AGRICULTURAL SYSTEMS AND PRODUCTION

Typical of the more marginal, arid, leeward portions of Moloka'i Island and of the archipelago generally, Kawela and Makakupaia Iki are not ecologically suited to the cultivation of certain indigenous Polynesian crops. Much of the land within these two *ahupua'a* consists of eroded upland slopes with limited soil development, and annual rainfall averages only 350-500 mm. Despite these constraints, the mouths of the larger gulches, and particularly the deltaic floodplain of Kawela Stream, offer areas of fertile alluvium, capable of producing relatively high yields *under irrigation*. The alluvium of the Kawela Stream delta consists of well-drained mollisols, well suited to sweet potato (*Ipomoea batatas*) production. The greatest constraint to agricultural production was the limited water available for irrigation. Kawela Stream is currently intermittent, and even assuming permanent flow prior to the historic-period deforestation, it is unlikely that this watercourse ever carried sufficient water to permit the development of extensive pondfield irrigation of taro (*Colocasia esculenta*), as was the case in the island's windward valleys (Kirch and Kelly 1975). There is both historical and archaeological evidence, however, for the intermittent irrigation of sweet potato, and a limited amount of taro, at Kawela.

Valuable data on land use in the early decades following European contact in Hawai'i are provided in the records of the Mahele or division of lands between the king, chiefs, and commoners from 1848-54 (Chinen 1958). These documents consist of land claims made by commoner (*maka'ainana*) cultivators to the Board of Commissioners to Quiet Land Titles, and of subsequent testimony, surveys, and awards pertaining to these claims. From these documents, one may reconstruct the pattern of mid-nineteenth century traditional land holdings, a pattern which was a continuation from the late perhistoric period. All of the land claims for Kawela *ahupua'a* are centered on the immediate area of the floodplain and delta, which was divided into a series of long, parallel strips, termed *'ili* (subdivisions of an *ahapua'a* in the indigenous Hawaiian system of land tenure). As reconstructed from the land claims, each *'ili* was cultivated and held by a commoner cultivator and his household

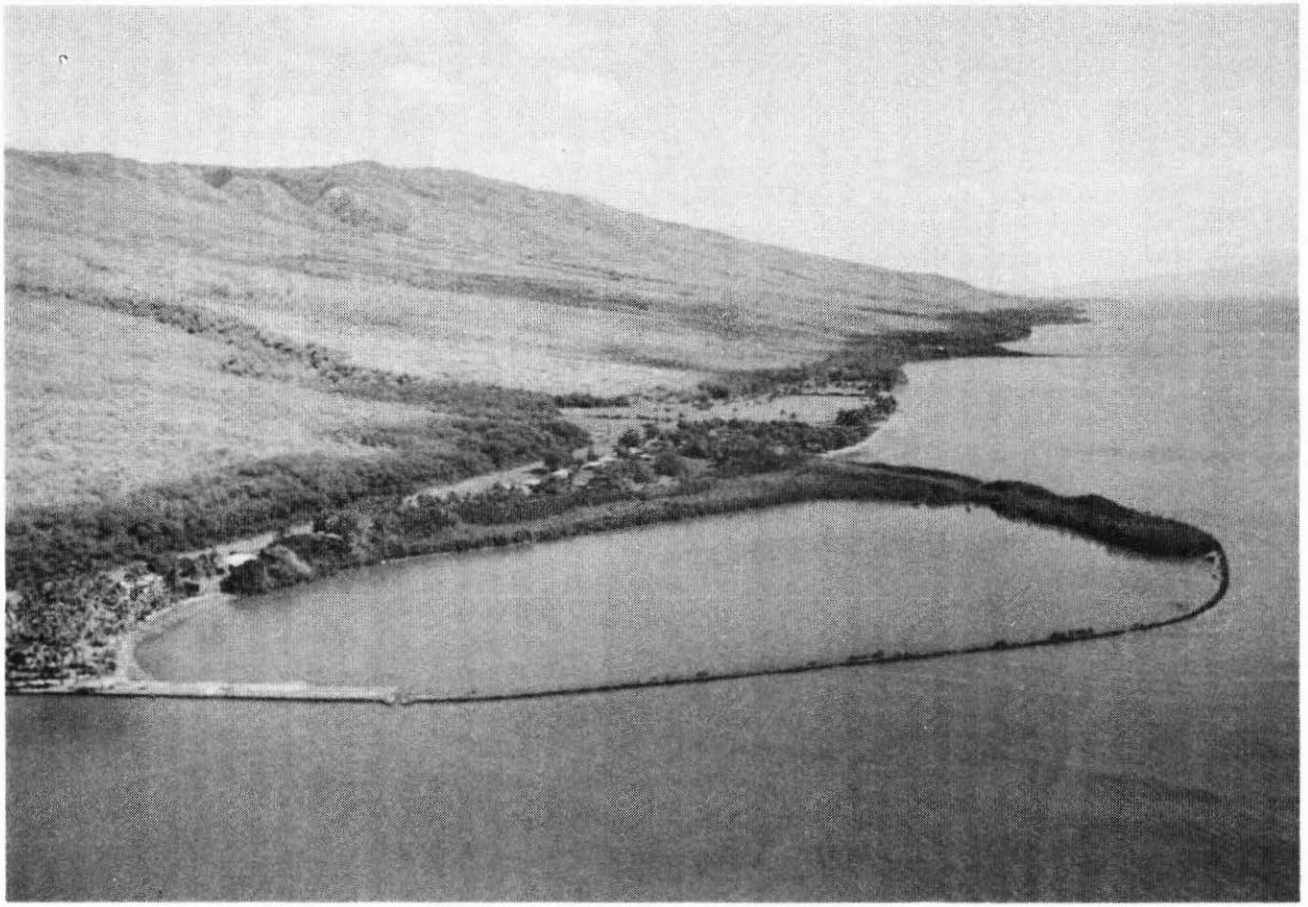

Figure 3: Aerial view of the Kawela study area looking northeast from Alii Fishpond (a *loko kuapa* type pond). Onini Gulch, located immediately inland from the pond, delineates the approximate west boundary of the study area. The broad alluvial plain supports exotic vegetation (seen here as dark areas), and has partially infilled the fishponds.

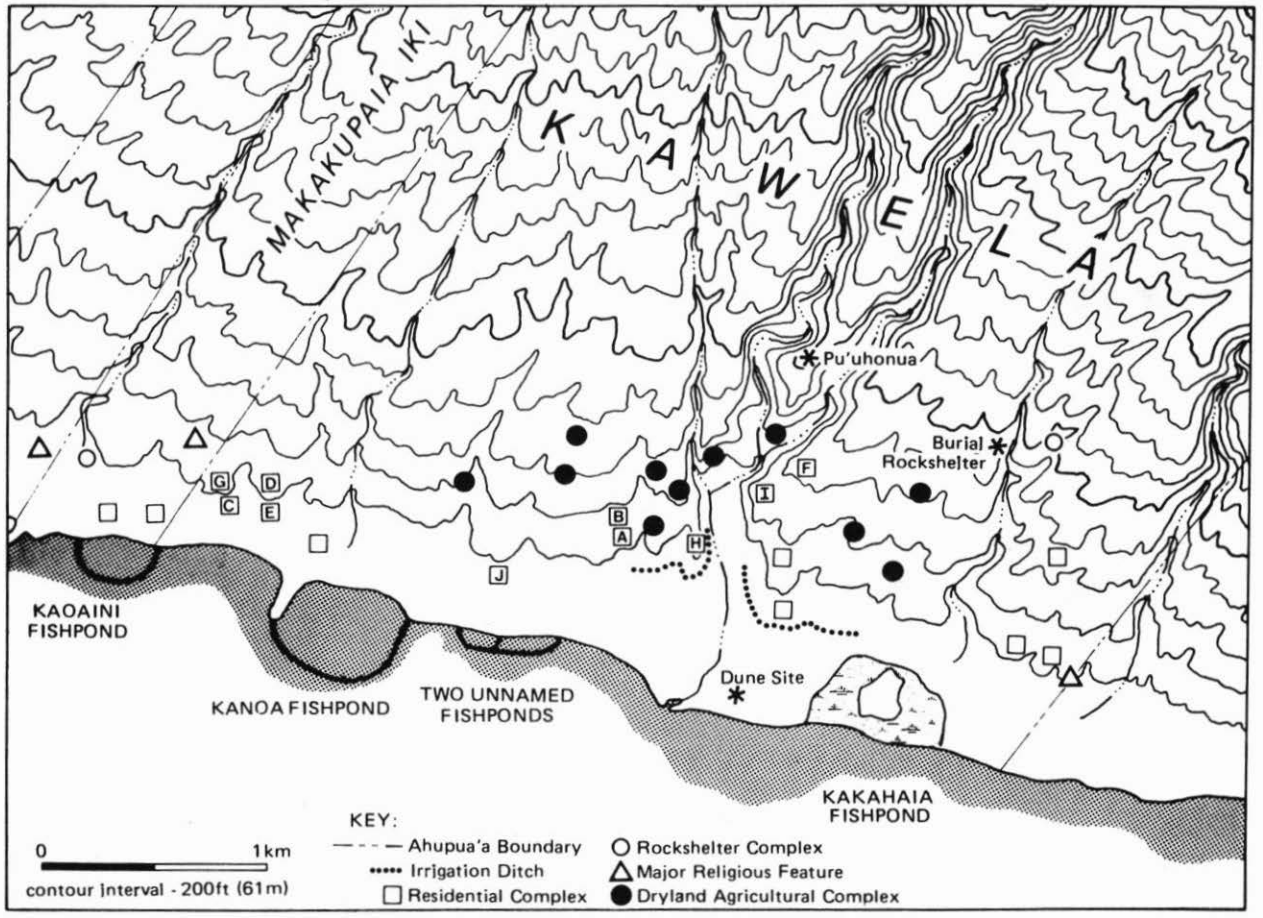

Figure 4: The Kawela study area illustrating *ahupua'a* boundaries and major archaeological features of the settlement pattern.

group, in exchange for labour and tribute to the land manager (*konohiki*) and chief who held the *ahupua'a* unit. Each *'ili* was further partitioned into subsections termed *mo'o* or *lele*, with a large coastal subsection on the lower floodplain, and a physically separate, smaller inland subsection on the narrow alluvial bench bordering Kawela Stream. The large coastal *mo'o* were cultivated for sweet potatoes, while the smaller inland sections were used for small fields of irrigated taro.

