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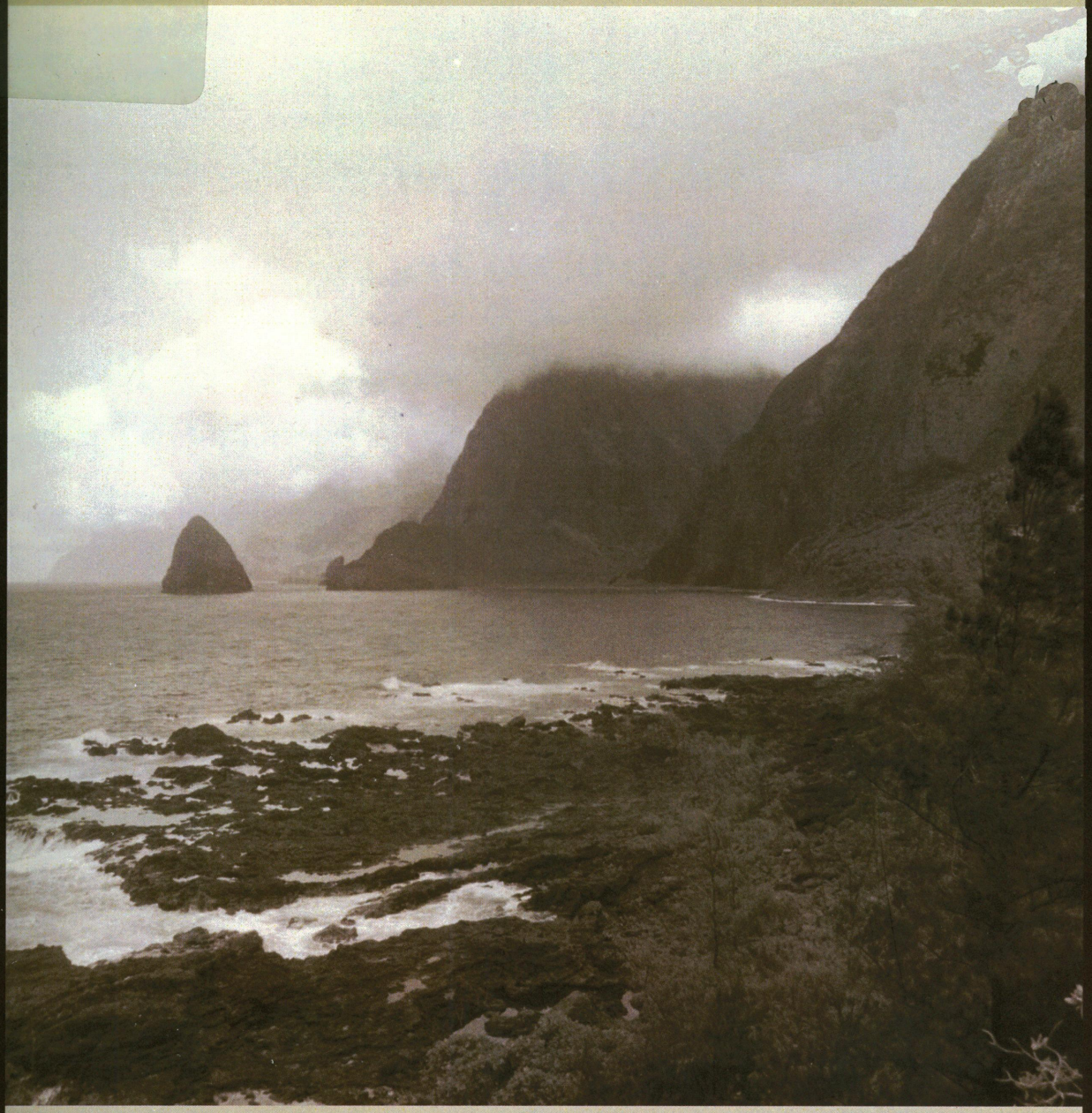
From the 'Cliffs of Keōlewa' to the 'Sea of Papaloa'

An Archaeological Reconnaissance of Portions of the Kalaupapa National Historical Park, Moloka'i, Hawaiian Islands



Patrick V. Kirch

The 2000 archaeology field team at the venerable Quonset hut, Kalaupapa. Left to right: James Coil, Sharyn O'Day, Solomon Kailihiwa, Sidsel Millerstrom, Patrick V. Kirch; not present, John Holson, Kathy Kawelu.

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An Archaeological Reconnaissance of Portions of the Kalaupapa National Historical Park, Moloka'i, Hawaiian Islands

Patrick V. Kirch

With the Collaboration of
James Coil, Lisa Holm, John Holson, Solomon Kailihiwa,
Kathy Kawelu, Sidsel Millerstrom, and Sharyn O'Day

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DEDICATED TO THE MEMORY OF
JOHN F. G. STOKES
AND
CATHERINE C. SUMMERS
WHO INDEPENDENTLY LAID THE
GROUNDWORK FOR
MOLOKA'I ARCHAEOLOGY

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PREFACE

Kalaupapa certainly ranks as one of the more elusive localities for archaeological—or that matter, for any scientific—studies within the Hawaiian archipelago. Not that the place is forgotten, or obscure; far from it, Kalaupapa is one of the most famous localities in the islands. Established in 1865-66 as a place of banishment, and later a treatment center for those suffering from leprosy, or Hansen's disease, Kalaupapa occupies a unique niche in the annals of Hawaiian history. This rugged peninsula, jutting out into the Pacific swells and cut off from the rest of Moloka'i by formidable cliffs rising thousands of feet, has become known largely as a landscape of suffering. The thousands of historic grave sites, marked and unmarked, that line the narrow road from the small airstrip to the settlement, cannot but impress the first-time visitor. Most famous for his suffering, of course, was Father Damien, now not merely beatified by the Catholic Church but—questionably to his greater glory—subject of a recent motion picture.

The elusiveness of Kalaupapa derives as much from its peculiar history as a place of containment and isolation for those afflicted by this once dreaded and formerly untreatable disease, as from its corollary, that visitors have been carefully restricted and monitored; indeed, they still are. Once controlled tightly by the Kingdom's and later the Territory's Board of Health, the County of Kalawao (which forms its own jurisdiction separate from Maui County) is currently administered by a delicate balance of authorities, including the State of Hawai'i (Department of Health, and Department of Hawaiian Home Lands), U. S. Coast Guard, and the U. S. National Park Service. New patients have not been admitted to the settlement since 1969, and plans call for the area to be gradually turned over to full control by the National Park Service. Kalawao County (and the Kalaupapa National Historic Park, KNHP) includes not only the peninsula itself (with the three *ahupua'a* of Kalawao, Makanalua, and Kalaupapa, from east to west), but also the large windward valley of Waikolu, and the smaller valleys of Wai'ale'ia and Waihānau, along with the isolated landshelf of Nihoa to the west.

I had gazed down upon the peninsula from the overlook at Pu'u Lua many times (the first, if I recall correctly, in 1959), and had even set down once or twice in small planes on the landing strip, but had never enjoyed the opportunity to explore Kalaupapa until 1993, when Earle ("Buddy") Neller, then residing at KNHP as a National Park ranger, invited me and my Berkeley colleague Kent Lightfoot to spend a day with him visiting sites. Crawling through the thick Christmas berry and lantana on the talus slopes to examine previously unrecorded habitation and *heiau* sites which Buddy had discovered, I was struck by the evident richness of the archaeological record. As Kent and I enjoyed a beer "topside" at the end of a long and stimulating day, we mused over the possibilities of long-term research at Kalaupapa.