There is little direct archaeological evidence of the extensive sweet potato cultivations on the lower, coastal portions of Kawela floodplain, which probably utilised simple mounding and/or furrowing techniques without construction of permanent terracing (Handy and Handy 1972; Yen 1974). Irrigation of the floodplain, however, required the use of permanent ditches to feed water from the stream along the inland edge of the alluvium. Two such ditches, shown in Figure 4, are represented in early historic maps, and the archaeological vestiges of the western ditch were discovered during our fieldwork. A 40-metre-long segment of the irrigation channel, including a stone barrage to deflect floodwater back into the main stream channel, can still be traced along the base of the steep gulch wall. Excavations across the channel revealed the ditch configuration and cross-section, permitting an estimation of the maximum possible discharge. This discharge was calculated as 550 cu.m of water per 24-hour day, but it is unlikely that this maximum discharge was carried on a continuous basis, given the erratic streamflow within Kawela Gulch. Rather, we believe that irrigation of the delta was carried out intermittently, a practice which would have produced reasonable yields of sweet potato, but which would have been insufficient for taro cultivation.

Further archaeological evidence for irrigation is restricted to two small complexes of stone-faced pondfields and associated ditch segments in the interior of Kawela Gulch, just below the major fork (Fig. 4). Individual pondfields are rather small, ranging from 3 by 5 m up to 10 by 15 m in size. These small irrigation systems probably correspond with the taro lands (*'aina kalo*) described in the 1848 land claims.

Our survey revealed archaeological evidence of limited attempts to cultivate the slopes to the west and east of Kawela Gulch (Fig. 4). Limited rainfall in the region would certainly have made any non-irrigated agriculture a risky proposition, and the agricultural complexes on the slopes may represent no more than attempts to coax out an additional crop during years of higher than average winter rainfall. One such dryland agricultural complex is illustrated in Figure 5. This complex consists of about 430 stone mounds (each averaging 0.8 m in diameter and 0.45 m high) on a gently-sloping ridge, with two rectangular stone enclosures which probably are temporary garden houses. Areal excavations in each shelter revealed several scoop hearths and limited amounts of shellfish which are interpreted as evidence of short-term, repeated occupation. Excavations through and around several of the stone mounds revealed that crops were planted in small soil pockets immediately adjacent to the mounds, and that the stone heaps themselves served as moisture retention devices. If *Lagenaria* gourds were one of the crops grown at this site, the stone mounds would also have provided vine supports.

Another dryland agricultural complex, unique within the entire study area, is shown in Figure 6. Superficially, this set of 14 stone-faced, earth-filled terraces resembles an irrigated pondfield system, yet there is no possible source of irrigation water. Rather, on the basis of our excavated data, it appears that seasonal sheet runoff down the slope was directed so as to accumulate silt behind the stone-faced

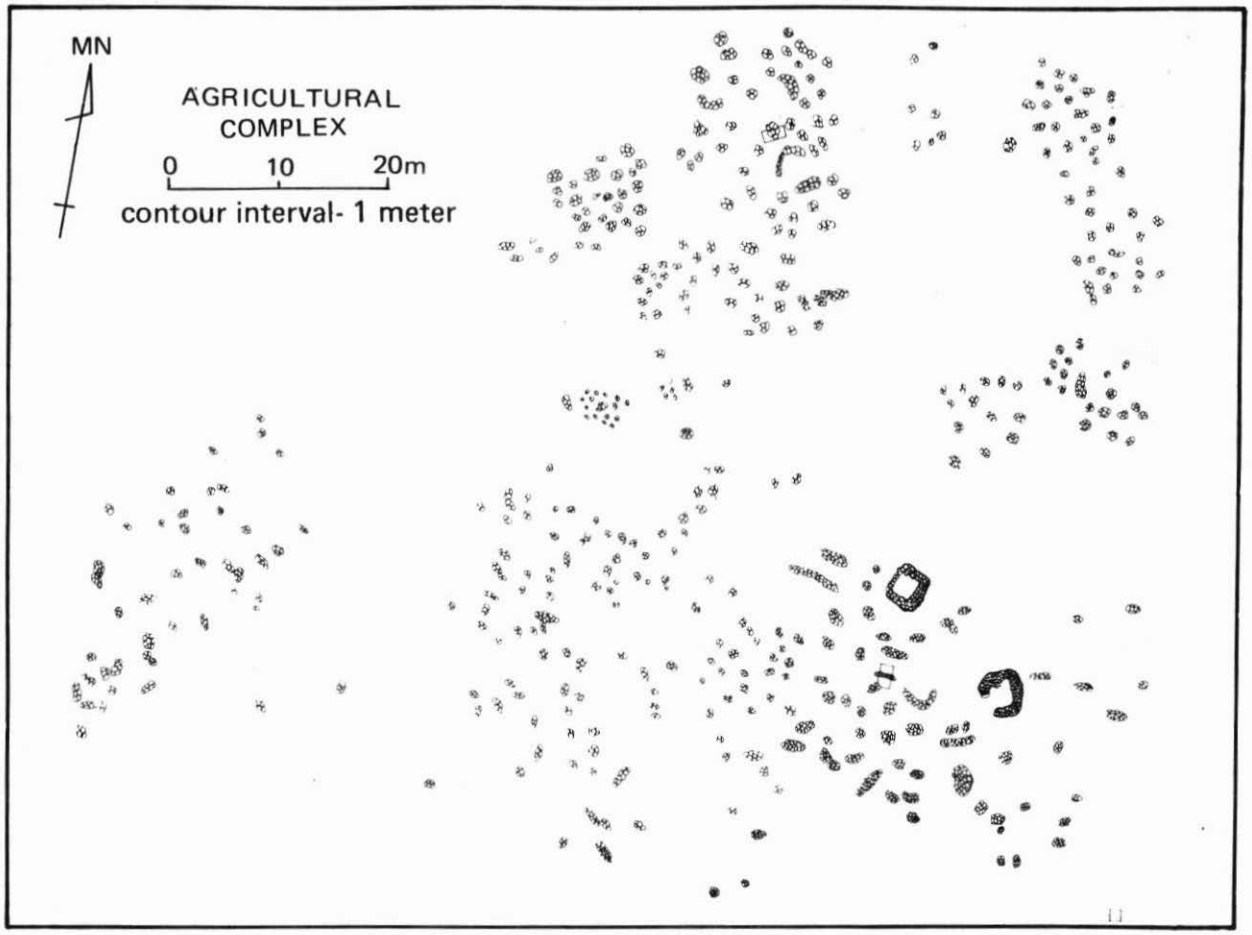

Figure 5: A dryland agricultural complex consisting of numerous stone mounds and several stone-faced earthen terraces surounding two rectangular enclosures or field shelters.

catchment walls. This silt, enriched with ash from burning of the local vegetation, would have provided an excellent planting medium, assuming that adequate seasonal rainfall was available.

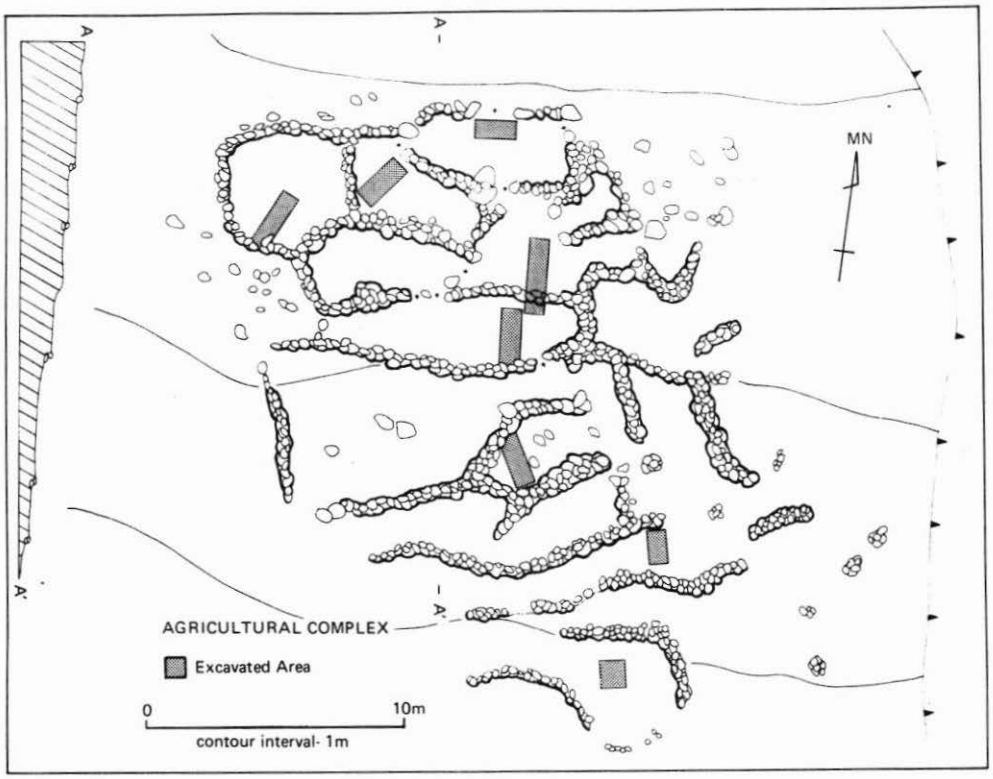

Figure 6: Superficially resembling an irrigated pondfield system, this upland agricultural complex (elevation 113 m) probably utilised seasonal sheet runoff for crop production.