In the late 1990s, I began informal discussions with Dr. Robert Hommon, Pacific region archaeologist of the National Park Service, and Ms. Laura Carter Schuster, of Hawaii Volcanoes National Park, regarding the potential of a long-term program of archaeological research in the Kalaupapa National Historical Park. In April 1999, the three of us were able to rendezvous at Kalaupapa for two days, guided to various sites by Mr. Dean Alexander, then KHNP Superintendent. This trip further convinced me that Kalaupapa deserved a closer archaeological exploration, and we began discussing how such a project might proceed. It seemed logical that the first step should be an intensive reconnaissance of selected portions of KNHP, to assess more fully the potentials for long-term archaeological study.

Pursuant to a Scope of Work submitted to Mr. Dean Alexander, Superintendent of the KNHP, on 1 May 2000, and subsequently approved, an archaeological research team from the University of California at Berkeley, under my direction, conducted a reconnaissance archaeological survey in selected portions of KNHP from August 11 to September 3, 2000. The field team consisted of the following individuals: P. V. Kirch, director; S. Millerstrom, J. Coil, and K. Kawelu, U. C. Berkeley archaeology graduate students; S. Jones O'Day, University of Florida archaeology graduate student;

S. Kailihiwa, U. C. Berkeley undergraduate student; and J. Holson and J. Cerny, volunteers. They were a first-rate team, as indeed they needed to be to deal with seemingly endless stretches of boulder beaches, a leaky and rustic Quonset hut, and restricted opportunities for provisioning. This report summarizes the field work accomplished by our team, and fulfills our obligations under the terms of our Scope of Work. Copies of all detailed site records generated during the reconnaissance survey have been deposited with the KNHP Superintendent, for curation as a part of the Park's archives.

ACKNOWLEDGMENTS

Financial support for this research project was provided by the Pacific Rim grant program of the Office of the President, University of California, and by the Class of 1954 Professorship endowed fund of the University of California, Berkeley. In-kind support was provided by the National Park Service, for lodging and local transportation. We are particularly grateful to KNHP Superintendent Dean Alexander, and his staff of rangers and assistants. NPS Archaeologists Dr. Robert Hommon and Ms. Laura Schuster were instrumental in setting up the project, and Rob provided additional maps and documentary sources. We also thank Dr. Holly McEldowney and Dr. Sara Collins of the State of Hawai'i Historic Preservation Division for additional assistance and support. Ms. Dorothe Curtis of Kamalo, Moloka'i, likewise offered additional source materials and information. In the final stages of report writing, Mr. Mark McCoy of Berkeley shared new archival and cartographic information he had obtained in Honolulu.

A special thanks to Dr. Emmett Aluli, who treated my badly injured leg (casualty of the Nihoa boulder beach), and who with Daviana McGregor gave our team a most welcome evening repast during our weekend "topside." Kat and Glenn Davis were likewise gracious hosts during that respite from trying fieldwork. We particularly extend our *mahalo nui loa* to the residents of Kalaupapa Settlement who welcomed us into their community.

All of my co-authors have contributed to the preparation, writing, and production of this report, whether through map-making, describing sites, carrying out laboratory analyses, or preparing graphics. The final report writing was coordinated by me, with particular assistance from Lisa Holm and Kathy Kawelu in the preparation of graphics and text layout. I thank Therese Babineau for her fine skills in printing the black-and-white photographs.

Patrick Vinton Kirch

Quinta Pacifica
El Sobrante

INTRODUCTION

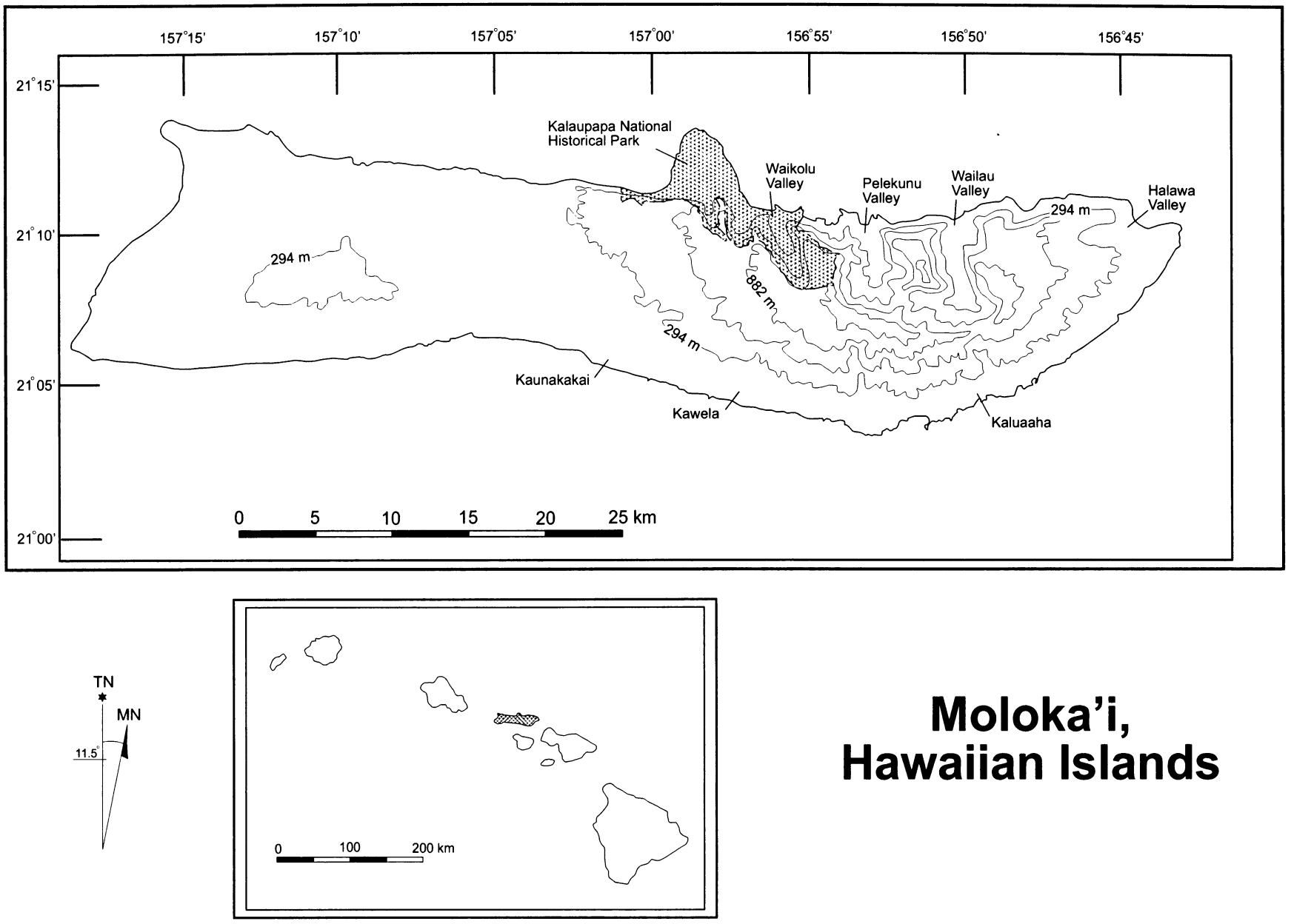
The overall purpose of the 2000 Kalaupapa project was to conduct a reconnaissance-level survey of selected portions of Kalaupapa National Historical Park (KNHP), in order to assess the range of prehistoric and early historic Hawaiian archaeological sites and features, as well as their geographic distribution and density. The goal was to obtain sufficient data to enable development of a possible multi-year research design for collaborative archaeological work in KNHP to be conducted in partnership between the NPS and the University of California at Berkeley, Archaeological Research Facility (ARF).