Aside from these dryland agricultural complexes, there is evidence of minor horticultural activities integrated into some of the residential complexes, such as stone mounds interspersed with terraces.

Of equal if not greater significance to the total scheme of production within Kawela and Makakupaia Iki *ahupua'a* were several large fishponds used for the husbandry of mullet (*Mugil cephalis*), milkfish (*Chanos chanos*), and other species. The development of these large ponds, and of the set of aquacultural techniques associated with them, was one of the remarkable achievements of late Hawaiian prehistory (Kikuchi 1976; Summers 1964). The southern Moloka'i Island coastline is particularly noted for its extensive fishponds, constructed and operated under the aegis of the chiefly class. Five ponds lie within our study area, the largest of which is Kanoa Pond (Fig. 3). Four of these ponds consist of arc-shaped walls built of basalt and coral boulders and cobbles out on to the shallow reef flat (a type known locally as *loko kuapa*. Kakahaia Pond is separated from the sea by a sand ridge or beach accretion barrier (the *pu'uone* type). Geomorphological and stratigraphic

studies by Weisler (1983) suggest that Kakahaia Pond was originally a *loko kuapa*, with a stone wall connecting two protruding points along the shoreline. The stone wall is presumably now buried under the sandy accretion barrier.

Kikuchi (1976) estimates that Hawaiian fishponds produced annual yields of between 300-500 pounds of fish per acre (335-560 kg/ha.). With the total fishpond area within Kawela and Makakupaia Iki totalling about 96 acres (38.8 ha.), the total annual production of fish ranged from 28,000 to 48,000 pounds (12,704-21,778 kg) per year. Significantly, such aquacultural production was controlled by the chiefly class, and is an example of the intensification of production deployed in the service of the larger political economy of the Hawaiian chieftainship (Kirch 1984).

RESIDENTIAL FEATURES AND COMPLEXES

As we have noted, the direct continuity between late prehistory and ethnohistory in Polynesia provides excellent opportunities for the use of ethnohistoric models in the analysis and interpretation of settlement patterns. Native Hawaiian writers of the nineteenth century described the paradigmatic residential complex (*kauhale*) as a cluster of separate houses and shelters, each structure restricted to certain household members and used for specific functions (Malo 1951; Kamakau 1964; Handy and Pukui 1958). Such a "model" household centred on a men's house (*hale mua* or *mua*) where rituals were performed, men ate, and the daily offering of narcotic *'awa* root (*Piper methysticum*) was presented to the gods; women were restricted from entering the *mua* and had a separate eating house (*hale 'aina*). While the men's house was one of the larger structures in the complex, other smaller thatched shelters included a *hale kua* for women to beat barkcloth in, *hale kahumu* or cookhouse, *hale papa'a* for crop storage, and *hale pe'a* or menstrual hut somewhat isolated from the main complex. Depending upon the status and occupational specialisation of the household, the residential complex might also include a separate temple (*heiau*) and a canoe shed (*halau*) if the principal males were engaged in fishing. From the ethnohistoric record, we can therefore project an archaeological model consisting of a cluster of structural foundations of various sizes and with material remains (both artefacts and faunal materials) reflecting diverse functions. The range of variation in this ethnohistoric model, however, requires archaeological testing.

The distribution of residential complexes at Kawela and Makakupaia Iki is essentially linear and parallels the coast, with a significant inland "bulge" in the area of Kawela Gulch (Fig. 4). Residential complexes are almost invariably situated atop ridges overlooking the coastal plain or gulch bottom, and exposed to the cooling tradewinds. Structure foundations are often built atop or incorporate stable bedrock outcrops while reserving soil areas for agricultural activity.

The typical residential complex is a spatial aggregate of structural features reflecting different activities. Table 3 lists selected attributes for 10 excavated residential complexes. The central focus of such a complex is one or more primary residential features, usually the largest structures, with a substantial stacked-boulder wall oriented north-south and thus perpendicular to the prevailing tradewinds, with a level, rubble-free soil area to leeward. Figure 7 illustrates such a residential complex with six structural features. In this example, the primary residential feature is an L-shaped structure opening on to a level soil area bounded on the downslope side by a single alignment of boulders. Other function-specific features surrounding the primary residence include a cookhouse, stone-tool production area, and agricultural modifications situated to the east of the dwelling area.

TABLE 3
ATTRIBUTES OF MAJOR RESIDENTIAL COMPLEXES

Attributes	Complex									
	A	B	C	D	E	F	G	H	I	J
Surface Collected & Excavated (m^2)	25.0	3.5	4.3	4.6	6.4	44.3	6.1	45.0	9.9	7.8
No.of Features	6	4	6	6	3	6	8	21	7	32
Primary Residence										
Cupboard	–	–	–	–	–	–	X	X	–	–
Hearth	X	–	–	X	–	–	–	X	X	–
Upright	–	–	–	X	–	X	–	–	–	–
Area (m^2)	60.5	–	12.3	7.5	15.9	9.8	24.0	77.5	51.0	38.4
Religious Feature										
Upright	–	–	–	X	–	X	–	X	X	X
Separate Feature	–	–	–	–	–	–	X	X	X	X
Absent	X	X	X	–	X	–	–	–	–	–
Burial Platform	–	–	–	–	–	–	–	X	–	X
Agricultural Feature	X	–	–	–	–	X	–	X	–	–
Cook-house	X	–	–	–	X	X	X	–	–	–
Bone										
Pig	–	–	–	–	–	X	–	X	X	X
Dog	–	–	–	–	–	X	–	X	–	–
Lithic Craft Area	–	–	–	X	–	X	X	X	X	X
Non-local Lithic Material	–	–	–	X	–	X	–	X	X	X
Grinding Slab	–	–	X	X	–	X	–	–	X	X

Primary residential features are sometimes internally divided into two or three terraces, with differential distributions of shellfish and bone midden, stone tools, basalt and volcanic glass flakes, grinding slabs, and stone-lined hearths. Figure 8 illustrates a primary residential feature probably occupied by a higher-ranking household. Differential use of space is suggested by the concentration of artefacts and food remains immediately leeward of the wall, and within the 20 cm subsurface contour. A basalt flaking area is marked by an alignment of three flat basalt boulders, perpendicular to the centre of the wall, where basalt debitage was concentrated.

Within a residential complex, the primary residential feature is surrounded by a variety of smaller, less formal shelters, often in the shape of C's, J's, or L's, or simply low, short wall sections. Excavated assemblages indicate that such ancillary structures were used for a variety of tasks, including food and tool storage, cooking and food preparation, and specialised craft activities (Fig.7). Figure 9 illustrates such a residential complex with ancillary structures lying to the east of the primary residential feature.

Residential complexes often incorporate a sacred or ritual component in the form of a residential shrine. Invariably, the ritual area lies east of the primary residential feature. Such domestic shrines vary from simple upright stones (probably representing *'aumakua* or family deities), to more formal walled enclosures and circular shelters. In the northeast corner of the primary residence illustrated in Figure 7 is an upright stone, while Figure 10 illustrates a formal, high-walled enclosure detached from the primary residence.

The survey and excavation data from Kawela and Makakupaia Iki allow us to define a late prehistoric residential complex minimally as incorporating: (1) a primary residence, usually the largest structure of the complex, and often including

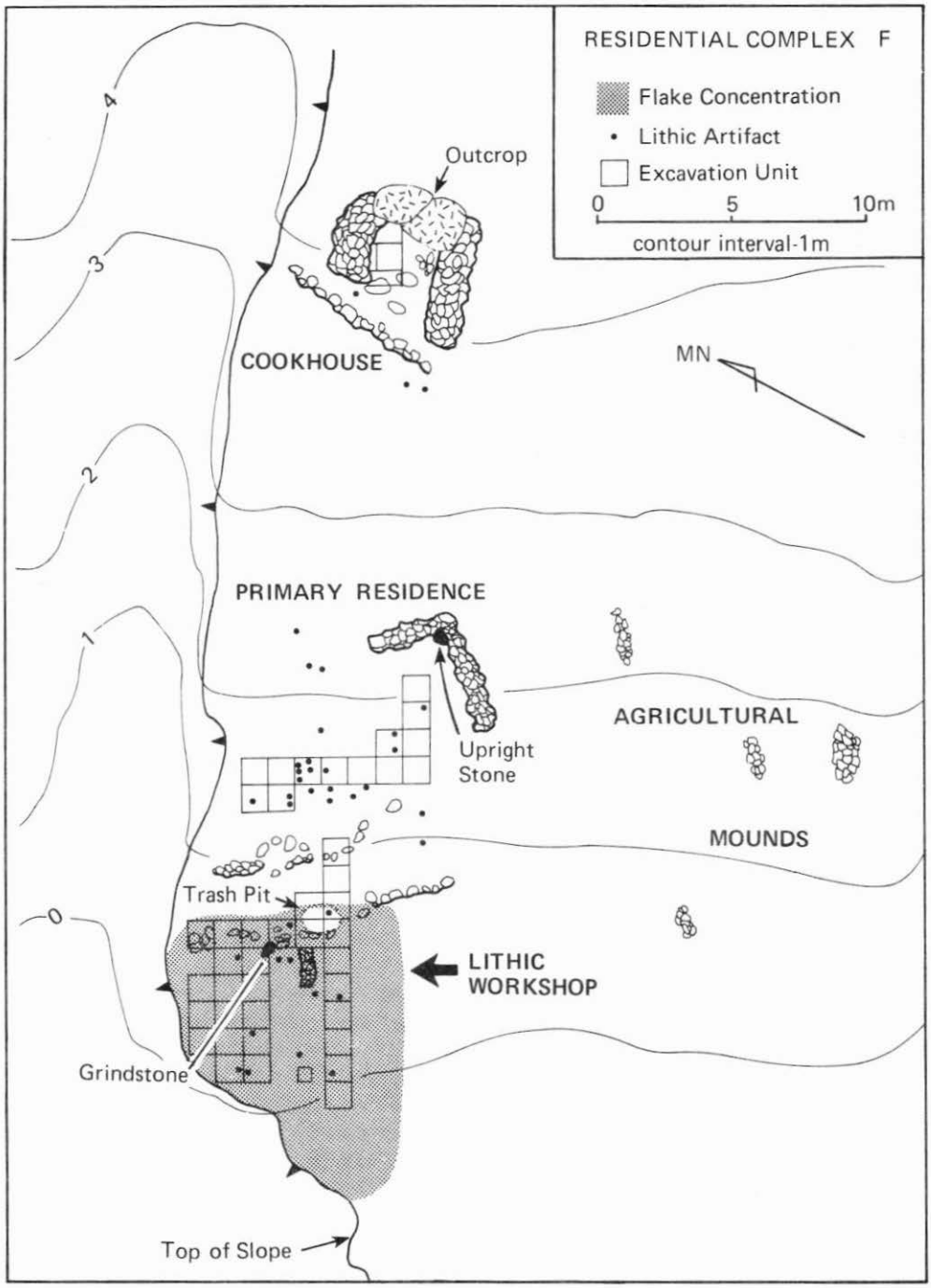

Figure 7: A relatively small residential complex presumably occupied by a lithic craftsman. Note the discrete activity areas centered around the primary residence.

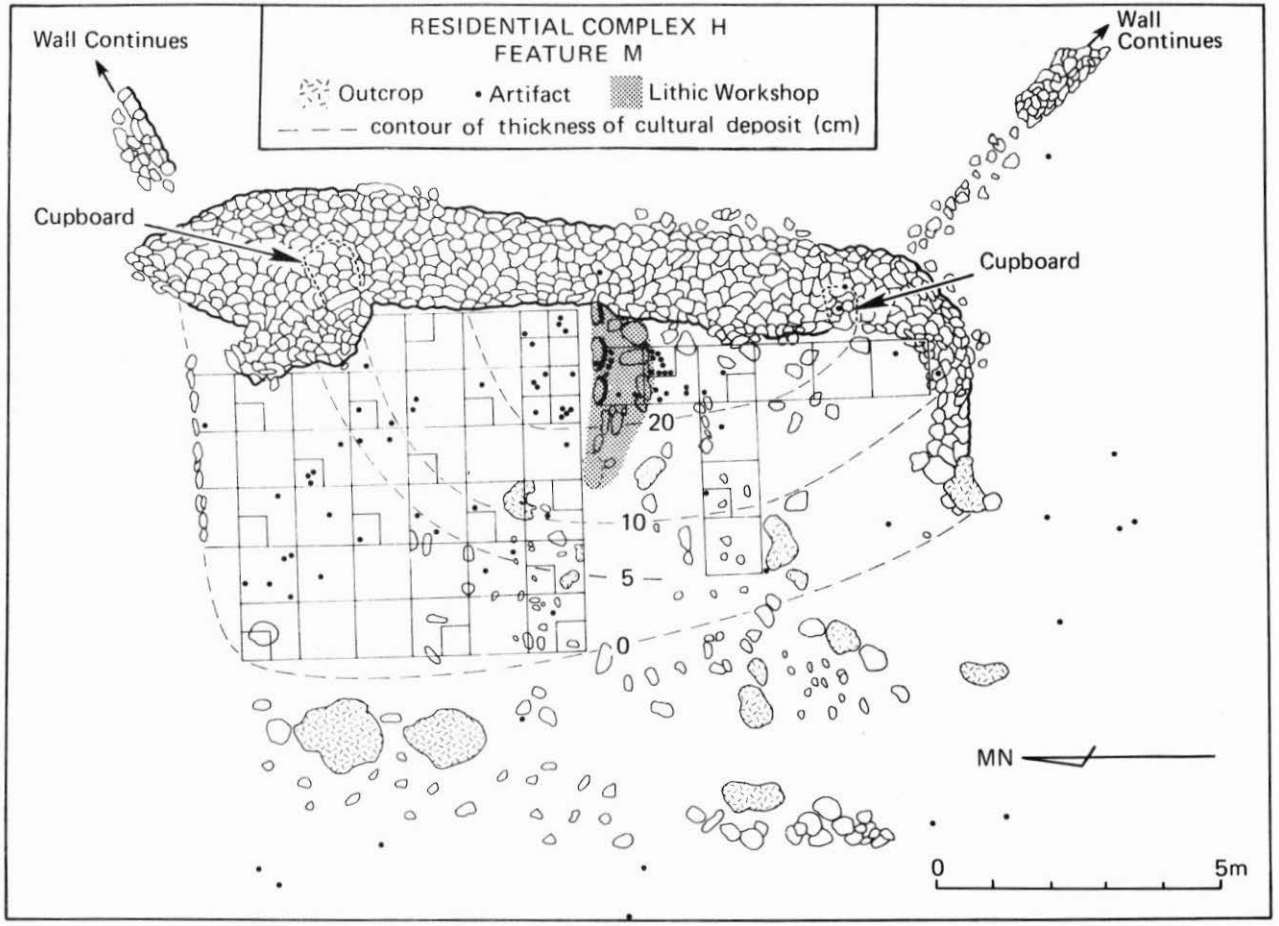

Figure 8: Areal excavation plan of a primary residence probably occupied by a high status household. Note the differential distribution of cultural materials with the maximum depth of cultural deposit immdiately inside the windward wall.

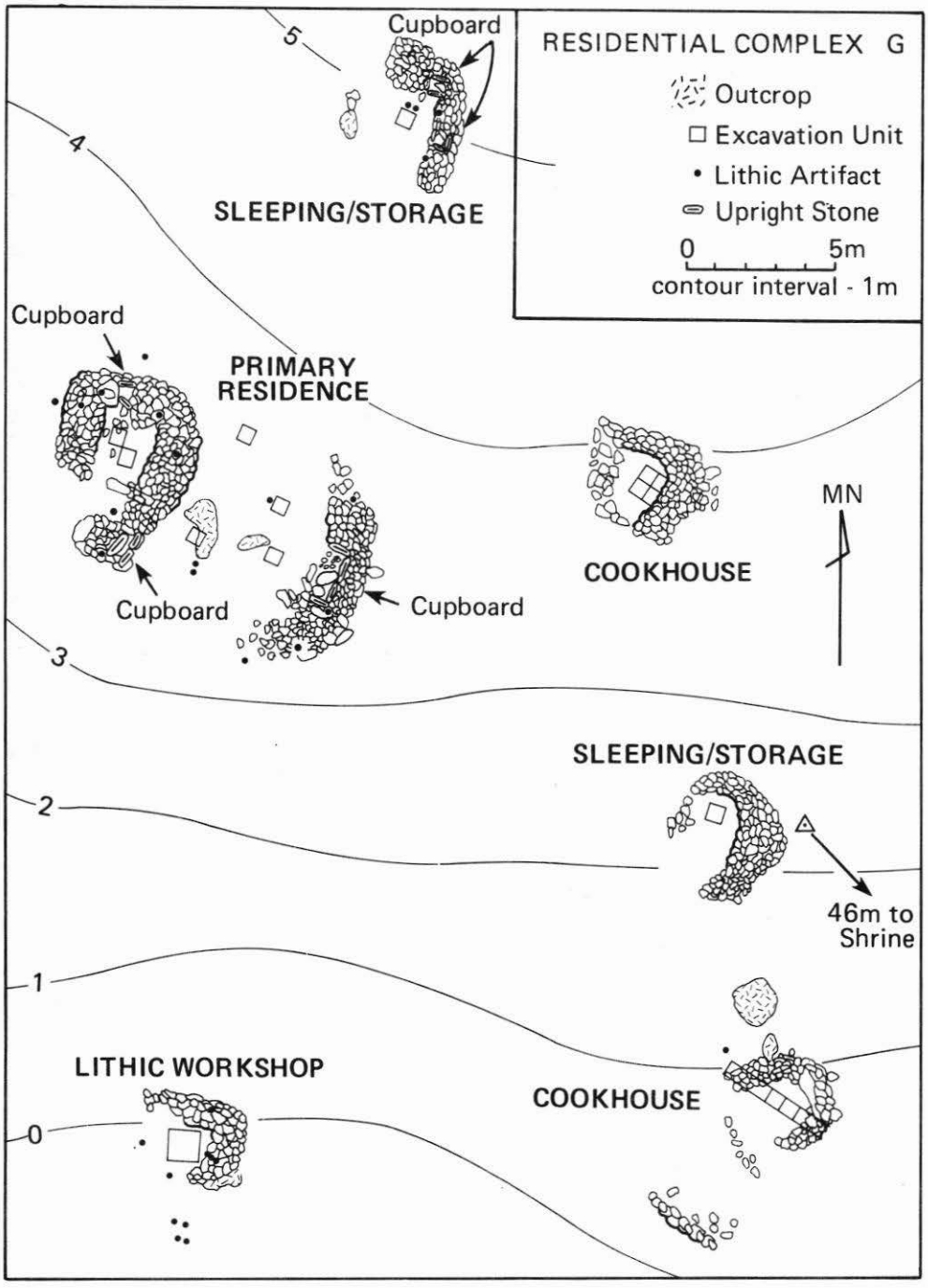

Figure 9: A residential complex consisting of a compound primary residential feature surrounded by five smaller, less formal shelters. A circular enclosure with an altar, upright god-stone, and branch coral offerings is located 46 m southeast.