The area of KNHP corresponds with that of Kalawao County, a separate administrative unit distinct from Maui County, the latter incorporating the remainder of Moloka'i Island along with Maui and Lāna'i (Fig. 1). Within the Park boundaries are four traditional Hawaiian land units (*ahupua'a*): Kalaupapa, Makanalua, Kalawao, and Waikolu (from west to east). The name Kalaupapa, then, has several connotations: as the traditional *ahupua'a* situated on the western side of the peninsula; as the name for the peninsula as a whole; as the name of the current Hansen's Disease settlement on the western side of the peninsula; and, in popular usage, as a synonym for the whole of Kalawao County. Throughout this report, we will distinguish these meanings by reference to Kalaupapa Ahupua'a, Kalaupapa Settlement, Kalaupapa Peninsula, and Kalaupapa Region (i.e., the area of KNHP).

Three specific objectives were outlined in our Scope of Work: (1) A reconnaissance survey of several selected environmental zones within the Park (e.g., the wet valleys, the colluvial and talus slopes inland of the peninsula, and the peninsula itself), in order to gain an overview of the kinds and distributions of major archaeological features. (2) Detailed plane table mapping and architectural recording of selected sites, including several known, but currently un-documented *heiau* and associated features. (3) Cleaning and re-recording of the test excavations conducted by Richard Pearson in 1966-67 in the Kaupikiawa lava tube complex in Kalawao (Site 312), which had produced an early 14C age determination. Because this site is of considerable significance for developing a long-term chronology and sequence for Kalaupapa, it was judged important that its stratigraphy be recorded, and new samples obtained to check the original dating results on Pearson's samples.

Our project explicitly did not focus on archaeological vestiges of the post-1866 period, when Kalaupapa became a leprosy settlement by Act of the Hawaiian Kingdom. Such remains are, in fact, extensive throughout the KNHP, and include the virtually intact remnants of the early Kalawao settlement, as well as later houses and settlement ruins (such as the Baldwin and Bishop Homes, and the foundations of the 1908 Federal research center overlooking Keawaiki and Wai'ale'ia Bay). Our expertise and interest is not primarily in historical archaeology, a specialized field which has come into its own in recent decades. We simply note here the tremendous scope for the historical archaeology of post-1866 Kalaupapa, and leave that field for others to develop in the future.

This short monograph presents the main results of our field survey. In addition, we review previous archaeological research within the KNHP, and summarize some pertinent ethnohistorical materials, including the interesting Mahele land claims dating to 1848-52. Given that so little archaeological research has been carried out in a region with such rich cultural resources, our aim here is to summarize the results of our reconnaissance survey, as well as to present our views regarding the potential of long-term archaeological research in the KNHP. Not included here, however, are full details on the re-excavation of the Kaupikiawa Rockshelter (sometimes called "Pearson's Cave"), or our stratigraphic sampling of the Waikolu 1 irrigation complex. Additional laboratory work is necessary to complete the analyses of this site, which will be published separately.

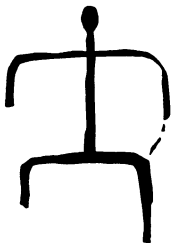


Moloka'i, Hawaiian Islands

Figure 1 Map of Moloka'i Island, showing the location of Kalaupapa National Historical Park.

CHAPTER 1

THE KALAUPAPA REGIONAL LANDSCAPE



Out of all the striking landforms found throughout the Hawaiian archipelago, that of the Kalaupapa Peninsula and its adjacent surroundings surely count as among the most awe inspiring. The peninsula itself—which juts out into the Pacific waters with limited reefs to lessen the impact of rolling swells on lava rock—interrupts the massive line of immense sea cliffs, rising to heights of 1,000 meters above sea level, that define the windward coastline of Moloka'i (Fig. 2). These towering cliffs are themselves cleaved in places by deep erosional valleys, such as Waikolu, Wai'ale'ia, and Waihānau within the KNHP boundaries; between the valleys, waterfalls tumble over the cliffs plunging into the sea, or billowing out into the mist. Sunrises and sunsets are equally spectacular at Kalaupapa, with the sun rising to the east off Cape Hālawa, and setting to the west beyond the landslip of Nihoa. From the perspective of the peninsula, however, it is the towering cliffs that continually loom up in the background, defining this detached world so isolated unto itself. It was just this isolation that made the Hawaiian Kingdom's health administrators choose Kalaupapa for a leper colony in 1866, and the additional restrictions imposed for that purpose have truly made Kalaupapa a world unto itself. Not surprising that the rest of Moloka'i above and beyond those imposing cliffs should be known to the locals as "Topside".

Within an archipelago famous for its physical and biotic diversity, the lands within KNHP are especially notable for the range of variation in virtually every aspect of natural history: geology, landform, rainfall and hydrologic resources, soils, and biotic communities. The following paragraphs summarize key aspects of this variability, which played a major role in influencing the ways in which precontact Hawaiians settled and utilized the peninsula and valleys that today make up KNHP. Our emphasis is on aspects of landscape and environment which were directly relevant to indigenous Hawaiian settlement patterns and cultural practices, and which helped to shape the ways in which people used the lands of KNHP prior to the development of the leprosy settlement. These environmental variations also supplied the major criteria in our selection of sampling areas for archaeological survey.

GEOLOGY AND GEOMORPHOLOGY

The geological history of Moloka'i was first thoroughly worked out by Stearns and Macdonald (1947) in their classic study of geology and groundwater resources. They recognized that the island

Figure 2 View eastwards along the windward coastline of Moloka'i Island. The towering cliffs were created by a combination of massive landslides and wave erosion. Waikolu Valley and Ōkala Island are visible in the middle portion of the photograph.

had been created by the coalescence of two separate shield volcanoes (the West Moloka'i and East Moloka'i volcanic series), followed by a major phase of erosion during which the great windward sea cliffs and deep amphitheater-headed valleys were created. Stearns and Macdonald debated whether the northern sea cliffs were formed solely by marine erosion, or whether faulting was also involved (1947:11). Recent work including submarine mapping has now shown that faulting and massive collapse were major processes at work in creation of the cliffs. Subsequent to the development of the deep windward valleys and formation of the high sea cliffs, a renewed phase of volcanic activity created the Kalaupapa Peninsula. Stearns and Macdonald described this late phase of volca-

nic activity as follows:

> The Kalaupapa basalt is named from the leper settlement which is built on this lava. The basalt forms a peninsula 2½ miles long and 2½ miles wide projecting from the base of the great windward cliff of East Molokai Mountain. The lava is a porphyritic olivine basalt pahoehoe . . . that issued from a flat lava cone 405 feet high indented with a crater a quarter of a mile wide and more than 450 feet deep. A brackish pond lies in the crater. Two distinct rock benches in the crater indicate that the lava lake halted twice during the recession of the magma column. Most of the lava discharged northward through a large lava tube that is now collapsed. Several other tubes are exposed at the sea where they have been eroded to form natural bridges, blow holes, and other scenic forms. Most of the cone lies under the sea. (1947:25)

Radiometric dating of volcanic rocks, such as potassium-argon dating, not available in Stearns and MacDonald's day, have now given the historical geology of Moloka'i a firm geochronology. The West Moloka'i shield dates to ca. 1.9 million years, and the East Moloka'i shield to ca. 1.5 million years. The rejuvenation stage which resulted in the Kalaupapa Peninsula is dated to ca. 570-350,000 years ago (Clague 1998:43). Between the creation of the East Moloka'i shield and the rejuvenation stage, indeed "probably late in the shield stage," the East Moloka'i volcano was bisected through its summit caldera "by the enormous Wailau landslide, which slid northward and thrust kilometer-sized blocks onto the seafloor up to 100 miles (166 km) offshore" (Clague 1998:43).

This complex geological history resulted in a diversity of geomorphological landforms within the area of KNHP. The peninsula itself consists of relatively gentle, only minimally weathered, lava flow slopes, emanating from the deep pit crater of Kauhakō. The coastline of the peninsula varies from 10-20 m high sea cliffs on the east, to more protected sandy beaches and rocky shores on the west. Along the inland (south) margin of the peninsula, landslides and erosion from the cliffs has created a zone of talus and colluvium (or, as Wentworth termed it, "taluvium"). In the eastern portion of KNHP are the large Wai'ale'ia and Waikolu Valleys, which slice deeply into the East Moloka'i Mountains. Wai'ale'ia has an intermittent stream and limited alluvial flats, with more extensive colluvial slopes, while Waikolu has a permanently flowing stream and more extensive alluvial deposits near the mouth of the valley, as well as extensive colluvial deposits. All of these alluvial and colluvial areas provided excellent zones for indigenous Hawaiian horticultural practices. In the far western part of KNHP is yet another landform, the "landshelf" of Nihoa which represents a block of the East Moloka'i shield which collapsed through faulting; other such landshelves are found along the length of the windward Moloka'i coastline.

CLIMATE AND HYDROLOGY

The major factor influencing rainfall on Moloka'i is orographic (or mountain-induced) precipitation, capturing the moisture-laden marine air typically borne landwards by the northeast trades. As KNHP is situated on the windward side of Moloka'i, it partakes fully of this orographic rainfall pattern. The northern tip of the peninsula, which is nearly at sea level and thus does not induce much rainfall, receives only about 1,000 mm (40 inches) annually, but between 1,500-2,000 mm (60-80 inches) falls towards the inland side of the peninsula against the talus and colluvial slopes (rainfall data from Giambelluca and Schroeder 1998). In contrast, the headwaters of Waikolu Valley receive an estimated 3,000+ mm (120+ inches) per year, more than enough to ensure permanent stream flow, even with a considerable quantity of Waikolu's water diverted through intakes and tunnels to arid West Moloka'i. Rainfall throughout KNHP displays a distinctly seasonal pattern, with a wet season from around November through April/May, and a drier season in the intervening months. Of course, within the context of the windward valleys such as Waikolu, the notion of a "dry season" is only relative.

This steep rainfall gradient, ranging from <1,000 mm to >3,000 mm in just over 7 km from north to south, had major implications for ancient Hawaiian land use, given the indigenous Hawaiian crop plant assemblage. Rainfall over most of the peninsula was sufficient only to support a few dryland crops, most notably sweet potato (*Ipomoea batatas*), and presumably also sugar cane (*Saccharum officinarum*), gourds (*Lagenaria siceraria*), and yams (*Dioscorea alata*). However, as one approached the extensive colluvial slopes along the southern base of the peninsula, the higher rainfall

levels (1,500-2,000 mm) would have been adequate not only for such crops, but also for dryland taro (*Colocasia esculenta*), bananas (*Musa* hybrids), as well as secondary crops such as *'awa* (*Piper methysticum*) or *noni* (*Morinda citrifolia*). In Waihānau, Wai'ale'ia, and especially Waikolu Valleys, very high rainfall as well as permanent streamflow were ideal for the creation of permanent irrigated pondfield systems for wet taro cultivation, although crops such as sweet potato may not have tolerated the continuously humid conditions.

The three valleys within KNHP vary greatly in their hydrologic regimes, largely a function of their respective sizes and drainage basins (Table 1); statistical data on streamflow are available for Waihānau and Waikolu Valleys, due to stream gauging stations maintained by the U. S. Geological Survey (USGS 1961, 1971). Waihānau, farthest to the west, is also the narrowest valley, with an average width at the base of the cliffs of ca. 100-300 m, leaving only restricted colluvial slopes on which cultivation could have been carried out. Although the main valley area is small, Waihānau Stream drains an extensive upland area extending to the base of Pu'u Kaeo, and therefore always has some flow in its upper portions. Waihānau Stream is subject to major flash flooding when there are heavy rains in the uplands, as we witnessed during the night of August 20, 2000, when a subtropical depression hit Moloka'i Island. Waihānau Stream discharges into the ocean just south of the Kalaupapa Settlement, about 50 m from the Quonset Hut, and the roar of the stream which was carrying entire trees and moving large boulders in its bed, was quite impressive.

Wai'ale'ia Valley contrasts strikingly with Waihānau in being much wider than the latter, and amphitheater shaped. There are many small alluvial terraces, and fairly extensive colluvial slopes in Wai'ale'ia Valley, which might have made horticultural practice there more inviting. However, unlike Waihānau, Wai'ale'ia has very little drainage area above Waimanu Falls, so that Wai'ale'ia Stream is dry much of the time, limiting the potential for irrigated pondfield agriculture. Moreover, at times of heavy rain the valley slopes and floor are subject to significant slope wash and flash flooding. Over much of these slopes we observed loose subangular to rounded gravel scree beds which were the result of surface water flow. These constraints—a lack of constant water in the main stream, and uncontrollable slope wash and flooding during heavy rains—may thus have rendered Wai'ale'ia less desirable for permanent settlement than first appearances might suggest.

Waikolu Valley is significantly larger than either Waihānau or Wai'ale'ia, being one of the four great windward valleys of Moloka'i (the others are Pelekunu, Wailau, and Hālawa). With valley walls rising to heights of 1,000 m, Waikolu visually overwhelms a diminutive human. The main valley has a length of about 4 km, and significant alluvial terraces and colluvial slopes are found well inland; at the valley mouth an alluvial floodplain was the setting for a significant taro irrigation system, and many other taro pondfield systems are distributed up the valley on the flats and slopes. Despite the fact that considerable streamflow is captured about 3.5 km inland, and diverted through a tunnel to the western side of the island, Waikolu Stream has an average discharge near the stream mouth of 18.9 cubic feet per second, and never goes dry. This is in part due to a number of springs which emanate from the lower valley walls, tapping perched ground water. Clearly, the potential for extensive irrigation systems in Waikolu is significant, a potential that was developed by indigenous Hawaiian cultivators well before contact, and which seems to have been further intensified and possibly transformed using Asian rice pondfield technology during the later part of the 19th century.

The peninsula itself has no streams flowing across it, although Waihānau Stream runs westwards along the base of the colluvial slopes to discharge into the sea at Pūwāhi. The absence of stream channels on the peninsula is largely a function of the young age of the substrate, gentle slopes, and relatively low rainfall. Thus it was not possible to develop irrigated, pondfield agriculture on the peninsula itself, and crops would have had to depend solely on rainfall. Moreover, fresh water for drinking would have had to be collected from rainfall, obtained from the pit crater at Kauhakō, or transported from Waihānau or Wai'ale'ia streams. There are very likely freshwater springs or seepages along the shore, which may well have been known to former residents of the peninsula.