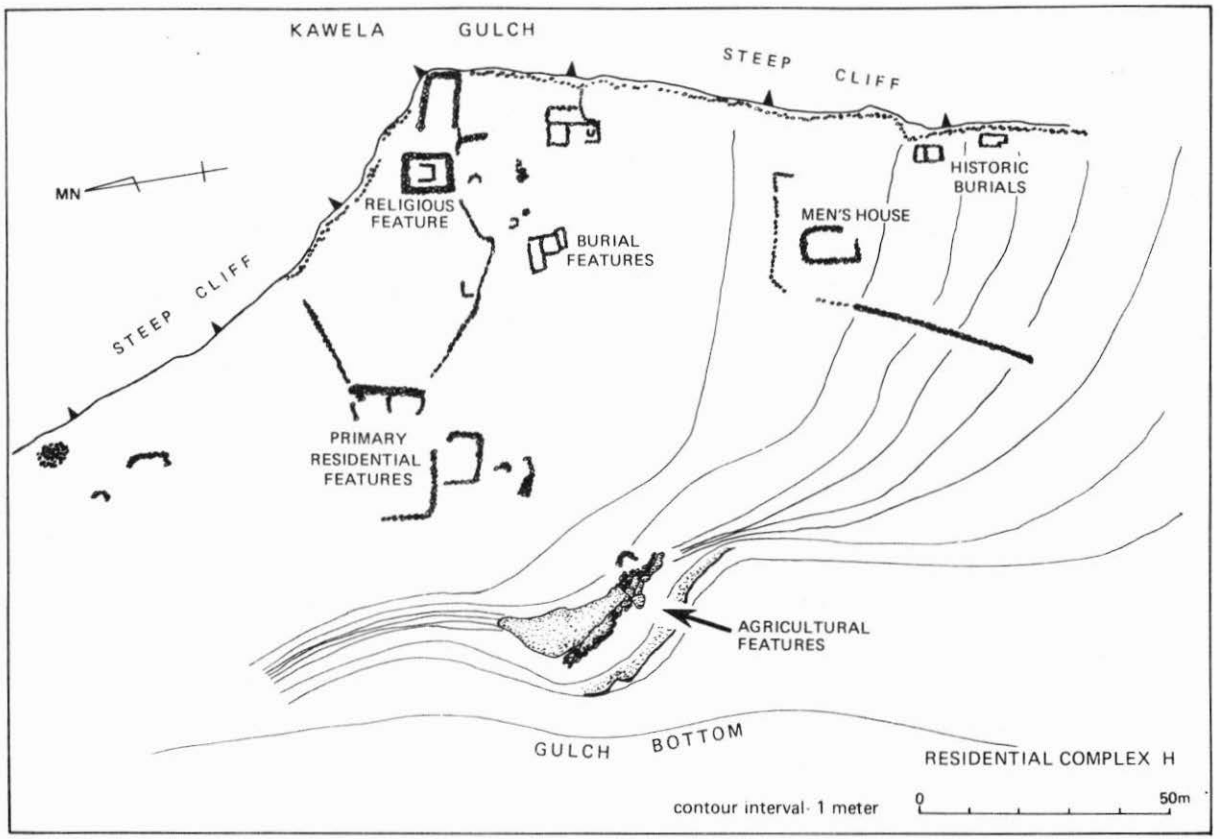

Figure 10: One of the largest residential complexes in the study area, this residence was probably occupied by a high status household. A formal, high-walled, enclosed temple (*heiau*) is located east of the primary residential features and these two areas appear to be "joined" by a low wall.

such architectural components as upright stones, a slab-lined hearth, and storage cupboards; (2) several smaller, ancillary shelters or short wall segments, one of which was used for cooking, others for craft activities or storage; and (3) minor horticultural features appearing as stone-faced earthen terraces and stone clearance mounds, or simply as soil areas cleared of stone.

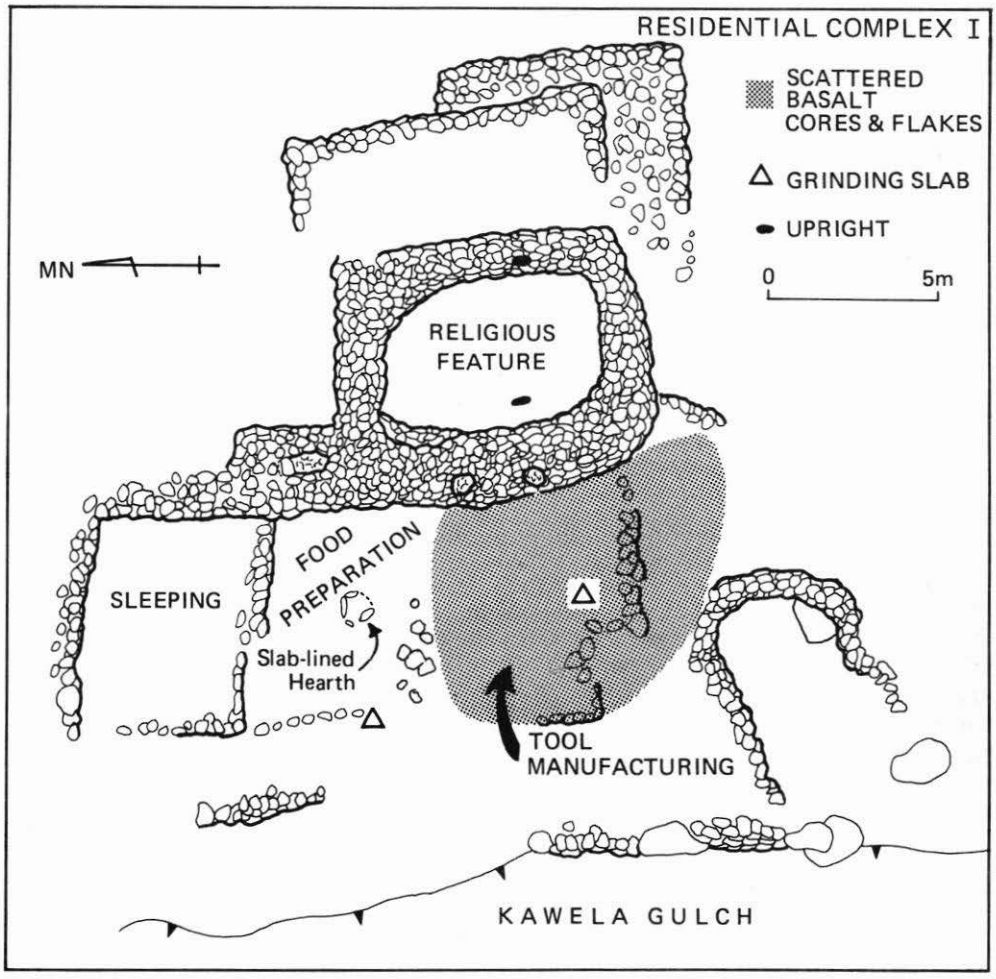

Figure 11: An architecturally impressive complex, this residence was probably occupied by a high status household. The activity areas are tightly clustered, yet spatially discrete. A men's house is located 23 m south. Note the degree of similarity in placement of discrete use-spaces with the residential complex illustrated in Figure 10.

A contrastive analysis of residential complexes within the study area also reveals significant distinctions which, we believe, reflect hierarchical differentiation in the rank or status of the households which occupied them. Two complexes, in particular, are interpreted as residences of prominent social groups, presumably households which centered around a lesser chief, or *konohiki*, the land manager of

a chief. These complexes are more extensive and architecturally complex than other residential sites in the study area (Figs. 10, 11). More importantly, only these two residential complexes incorporate rectangular, fully-enclosed and high-walled temples (*heiau*). It is also relevant to note that these two sites command prominent topographic settings, with views of the south Moloka'i coast and its fishponds, the agricultural lands of Kawela Gulch, and beyond to the islands of Lana'i, Maui, and Kaho'olawe.

Determining the relative status of households formerly occupying residential complexes is a problem that must be addressed using a diverse array of archaeological data. In our view, simple measures such as floor area (which Cordy (1981) argues is directly reflective of status) are in themselves insufficient criteria for the social interpretation of residential complexes. The Kawela and Makakupaia Iki data (see Table 3), however, indicate that status differences are reflected by sets of attributes such as: (1) the number of structural features in a residential complex; (2) the nature of the ritual feature, whether a formal structure separate from the primary residence, or a simple upright stone within the residence; (3) the presence of burial platforms; (4) high frequencies of pig and dog bone, both status foods according to the ethnohistoric record; (5) high density and range of formal artefacts (e.g. adzes, gaming stones, stone lamps, gourd stoppers, bone picks, tattoo needles); (6) presence of non-local lithic materials; (7) density of shellfish and other faunal remains; and (8) topographic setting. A contrastive analysis of the Kawela residential complexes using these criteria indicates that Complexes H and I were occupied by households of relatively higher status. Complex G (Fig. 9) exemplifies a household cluster of a relatively lower status group.

RELIGIOUS STRUCTURES

We have already described the religious or ritual structures that form integral components of residential complexes – usually single upright slabs, or small shelter-like circular enclosures associated with one or two upright stones, and lying east of the main residential feature. As noted, more architecturally substantial enclosed temples are associated with the two residential complexes of higher status households.