Table 1 Characteristics of Waihānau, Wai'ale'ia, and Waikolu Valleys*

Parameter	Waihānau	Wai'ale'ia	Waikolu
Length of main valley	1.5 km	2 km	4 km
Average width at cliff base	0.1-0.3 km	0.5 km	0.3-0.5 km
Drainage basin area	1.18 sq mi	No data	3.68 sq mi
Average discharge	3.02 cfs	No data	18.9 cfs
Maximum discharge	4,950 cfs	No data	6,600 cfs
Minimum discharge	0.09 cfs	No data, stream dry at times	5.1 cfs

*Drainage basin area and discharge statistics from USGS (1961, 1971).
Cfs = cubic feet per second.

SOILS

In addition to rainfall and surface hydrology, the distribution of soil types was of fundamental significance in shaping traditional patterns of land use. Of course, rainfall and soils are themselves related, as the rate of rock weathering and soil formation increases as a function of rainfall (Chadwick and Chorover 2001). However, nutrient depletion (especially of phosphorus) may also become a limiting factor in areas of very high rainfall (Chadwick et al. 1999). Two soil surveys have covered the KNHP region, both under the auspices of the U. S. Department of Agriculture (Cline ed., 1955; Foote et al. 1972), but using different soil classification systems; we have consulted both. Neither survey seems to have paid close attention to the valleys, and we suspect that these were either not field surveyed, or at best covered in a very cursory fashion.

The soils of the peninsula proper have parent materials of relatively young basaltic lavas, and consequently are not deeply developed; on the other hand, this young age may equate with a relatively high nutrient status, a hypothesis we will develop further in our conclusions. Cline (1955:631) classified the soils of the peninsula as "Rockland (map symbol RB)", a soil unit "made up of young lavas with a very thin cover of volcanic ash." He elaborated that

> where soil occurs, it averages less than 10 inches deep, but ranges from a fraction of an inch to as much as 2 feet deep within a very short distance... Commonly the A1 horizon rests directly on solid bedrock, but in the cracks and crevices of this rough, broken lava, soil material typical of Kawaihae, Waikaloa, or Naalehu soils may extend to depths of 2 feet (1955:631).

In the more recent survey of Foote et al. (1972), the soils of the peninsula were more closely subdivided, between "Rock Land (rRK)" on the northwest and northeast peripheries of the peninsula, and a special soil type distinctive to the area, the "Kalaupapa Series." The distribution of these soil types is shown in Figure 3. Rock Land, which makes up a smaller area closer to the ocean, is defined as "areas where exposed rock covers 25 to 90 percent of the surface" (1972:119). Typical of this category is the area around the Kaupikiawa Rockshelter. The larger percentage of the peninsular lands, however, consist of the Kalaupapa Series, which are described as "well-drained upland soils underlain by pahoehoe bedrock at a depth of about 14 inches" (1972:56). Foote et al. elaborate on this important soil type as follows:

> This soil occurs as one large area. It is shallow, and there are many stones and cobblestones on the surface and few to many in the profile. Rock outcrops cover about 15 percent of the surface.
> In a representative profile the surface layer is dark-brown silty clay loam about 6 inches thick. The subsoil, about 8 inches thick, is dark yellowish-brown, nearly massive silt loam. Hard pahoehoe bedrock occurs at a depth of about 14 inches. The soil is neutral throughout the profile (1972:56).

In a remark that underscores the bias of USDA soil surveys towards large-scale, commercial agricultural interests, Foote et al. note that "cultivation is impractical because of shallowness, the many stones, and the rock outcrops" (1972:56). Of course, the unstated assumption here is that one is

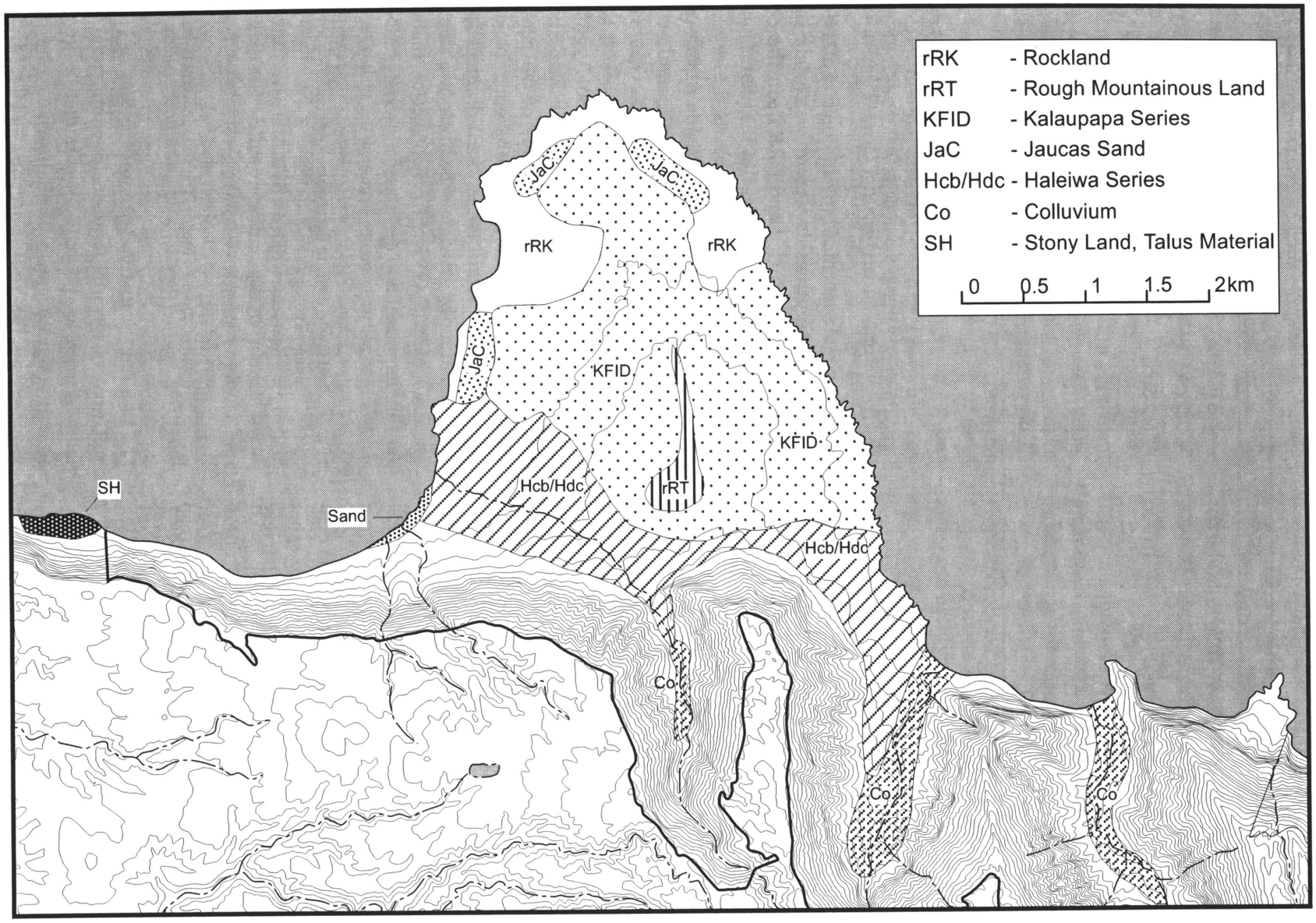


Figure 3 Map showing the distribution of major soil types within the Kalaupapa National Historical Park. See text for further discussion.

using mechanized equipment; for a Hawaiian cultivator working with a hardwood *'o'o* (digging stick), stoniness may not have been particularly significant, and stones could easily be piled into windbreaks and mounds. What mattered more was the fertility of the soil. Given that the Kalaupapa Series coincides with the archaeological manifestations of a remarkable agricultural field system, it might seem reasonable to suppose that the fertility and productivity of the Kalaupapa Series soils are quite high.