In addition to these domestic shrines and temples, two other classes of religious structure are distributed over the Kawela and Makakupaia Iki landscape, and are significant for their social and political implications. The first of these classes includes three examples, each situated just within the eastern boundaries of the respective *ahupua'a* of Kawela, Makakupaia Iki, and Makakupaia Nui. These are compound structures, with internal spatial differentiation, as seen in the plan of the Kawela structure (Fig. 12). This site consists of a large stone-filled terrace, bordered to the north and east by a substantial wall, and with a raised platform in the southwest corner. To the east of the main structure is an artificial pit, adjacent to which are large quantities of branch coral. On the basis of ethnohistoric data, this site, as well as the other two structures in this category, represents a former Hale-o-Lono, or temple dedicated to the primary deity of agriculture (Malo 1951; Kamakau 1964). These temples, under the authority of the *ahupua'a* chiefs, were the loci of the annual Makahiki tribute collections, presented to the paramount chief in the form of a *ho'okupu* or offering to the god Lono. The Hawaiian ethnohistorian Malo described this situation: "The *konohiki* [chief's land manager] was expected to have all the taxes of the district collected beforehand and deposited at the border of the *ahupuaa*, where was built an altar" (Malo 1951:146). The location of these three

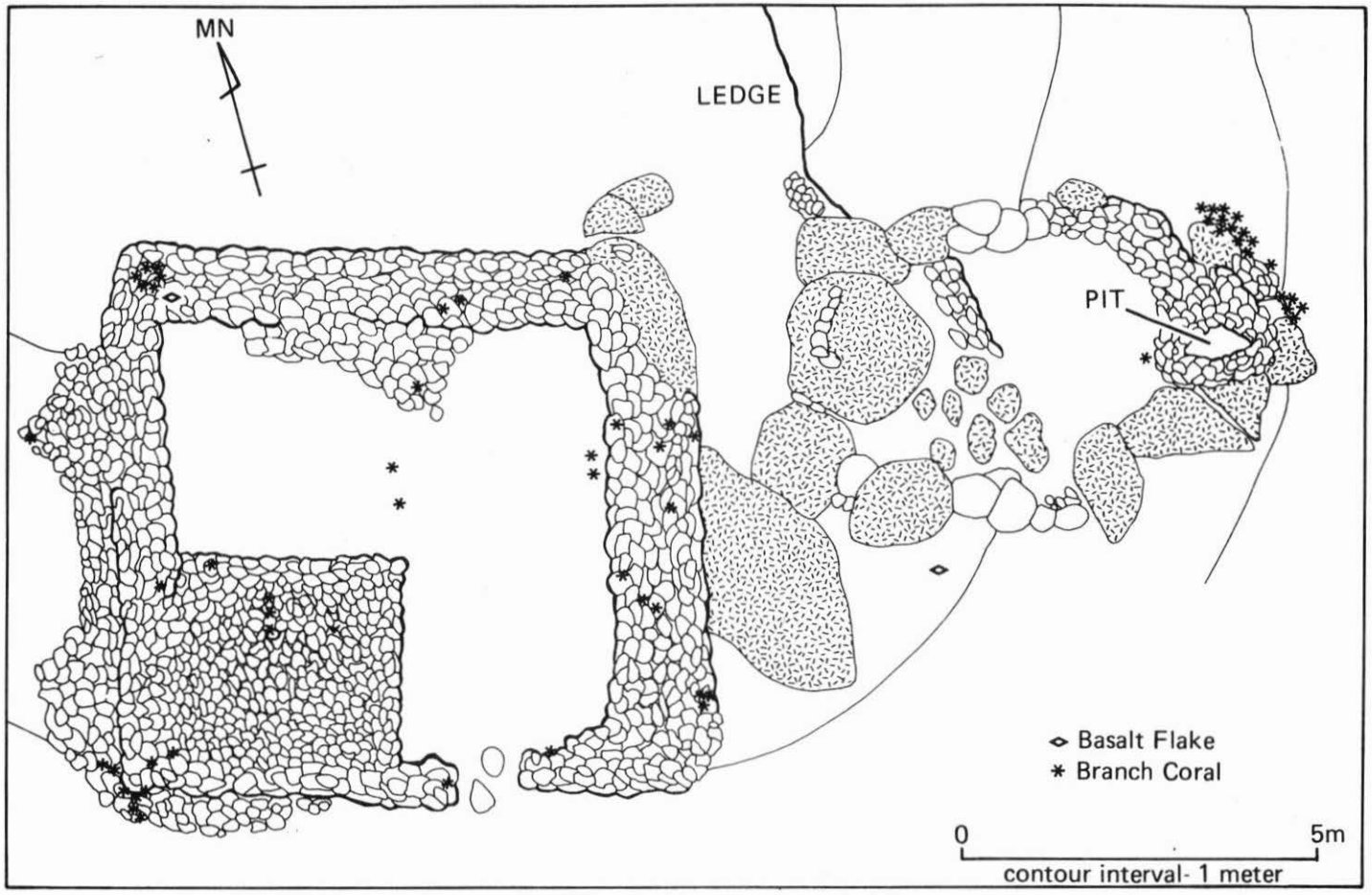

Figure 12: Plan map of Hale-o-Lono or temple located on the eastern boundary of Kawela *ahupua'a*. Note the large quantity of branch coral adjacent to (east of) the artificial pit.

study-area temples at the eastern borders of the *ahupua'a* is thus significant, for in traditional accounts of the Makahiki circuit, the Lono image first entered each territorial unit from the east.

The largest religious structure in Kawela is in a class of its own, as well as in a unique topographic setting. According to nineteenth-century ethnohistoric sources, this was a *pu'uhonua*, or place of refuge, situated atop a fortified ridge dividing east and west forks of the Kawela Gulch. The temple itself consists of a large dry stone masonry compound structure, the largest single construction in the study area. This structure reflects the integration of Kawela *ahupua'a* into a larger social and political network that extended even beyond leeward Moloka'i Island to encompass the central islands of the archipelago. By traditional accounts (Kamakau 1961:67-71), the *pu'uhonua* at Kawela was one of several refuges to which the people of leeward Moloka'i fled upon the invasion of their island by ruling chiefs from O'ahu, Maui, and Hawai'i Islands, events that occurred more than once in the late prehistoric to early historic era.

OTHER SETTLEMENT PATTERN COMPONENTS

In addition to the major economic, habitation, and ritual sites described above, a variety of other special purpose features are incorporated in the Kawela-Makakupaia Iki settlement pattern. Distributed throughout both *ahupua'a* are 32 rockshelters of varying sizes, some of which contain stratigraphic deposits indicative of at least temporary habitation (Fig. 4). Formed when previously higher stream levels scoured weakly consolidated a'a basalt flows, these shelters are generally wider than they are deep, and rarely exceed 2 m in ceiling height. Average floor area is 19.6 sq. m. While most rockshelters are not structurally modified, 12 have stone-faced earthen terraces that level and extend the natural floor area beyond the dripline. Basalt debitage and artefacts often litter these terraces and suggest that craftsmen took advantage of better lighting conditions in these otherwise dark and cramped shelters. Also evident are hearth areas delimited by charcoal concentrations; slab-lined hearths are rarely present in rockshelters. Dried bunchgrass concentrations, usually found at the rear of the shelters, probably mark sleeping areas. Although difficult to place within the larger social system at Kawela and Makakupaia Iki, these rockshelters have produced a wealth of organic remains not normally surviving on open sites, including a rare, two-piece canoe paddle (illustrated in Holmes 1981:60), barkcloth or *kapa*, fish net fragments, fire-ploughs and palaeo-floral remains (sugarcane, bamboo, gourd, *Pandanus, Cordyline*, and *Touchardia*). Identified from fragments of barkcloth was the fibre plant *Boehmeria grandis*, thought to be "a minor source of *tapa*" (Neal 1965:318). The use of *Boehmeria* for barkcloth had not been documented previously (E. Funk, University of Hawaii, pers.comm. 1982).

An aesthetic component of the settlement landscape, sometimes integrated with the residential complexes, are 11 petroglyph groups. These take many anthropomorphic forms as well as lines, small abraded surfaces, dogs, and one interesting group found in an agricultural complex which illustrates male and female figures in a single row with five rotating fishhooks under them.

Situated near the seaward edge of the broad alluvial plain and just west of Kawela Stream is a low sandy dune 15 m in diameter and 1.5 m high. Initial human use of the Kawela area, evidenced by deposits in this sand dune site, centred on the exploitation of coastal marine resources and birds, beginning about A.D. 1500. The well stratified dune deposit has a total depth of 2.35 m, and although artefact

frequencies are low, exhibits dense to light concentrations of fishbone, shellfish, crustacea, and birdbone in thin, dark layers associated with scoop hearths. The cultural content and depositional regime suggest that this coastal site was used intermittently by small fishing groups for short periods of time. Located about 1 m below the dune site surface is a 60 cm thick dark midden layer with dense concentrations of food remains, whose date of deposition correlates with the upland eighteenth century structural sites. Several cultural layers in the site also yielded faunal material of the endemic Hawaiian goose (*Nesochen sandvicensis*), extinct on Moloka'i Island during the historic period.

Human burials were encountered at Kawela in a variety of archaeological contexts, including: (1) sandy dune deposits situated along the base of the ridgelines and on the alluvial plain, with two examples; (2) platform and stone-filled terrace burials, both prehistoric and early historic, associated with residential complexes, 19 examples; and (3) one isolated cave burial of an adult male, found inland of the 125 m contour.

THE STRUCTURE OF SETTLEMENT SPACE

Moving beyond the descriptive analysis of the settlement landscape of Kawela and Makakupaia Iki, we now present some interpretations of the structural organisation of space in this late prehistoric Hawaiian society. To date, the majority of Polynesian settlement pattern studies have tended to treat spatial organisation on one or both of two levels: the ecological or environmental "determinants" of settlement, and the social or community patterns reflected in settlement layout (e.g. Bellwood 1979; Green *et al.* 1967; McCoy 1976). However, these are only two among a larger number of possible paradigms that may be of analytical value in assessing the structure of spatial use and organisation. In this discussion, we will consider the Kawela-Makakupaia Iki settlement patterns in light of four paradigms: (1) environmental; (2) social; (3) economic and political; and (4) semiotic. We stress that each of these paradigms offers alternative ways of looking at our data, and they are by no means mutually exclusive or competing.

South-central Moloka'i is typical of the more arid, leeward regions throughout the archipelago, and therefore poses several significant *constraints* which in turn have influenced the development of settlement patterns. Among these are low and seasonally uncertain rainfall (at the lower limit for Polynesian crop plants), variable and low streamflow even in the larger gulches, and poorly developed soils. On the other hand, the very broad reef flat which extends along the southern Moloka'i coast offered an environmental opportunity for the development of large fishponds. It is possible that the permanent settlement of the Kawela area—a late phenomenon in Hawaiian prehistory—was stimulated by the expansion of fishpond technology along the island's southern coast. Indeed, not only fishpond construction, but the larger settlement pattern as a whole, may have been politically motivated, under the aegis of ruling chiefs (Earle 1978; Kirch 1984).

At one scale, the distribution of settlement components in Kawela and Makakupaia Iki *ahupua'a* reflects the environmental constraints and opportunities mentioned above. Residential complexes are arrayed in a generally linear pattern, paralleling the coast with its productive ponds and reef-fishing resources, but with a significantly higher density of residential sites around the periphery of Kawela Gulch, the one area in which streamflow and soils were adequate for permanent agricultural production. Similarly, the agricultural systems themselves reflect

adaptation to the same environmental constraints, with the dominance of sweet potato cultivation on the alluvial floodplains, and minimal development of dryland cultivation on the upland slopes.

Environmental conditions influenced not only areal distribution patterns, but certain aspects of site architecture. The siting of residential complexes on ridge crests, for example, was certainly a response to local topography and for exposure to the cooling tradewinds. At the same time, the extensive use of windbreak walls in feature construction is clearly an adaptation to these same windy conditions. Thus, local architecture at Kawela and Makakupaia Iki contrasts significantly with patterns of site construction found in less exposed valley situations, such as Halawa (Kirch and Kelly 1975).

At one level, then, both areal site distribution patterns and aspects of site architecture may be interpreted as adaptive responses to particular environmental constraints and opportunities. Certain contrasts between the settlement patterns of Kawela, and those of windward valleys such as Halawa, or of less arid leeward slope regions such as Lapakahi (Rosendahl 1972), are amenable to explanation in these environmental terms. An environmental paradigm, however, is incapable of explaining the full range of variability in Hawaiian settlement patterns.

The basic principle that settlement patterns reflect the structure and organisation of *social groups* goes back to the beginnings of an explicit settlement pattern archaeology, although it has only been within the past several years that attention has focussed on the delineation and analysis of *household clusters* as one of the fundamental units in the social analysis of space. In Polynesia, household clusters or units have been explicitly discussed by McCoy (1976) for Easter Island, and by Jennings and Holmer (1980) for Samoa. (It is worth noting that the household cluster has also emerged as a significant analytical unit in other regions, such as Mesoamerica; cf. Flannery (1976); Rathje (1983); and Tourtellot (1983)). The settlement pattern data from Kawela and Makakupaia Iki have much to contribute to our understanding of late prehistoric Hawaiian household composition, a phenomenon typically treated in a normative fashion based on a few generalised ethnohistoric accounts (e.g. Malo 1951). A detailed architectural analysis of Kawela-Makakupaia Iki household clusters (residential complexes), combined with data on activity use obtained from extensive excavations, permit a consideration of the range of variation in late prehistoric Hawaiian household clusters, and of the possible *social* implications of such variation.

All residential complexes in our study area share certain invariant features or attributes, such as the presence of a primary residential feature surrounded by a (variable) number of smaller ancillary features. Implicit in this arrangement is a spatial separation of certain activities, in particular food preparation, craft activities, and ritual. These underlying structural similarities are consistent enough to pose little problem in the identification of a cluster of features as a residential complex. At the same time, there is an amazing degree of variation between such complexes, and even within, for example, the class of primary residences (more, for example, than is suggested in the recent monograph by Cordy (1981)).

As we have suggested, some of the variation in residential complexes is explicable on the basis of differential social status or rank, particularly the distinction between commoner (*maka'ainana*) and chiefly (*ali'i* and *konohiki*) classes of late prehistoric Hawaiian society. Thus, residential complexes H and I with their distinctly more elaborate architecture including enclosed temples, frequency of status food remains (e.g., dog and pig), and general material wealth are interpreted as the household

clusters of higher-ranking persons, very probably the local managerial elites (either the *konohiki* or *ali'i-'ai-ahupua'a*, or both). Other variable aspects of household clusters presumably reflect such factors as the size and age-sex composition of individual households, and presence of craft specialists.

To understand the structure of settlement space at Kawela and Makakupaia Iki, however, requires a consideration of economic and political, as well as social, factors. Protohistoric Hawaiian society had achieved a level of development virtually unique within Polynesia, in which overt political considerations strongly influenced social grouping, economic production, and territorial organisation (Sahlins 1958; Goldman 1970; Kirch 1984). For example, the ancestral and widespread Polynesian pattern of corporate descent groups which held land in common (often termed *kainanga*) had ceased to exist in Hawai'i at the time of European contact. Instead, land was held by the chiefly class (organised on the *ahupua'a* system), and was worked by the commoner or *maka'ainana* class. (The term *maka'ainana* is, in fact, the Hawaiian reflex for an older Proto-Polynesian term, **kainanga*, which was a land-holding corporate descent group.) At contact, with descent no longer a significant factor for validating rights to ancestral lands, population mobility had increased, and households were usually organised around senior males who had access to land *vis-a-vis* their relationship to a land-holding chief. For the commoners, extensive lateral kin networds came to be far more important than genealogical, lineal relationships.

The settlement pattern of Kawela and Makakupaia Iki *ahupua'a*, dating to the final one to two centuries prior to European contact, reflects these transformations of Hawaiian society and political organisation. Rather than agglomerations of households grouped on ancestral lands, and sharing a common religious facility which ritually validated land claims (as, for instance, with the Society Islands *marae*), we see a pattern of dispersed, independent households, each with its own ancestral (*'aumakua*) shrine. The overtly political organisation of territory is reflected in several ways. One of these is the siting of the household clusters of the higher ranking elites (residential complexes H and I) in the geographical core of Kawela *ahupua'a*, where they could easily dominate the local production system. The territorial organisation is also represented in the major *ahupua'a* temples which define the eastern borders of each land section, and which also reflect the annual tributary relationship of the *ahupua'a* chief to the ruling paramount of the chiefdom. The fortified *pu'uhonua* site also is indicative of the integration of Kawela into the larger, chiefdom-wide political system. Other aspects of the political control of production are reflected in the organisation of space, particularly in the close association of craft specialisation sites with the household clusters of the ranking elites.

We have now examined the organisation of settlement space at Kawela and Makakupaia Iki in terms of several paradigms, including environmental, social, and political. Each of these perspectives yields valid insights, while no single paradigm can explain completely the observed architectural and site distribution patterns. We turn now to a fourth paradigm, one which has been virtually ignored in archaeological studies of settlement pattern. This is a *semiotic* paradigm, in which an architectural and spatial-use system is viewed as a system of meaningful signs, reflecting a visual code analogous to the linguistic codes underlying verbal behaviour. This approach has been developed recently by Preziosi, who writes:

> ... every human society communicates architectonically. The component units of an architectonic code or system consist of contrastively-opposed formations in media addressed to visual perception. Distinctions or disjunctions in material formation are intended to cue culture-specific differences in meaning precisely analogous to other semiotic systems such as verbal language or bodily gesturing. (1979:1)

Mary Douglas, who similarly maintains that "the organization of thought and of social relations is imprinted on the landscape", has questioned how archaeologists, with only the "physical aspect" of space in evidence, can get at the symbolic order which underlay the physical patterns (1972:521), a question with which many prehistorians would concur. (It is interesting to observe, however, that a symbolic or ideological perspective is rapidly gaining the attention of Mesoamerican settlement-pattern archaeologists, cf. Vogt 1983.) The Kawela-Makakupaia Iki case, in which we are dealing with a set of physical remains which immediately pre-date or overlap the historic-contact period, is ideal for the coordinate use of ethnohistoric data on the symbolic ordering of space and archaeological evidence for consistently patterned spatial behaviour. Elsewhere in Polynesia, Prickett (1979; 1982) has shown that ethnohistoric data on Maori spatial symbolism is reflected in the archaeological patterning of house floors, and Kirch and Yen (1982:131) have documented activity patterns that correlate with ethnographically-attested Tikopia concepts of dwelling space (Firth 1936:76). In short, the direct historical continuity between late prehistory and ethnohistory renders Polynesia an ideal region in which to examine the role of symbolic systems in settlement patterns.

Although a full discussion of a semiotic paradigm for the analysis and interpretation of Hawaiian settlement patterns must be deferred to a later work, two examples will illustrate our point. The first concerns the spatial organisation of household clusters, which reflect not only *functional* differentiation of activities (e.g.,cooking, lithic tool production) but consistently structured spatial distinctions between activities which in turn reflect certain *cultural values*. Lawrence (1981), in his study of contemporary English and Australian domestic space, argues that space and activities are classified and demarcated according to such dichotomous distinctions as clean/dirty, front/back, day/night, and public/private. We believe that analogous oppositions were involved in the structuring of space and activity in Kawela and Makakupaia Iki household clusters, regardless of the social rank of the occupants. Among the distinctions which may have been culturally significant are those between male/female, front/back, and sacred/secular. For example, religious shrines in household clusters are invariably situated to the east of such activity areas as lithic workshops and food preparation areas. Similarly, food preparation was always removed from other activities. In at least one cluster, an outlying ancillary structure to the west of the main complex appears to be a *hale pe'a*, or hut for menstruating women. At residential complex H, low boundary walls appear to have served as visual cues separating areas of the complex reserved for persons of higher status (e.g., the walls connecting the primary residence to the walled temple).

A further example of the structuring of space according to a semiotic code concerns an east/west distinction. Polynesian and Hawaiian ethnohistory is replete with suggestions as to the significance of the opposition between these cardinal directions, such as:

east: west
sacred: profane
male: female.