As noted earlier, running along the southern margin of the peninsula where it meets the towering cliffs, is a zone of talus and colluvium, as well as some alluvial deposits emanating from the mouth of Waihānau Valley. This geomorphic province has its own distinctive soils, as might be anticipated. In the older Cline study, these were classified within the Kawaihapai Series (1955:588-93), a group of "brown or reddish-brown soils derived from very young deep alluvium washed from humid regions." At Kalaupapa, the specific soil type was defined as Kawaihapai Very Stony Clay Loam (map symbol K2y), a "moderately fine textured soil . . . found mainly in narrow valleys where loose stones litter the surface and are scattered throughout the profile" (1959:593). (Again, the problems for machinery are noted.) In the later Foote et al. study, this area was included within a newly-defined Haleiwa Series, "well-drained soils on fans and in drainageways along the coastal plains" (1972:33). The agricultural potential of these soils is again seen as restricted due to stoniness, although it is noted that sugarcane and truck crops are grown on them.

The importance of the Kawaihapai-Haleiwa soil category for indigenous Hawaiian horticulture deserves notice. In his 1977 comparison of pre-contact valley agricultural systems on O'ahu and Moloka'i Islands, Kirch pointed to the prevalence of Kawaihapai Series soils in areas with evidence for intensive Hawaiian cultivation (1977:250). Referring to analyses made by the Cline (1959) team, Kirch wrote that soils

> . . . of the Kawaihapai Family are excellent for cultivation, being well supplied with bases, having a pH invariably greater than 6.0, and containing small amounts of calcium and potassium, as well as average amounts of nitrogen (1977:250).

Kirch also noted that the distinctive Hauula Paddy Soils of Hawaiian pondfield irrigation systems were often developed on soils of the Kawaihapai Series. Thus, the existence of an extensive zone of Kawaihapai-Haleiwa soils running along the southern part of the peninsula—in an area where annual rainfall reaches ca. 1,500-2,000 mm—suggests that this environmental subzone of KNHP may have been a significant agricultural sector in pre-contact and traditional times. Evidence for agricultural utilization of this zone will be presented in detail below.

The soils of the three valleys, as noted, have not been studied or described in detail. Cline (1955) classified these as "Rough, Broken Land (map symbol Rs)", but this general category does not do justice to the variations we observed, and we doubt that the Cline team actually visited these difficult-to-access valleys. The same is probably true for the Foote et al. (1972) study which lumps the areas of all three valleys into a category of "Colluvial Land", consisting of "steep and very steep talus slopes in windward valleys on the island of Molokai" (1972:29). In our opinion, the soils of these valleys probably incorporate significant variation between small alluvial flats, colluvial slopes, weathered ridges, talus deposits, and so forth, which would require detailed study to evaluate. There are, for example, probable areas of Kawaihapai-Haleiwa soils which have not been mapped. What we can say is that the soils of the valleys are rather deeply developed, generally on colluvium or alluvium, and derive from parent material that is on the order of 1.5 million years old.

Finally, there is the Nihoa landshelf, which was mapped by Cline (1955:623) as "Stony land, talus material" (map symbol SH), and not distinguished at all in the Foote et al. study. Cline writes that "this land type is mapped at the base of cliffs or escarpments where rock debris brought down by gravity and water has accumulated. . . Among the stones there is enough fine soil material to provide some medium for the rooting of plants. This fine material is generally similar to that of Alluvial soils, but in some places it is moderately sticky and plastic clay comparable to that of the Kaena series" (1955:623). From our field survey of Nihoa, we can state that the

landshelf indeed has a considerable depth of alluvium and supports a dense vegetation cover.

BIOTIC COMMUNITIES

Given the great variability in geology, geomorphology, climate, and soils as discussed above, the Kalaupapa region predictably displays a tremendous range in biotic communities—particularly vegetation communities—from coastal dry herblands and shrublands rimming the peninsula, through lowland dry and mesic shrublands and forests, to montane forests in the interior portions of the valleys. However, the extent to which these communities have been modified by human actions on the land, both through pre-contact Native Hawaiian land use and subsequent changes in the post-contact period, also varies considerably over space. The peninsula itself along with the coastal regions and valley bottoms and colluvial slopes have been the most affected, whereas the steep valley walls and tablelands inland remain significant zones of largely native vegetation (e.g., the *Acacia-Metrosideros* montane forests in the interior portions of Waikolu Valley). Although the peninsula does retain important vestiges of its endemic and indigenous flora, much of it is dominated today by historically-introduced taxa, such as Christmas berry (*Schinus terebinthifolius*) and lantana (*Lantana camara*) in the drier zones, or Java plum (*Syzgium cumini*), rose apple (*Syzgium jambos*) and strawberry guava (*Psidium cattleianum*) on the talus slopes.

Prior to the introduction of these now-dominant exotic taxa, the vegetation communities within the Kalaupapa region would have included at least the following major zones, as based on the classification of vegetation communities by Gagné and Cuddihy (1990): (1) **coastal dry communities** with such shrubs as *naupaka* (*Scaevola sericea*) and *'ilima* (*Sida fallax*); **lowland dry grasslands** and **shrublands** across much of the peninsula proper, with such dominants as *pili* grass (*Heteropogon contortus*), and shrubs such as *'āweoweo* (*Chenopodium* spp.), *'a'ali'i* (*Dodonaea* spp.), *'akoko* (*Chamaesyce celastroides*), *alahe'e* (*Canthium odoratum*), and *'akia* (*Wikstroemia* spp.); (3) **lowland dry forests** dominated by *wiliwili* (*Erythrina sandwicensis*) trees and other species; (4) **lowland mesic forests** on the talus slopes and lower portions of the valleys, with such trees as *koa* (*Acacia koa*), *'ohi'a* (*Metrosideros polymorpha*), *lama* (*Diospryros* spp.), *loulu* palm (*Pritchardia hillebrandii*), and the Polynesian-introduced *kukui* (*Aleurites moluccana*), the latter found especially in the wetter ravines; (5) **coastal *hala* forests** (*Pandanus tectorius*) and possibly *loulu* forests along the coastal ridges and steep slopes separating the valleys; and (6) **montane wet forests** dominated by *'ohi'a* and *koa* in the interior mountainous zones. Clearly, this tremendous range of vegetation zones and communities, packed into a relatively small geographic space, offered a considerable variety of floristic resources to the region's inhabitants, and may have been an inducement to early settlement.

Reconstructing the vegetation communities and zonal biogeography of the Kalaupapa region both prior to, and during the course of several centuries of Polynesian occupation, as well as the changes which occurred following European contact, poses a challenge. Significant information for this task can potentially be provided by analysis of charcoal and other macro- and micro-botanical remains recovered from archaeological sites. Some initial data along these lines has been derived from our work at Kaupikiawa Rockshelter, and will be presented below. Other data might be derived through sediment coring of Kauhakō Crater and extraction of pollen assemblages from the lake's sediments, assuming that these have stratigraphic integrity.