Handy, for instance, stated that the Polynesians "distinguished locally and geographically the east from the west, and the left from the right side of man, and associated the two in their dualistic philosophy" (1927:36). We have already observed that within household clusters, religious shrines are invariably east of the secular activity areas. In the two major residential complexes associated with high-status persons (Complexes H and I), the walled temples are located directly east of the primary residential structures. Within the Complex I walled temple, two upright "god stones" form an alignment only one degree from the true east-west axis. Further, at the major temple complex which we have interpreted as a Hale-o-Lono (Fig.12), the offering pit with branch coral lies immediately east of the main temple platform. This site, and its equivalents in Makakupaia Iki and Makakupaia Nui *ahupua'a* lie directly within the eastern borders of their respective land units. We believe that these instances are not unrelated or random phenomena, but reflect one aspect of late prehistoric Hawaiian concepts of the social and natural world, including a "proper" scheme of spatial structure. Naturally, these preliminary interpretations should be tested on archaeological settlement pattern data from other areas in Hawai'i, but they promise a new and exciting analytical viewpoint for the study of Polynesian settlement patterns.

CONCLUSION

The settlement landscape of Kawela and Makakupaia Iki *ahupua'a* offers an unparalleled opportunity to address the nature of spatial use and organisation in late prehistoric Hawai'i, the most socio-politically complex of all Polynesian societies. The large study area, size and quality of the survey and excavation data bases, contemporaneity of features, and excellent preservation of materials all contribute to the potential of the Kawela-Makakupaia Iki area. In this summary report, we have discussed the structure of settlement space, first, in descriptive terms, and second, in terms of four complementary paradigms. Environmental, social, political, and semiotic factors have all played roles in the structuring of space and associated activities, and each of these viewpoints is necessary in a holistic interpretation of settlement pattern. Although social considerations have always played a role in Polynesian settlement pattern studies, we detect a tendency in much of the settlement pattern archaeology conducted in Hawai'i and elsewhere in Polynesia, to emphasise environmental "determinants" of spatial organisation, and to view settlement patterns as one aspect of human adaptation to environmental conditions. While we clearly do not reject such functionalist viewpoints, we argue that an environmental/adaptive perspective is in itself too limiting. Polynesian societies appropriated aspects of the their natural environments—indeed whole landscapes—and transformed these into cultural landscapes organised according to culturally prescribed value systems. The creative, cultural role of human actors in structuring the use of space cannot be lost sight of in settlement pattern archaeology.

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REFERENCES

Bellwood, P. 1979. Settlement patterns *In* Jennings, J. (Ed.), *The Prehistory of Polynesia*: 308-322. Harvard University Press, Cambridge.

Chinen, J.J. 1958. *The Great Mahele: Hawaii's Land Division of 1848*. University of Hawaii Press, Honolulu.

Cline, M.G. *et al.* 1955. *Soil Survey of the Territory of Hawaii*. U.S. Department of Agriculture Soil Survey Series 1939, No. 25. Washington.

Cordy, R. 1981. *A Study of Prehistoric Social Change: The Development of Complex Societies in the Hawaiian Islands*. Academic Press, New York.

Douglas, M. 1972. Symbolic orders in the use of domestic space. *In* Ucko, P., R. Tringham, and S. Dimbleby (Eds.), *Man, Settlement, and Urbanism*: 513-21. Duckworth, London.

Earle, T. 1978. Economic and social organization of a complex chiefdom: the Halele'a District, Kaua'i, Hawai'i. *Anthropological Papers of the Museum of Anthropology, University of Michigan* 63. Ann Arbor.

Euler, R.C. and G.J. Gumerman (Eds.). 1978. *Investigations of the Southwestern Anthropological Research Group*. Museum of Northern Arizona, Flagstaff.

Firth, R. 1936. *We, The Tikopia*. Allen and Unwin, London.

Flannery, K. (Ed.). 1976. *The Early Mesoamerican Village*. Academic Press, New York.

Goldman, I. 1970. *Ancient Polynesian Society*. University of Chicago Press, Chicago.

Green, R.C. 1980. Makaha before 1880 A.D. *Pacific Anthropological Records* 31. B.P. Bishop Museum, Honolulu.

Green, R.C., K. Green, R. Rappaport, A. Rappaport, and J. Davidson. 1967. Archeology on the island of Mo'orea, French Polynesia. *Anthropological Papers of the American Museum of Natural History* 51(2). New York.

Handy, E.S.C. 1927. Polynesian religion. *Bernice P. Bishop Museum Bulletin* 34. Honolulu.

Handy, E.S.C. and E.G. Handy. 1972. Native planters in old Hawaii: Their life, lore, and environment. *Bernice P. Bishop Museum Bulletin* 233. Honolulu.

Handy, E.S.C. and M.K. Pukui. 1958. *The Polynesian Family System in Ka'u, Hawai'i*. The Polynesian Society, Wellington.

Holmes, T. 1981. *The Hawaiian Canoe*. Editions Limited, Hanalei, Hawaii.

Jennings, J. and R. Holmer. 1980. Archaeological excavations in Western Samoa. *Pacific Anthropological Records* 32. Bernice P. Bishop Museum, Honolulu.

Kamakau, S.M. 1961. *Ruling Chiefs of Hawaii*. Kamehameha Schools Press, Honolulu.

Kamakau, S.M. 1964. *Ka Po'e Kahiko: The People of Old*. B.P. Bishop Museum Special Publication 51. Honolulu.

Kikuchi, W.K. 1973. Hawaiian aquacultural system. Ph.D. Dissertation, University of Arizona.

Kikuchi, W.K. 1976. Prehistoric Hawaiian fishponds. *Science* 193:295-99.

Kirch, P.V. 1984. *The Evolution of the Polynesian Chiefdoms*. Cambridge University Press, Cambridge.

Kirch, P.V., and M. Kelly (Eds.). 1975. Prehistory and human ecology in a windward Hawaiian valley: Halawa Valley, Molokai. *Pacific Anthropological Records* 24. B.P. Bishop Museum, Honolulu.

Kirch, P.V. and D.E. Yen. 1982. Tikopia: prehistory and ecology of a Polynesian Outlier. *Bernice P. Bishop Museum Bulletin* 238. Honolulu.

Lawrence, R.J. 1981. The social classification of domestic space. *Anthropos* 76:649-64.

Lindgren, W. 1903. Water resources of Molokai, Hawaiian Islands. *Water Supply and Irrigation Paper* 77. Government Printer, Washington D.C.

Malo, D. 1951. *Hawaiian Antiquities*. Bernice P. Bishop Museum Special Publication 2. Honolulu.

McCoy, P.C. 1976. *Easter Island Settlement Patterns in the Late Prehistoric and Protohistoric Periods*. International Fund for Monuments, New York.

McEldowney, H. ms. Vegetation survey of Kawela and Makakupaia, Molokai. Ms. on file, Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

Neal, M.C. 1965. *In Gardens of Hawaii*. Bernice P. Bishop Museum Special Publication 50. Honolulu.

Nie, N., C. Hull, J. Jenkins, K. Steinbrenner, and D. Bent. 1975. *SPSS: Statistical Package for the Social Sciences*. McGraw-Hill, New York.

Preziosi, D. 1979. *The Semiotics of the Built Environment: An Introduction to Architectonic Analysis*. Indiana University Press, Bloomington.

Prickett, N. 1979. Prehistoric occupation in the Moikau Valley, Palliser Bay. *In* Leach, B. and H. Leach (Eds.), *Prehistoric Man in Palliser Bay*: 29-47. National Museum of New Zealand Bulletin 21, Wellington.

Prickett, N. 1982. An archaeologists' guide to the Maori dwelling. *New Zealand Journal of Archaeology* 4:111-47.

Rathje, W. 1983. To the salt of the earth: some comments on household archaeology among the Maya. *In* Vogt, E. and R. Leventhal (Eds.), *Prehistoric Settlement Patterns*: 23-34. University of New Mexico Press.

Rosendahl, P.H. 1972. Aboriginal agriculture and residence patterns in upland Lapakahi, Island of Hawaii. Ph.D. Dissertation, University of Hawaii.

Sahlins, M. 1958. *Social Stratification in Polynesia*. American Ethnological Society, Seattle.

Stearns, H.T. and G.A. MacDonald. 1947. Geology and groundwater resources of Molokai, Hawaii. *Hawaii Division of Hydrography Bulletin* 11. Honolulu.

Summers, C. 1964. *Hawaiian Achaeology: Fishponds*. Bernice P. Bishop Museum Special Publication 52. Honolulu.

Taliaferro, W.J. 1959. *Rainfall of the Hawaiian Islands*. Prepared for the Hawaii Water Authority, Honolulu.

Tourtellot, G. 1983. An assessment of classic Maya household composition. *In* Vogt, E. and R. Leventhal (Eds.), *Pehistoric Settlement Patterns*: 35-54. University of New Mexico Press, Albuquerque.

Tuggle, H.D. and P.B. Griffin (Eds.). 1973. Lapakai, Hawaii: archaeological studies. *Asian and Pacific Archaeology Series* 5. Social Science Research Institute, University of Hawaii, Honolulu.

Vogt, E.Z. 1983. Some new themes in settlement pattern research. *In* Vogt, E. and R. Leventhal (Eds), *Prehistoric Settlement Patterns*. University of New Mexico Press, Albuquerque.

Weisler, M. 1983. An archaeological survey and geomorphological reconstructions of the Kakahai'a National Wildlife Refuge, Kawela, Molokai, Hawaiian Islands. Ms. on file, Department of Anthropology, Bernice P.Bishop Museum. Honolulu.

Yen, D.E. 1974. The sweet potato and Oceania. *Bernice P.Bishop Museum Bulletin* 236. Honolulu.

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