The terrestrial fauna inhabiting these vegetation zones has also doubtless changed significantly over time, and zooarchaeological assemblages from future excavations within the KNHP may be expected to provide significant data for tracing these changes. Certainly, a rich endemic avifauna must have occupied the region at the time of initial Polynesian settlement, but as elsewhere we might predict that many of these birds—especially flightless taxa—were quickly eliminated through a combination of direct predation and habitat disturbance. Following European contact, a variety of animals were introduced, including on Moloka'i the highly destructive *Axis* deer which have run rampant over the peninsula in recent years, wreaking havoc on much of the remaining endemic vegetation.

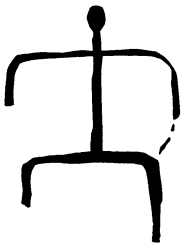
Finally, we can briefly comment on the marine biotic communities which were so important to the

Native Hawaiian inhabitants as a primary source of protein. The peninsula's coastline and offshore environments vary greatly as one moves from the eastern to western sides, the latter being in the lee of the dominant currents and swells. Thus the eastern shore is one of sea cliffs continually subject to wave action, difficult and dangerous to access (Fig. 4), whereas the western shore is much more protected, with easy access, sand beaches and basalt shelves where a range of shellfish can be readily collected, and where in-shore fishing is feasible most of the year. Fringing coral reef is restricted to this western side of the peninsula, and not surprisingly the Mahele land records refer to several proprietary fishing spots (*ko'a*) in this area. Elsewhere, along the boulder beaches between Waikolu and Wai'ale'ia valleys, and between the peninsula and Nihoa, the high wave energy and dynamic geomorphic environment prohibit development of reefs. However, these boulder beaches do provide a substrate for the much-desired *'opihi* (*Cellana exarata*) limpets and *hā'uke'uke* (*Colobocentrotus atratus*) sea urchins, which can be gathered when the sea is calm, usually the summer months.

Figure 4 View along the rocky eastern shore of Kalaupapa Peninsula, characterized by low basalt cliffs.

CHAPTER 2

ETHNOHISTORICAL BACKGROUND: THE KALAUPAPA REGION



The history of Kalaupapa and its environs as a leprosy settlement, beginning in 1865-66, has been amply documented by Greene (1985), and in other sources such as Daws' biography of Father Damien (1973). These and other accounts of the post-1865 period (e.g., Korn [1976] on the letters of Peter Kaeo) will be of great interest to historical archaeologists in working out the many transformations of land and settlement that came with the conversion of the peninsula to the dreaded land of isolation. However, such conventional histories of Kalaupapa generally bypass the pre-1865 period, relegating it to a few generalities. Indeed, the early post-contact history of Moloka'i in general is neglected terrain. Yet it is this early period immediately following contact with the West—as well as the pre-contact history given through oral traditions and genealogies (e.g., Abad 2000)—which are of the greatest importance to archaeologists focused on the prehistoric and protohistoric periods.

Summers (1971:11-20) offers a synthesis of the traditional histories as they relate to Moloka'i, drawn primarily from such sources as Kamakau (1961) and Fornander (1916-17). What is most striking about these accounts, however, is that they are really histories of the ruling chiefs of O'ahu, Maui, or Hawai'i, into which Moloka'i and its *ali'i* or chiefs figure from time to time. We need not repeat these accounts in detail, other than to note that Moloka'i was originally an independent polity or polities (*moku*), which in the final century or two prior to European contact increasingly came under the control of *ali'i* from the larger and more powerful islands, especially Maui and O'ahu. It is also clear that there were long-standing tensions between the two Moloka'i *moku* of Kona and Ko'olau, that is the leeward and windward sides of the island, and that at times these *moku* were separate, warring polities. This is particularly brought out in the traditional history of Kuali'i, the ruling chief of O'ahu sometime in the early 1700s, who came to the aid of the Kona chiefs in their battles against the Ko'olau chiefs (Fornander 1916-17:416-21). Decisive battles were fought both at Kalaupapa and at Pelekunu along the Ko'olau coast, with Kuali'i and the Kona chiefs emerging victorious. Kuali'i made a redivision of the *ahupua'a* lands of the island at this time, leaving Moloka'i in the charge of the warrior chief Paepae who had first enlisted his aid (Fornander 1916-17:420).

Throughout the remainder of the 18th century, Moloka'i was variously fought over by the O'ahu chiefs descended from Kuali'i (including Kapi'iohokalani, Kanahaokalani, and Peleioho-

lani), and the Maui chief Kahekili. At one point, the Hawai'i Island paramount Alapa'inui also become involved in the Moloka'i wars, coming to the defense of the Moloka'i chiefs (to whom he was related) in their battles against Kapi'iohokalani of O'ahu. Peleioholani is said to have wreaked particular havoc in one war, around the mid-18th century, in revenge for the death of his daughter at the hands of the Ko'olau chiefs (Summers 1971:18). When O'ahu fell to the forces of Kahekili in 1785, Moloka'i also came under the expanded Maui polity.

In these final years of the 18th century, when Europeans were beginning to make inroads through exploration and the Northwest Coast fur trade, Moloka'i was one of the pawns in the struggle between Kahekili and the great war chief of Hawai'i, Kamehameha I. Kamehameha invaded Moloka'i in 1790, apparently causing considerable destruction; the island was, however, regained by the forces of Kahekili in 1791. With Kahekili's death at Waikīkī, O'ahu, in 1794, Kamehameha was emboldened to make his great push to claim the leeward islands, and his war fleet swept through Moloka'i on its way to victory on O'ahu in 1795. The *ahupua'a* of Moloka'i were presumably once again redivided among the followers of Kamehameha, as is evidenced in the *ali'i* either related to him or in his following who a half-century later claimed many Moloka'i *ahupua'a* in the Great Mahele (see below).[1]

Traveling to or from the windward Ko'olau valleys and Kalaupapa Peninsula remains difficult to this day, especially in the winter months when high swells and surf make access by sea tenuous, and these factors always seem to have limited contact with the Ko'olau region. Thus it was on the leeward, Kona side that the Protestant missionaries under the Rev. H. R. Hitchcock established their first station at Kalua'aha in 1832, and also on the Kona side that limited commercial enterprises (such as ranching, and later sugarcane and pineapple growing) were established. Accounts of Ko'olau including the region from Waikolu to Kalaupapa are therefore few and far between prior to the establishment of the leprosy settlement in 1865-66. Those which do exist, however, provide some glimpse into Hawaiian life in these remote valleys and on the plains of Kalaupapa in the first half of the 19th century.

One of the few who ventured under the imposing and dangerous Ko'olau cliffs was the naturalist-explorer Jules Rémy, who traveled by whaleboat from Hālawa to Kalaupapa in July of 1854. Nearing Waikolu, they passed the islets of Mōkapu and 'Ōkala, one of which "supported a bouquet of palm trees, *loulu* [*Pritchardia* sp.] fan-palms." After passing the islets they could see "Waikolu, a village situated at the debouchement of a valley which marked, to the west, the limit of the insurmountable *palis* of Molokai." Rémy and the Catholic priest, Father Aubert, who accompanied him arrived at the "Calvinist temple," evidently the Congregational church, where a weekly assembly of the women was in progress; Rémy was invited to share in a repast of *poi*, *lū'au*, onions, and shellfish. Afterwards Rémy explored the valley:

> I advanced into the valley through fields of *kalo* watered by a pleasant brook. All the houses which I approached were old, miserable, a lack of propriety all the more striking because their tenants possessed a marked amiability. In one of the houses, I had occasion to be witness to the reception being given a family which had come from Maui to visit their parents; as soon as they recognized one another, they all saluted by rubbing noses; then they sat down on the floor in silence, and began to weep for several minutes before saying a word (Rémy, Knowlton trans. MS, p. 18).

After another feast of roasted dog and pig, Rémy and his party continued by foot ("over the cobbles between the sea and the foot of the escarpments") to Kalaupapa, the Waikolu folk cheerfully carrying their luggage.

> . . . we arrived at a dwelling perched on a sort of promontory at the entrance to Kalaupapa: it is the name given to a tongue of land which projects from the foot of the cliffs into the sea, forming a low, semi-circular plain, slightly convex (hump-backed), about three miles in diameter. About 100 feet from the house, at the hamlet of Kalawao, a horse awaited me, all saddled, which I mounted to continue my route through cultivated land, where grew thorny Mexican poppies, tropical shrubs (Malvaceae), common leguminous plants, and the like. We rode through one village surrounded by fields of potatoes.
>
> At 6 p.m. I stopped for the night at the home of Maipelekane, the tenant farmer of Liholiho, whose house was part of the principal village of Kalaupapa . . . After having, since morning, travelled at the foot of the escarpments and penetrated into a narrow valley [Waihanau ?] where I observed the same rupestrian type of vegetation as on Waikolu, I continued on and directed my steps to the most swollen part of the plain

> of Kalaupapa, walking on a terrain slightly sloping, carpeted with *pili* grass and common shrubs; desmodium (knotweed), euphorbia, waltheria, vaccinium, verbesina, etc. Soon I arrived at the edge of a large ditch rounded in the form of a crater, which the natives had mentioned to me calling it Kauhako. It was evidently an old crater. I went down into it through a jumble of interesting vegetation, having a vigor and variety more pronounced on the East than on the other coasts: frutescent violet plants (shrubby), cassia, neraudia, a caryophyllus, ligneous euphorbia, banana trees, rose apple, daphne, phyllanthus, cassytha (dodder laurel), *ohe* aralia (spikenard), bancoulier, erythrina (coral tree), *halapepe* (Dracaena Pleomele), *kakalaioa* (a thorny bramble), *ilima* (Sida), sonchus (sow-thistle), etc. . . .
>
> My exploration completed, I went to the large village of Kalaupapa, where Father Aubert was waiting for me among his half dozen disciples in a very small house near the beach. . . Not having seen in the fields of Kalaupapa coconut trees, pandanus, taro, I asked these people why these were not planted. They replied that it was not their custom, and as regards the taro, the ground was not suitable for its cultivation; it produced potatoes in any amount at will and these could readily be exchanged for products cultivated in Waikolu (Rémy, Knowlton trans., pp. 20-23).

Rémy ascended the steep trail up the *pali* leading to Kalae to continue his botanical explorations on the central mountains of Moloka'i. Just a year earlier, another traveler, Marston Bates (who published under the pen name, "A Haole") had viewed the plains of Kalaupapa from the top of the *pali*, without descending: "From the base of the *Pali*, the plains of Kalaupapa extend some distance seaward. Over its surface were scattered a number of dwellings belonging to the natives, besides numerous pasture-lands and plantations" (Haole 1954:282).

In 1871-72, Charles Nordhoff (grandfather of the famous South Seas novelist) toured Hawaii, making a special trip to Moloka'i to see for himself the newly established leprosy settlement, which he toured in the company of Otto Meyer, the German immigrant who had charge of the settlement in its early years. Nordhoff's account is worth quoting in part, as he remarks specifically on the evidence of former intensive cultivation:

> The whole great plain is composed of lava stones, and to one unfamiliar with the habits of these islanders would seem to be an absolutely sterile desert. Yet here lived, not very many years ago, a considerable population, who have left the marks of an almost incredible industry in numerous fields inclosed between walls of lava rock well laid up; and in what is yet stranger, long rows of stones, like the windrows of hay in a grass field at home, evidently piled there in order to secure room in the long, narrow beds thus partly cleared of lava which lay between, to plant sweet-potatoes. As I rode over the trails worn in the lava by the horses of the old inhabitants, I thought this plain realized the Vermonter's saying about a piece of particularly stony ground, that there was no room in the field to pile up the rocks it contained.
>
> Yet on this apparently desert space, within a quarter of a century more than a thousand people lived contentedly and prosperously, after their fashion; and this though fresh water is so scarce that many of them must have carried their drinking water at least two or even three miles. And here now live, among the lepers, or rather a little apart from them at one side of the plain, about a hundred people, the remnant of the former population, who were too much attached to their homes to leave them, and accepted sentence of perpetual seclusion here, in common with the lepers, rather than exile to a less sterile part of the island (Nordhoff 1875:100-101).

Nordhoff's remarks on the former population of Kalaupapa raise the key issue of the demographic history of the peninsula and larger region. Unfortunately, no accurate censuses were taken until after the establishment of the leprosy settlement, and even the early missionary censuses for Moloka'i lumped the entire island together, making it impossible to obtain accurate counts for the Ko'olau valleys and Kalaupapa. The earliest estimates for the island as whole are from King (36,000) and Bligh (20,000) on Cook's 1778-79 expedition (Schmitt 1968:table 6), although many have considered these too high.[2] However, the missionary census of 1831-32 put the island's population at 6,000, and this would have been after a half-century of impacts from disease, so Bligh's figure of 20,000 at initial contact may not be unreasonable. Curtis (MS [1991], p. 12) cites an 1836 *Missionary Herald* report that there was a population of 2,700 "within a few miles of the Kalaupapa Station", which probably therefore included Waikolu Valley. A Kalua'aha Station Report for 1841 puts the Kalaupapa census figure at "about 700" (Curtis MS, p. 12). Between 1850 and 1878, the island-wide population continued to decline, from 3,540 to 2,581 (Schmitt 1968:table 12). Coulter (1931:20-21) puts the island population in 1853 at 3,607, and graphically identifies "the Makanalua Peninsula" and neighboring Waikolu as population cen-

ters, with about 340 persons indicated for the Kalaupapa region (Coulter 1931, fig. 7).

Retrodicting the maximum population of the Kalaupapa region, prior to European contact, is a problem that will require archaeological assessment and paleodemographic modeling. However, given the intensity of agricultural field system remains on the peninsula, and the potential for intensive irrigated agriculture in the valleys, an overall population on the order of 3,000 (or possibly even higher) persons for the Kalaupapa-Waikolu region prior to contact seems to us to be a reasonable working hypothesis.

Without doubt, it was the agricultural productivity of the Kalaupapa region which made it a significant center of population. Ethnologist Edward S. C. Handy, who toured Moloka'i in 1931 during his field studies for "the Hawaiian planter" (Handy 1940; Handy and Handy 1972) compiled both original observations and other reports of planting areas on the island, including the Kalaupapa region. Concerning irrigated taro cultivation, Handy wrote:

> There were a few small wet-taro sections in Waikolu [in 1931, presumably]. On the slopes of Kalawao, watered from Waileia Stream, are extensive terraces, cultivated for subsistence by the people living in the Kalaupapa Leper Settlement. There must formerly have been wet patches below Waihanau Valley, the stream of which empties near Kalaupapa Settlement (1940:102; see also Handy and Handy 1972:516).

With respect to sweet potato cultivation at Kalaupapa, Handy quotes at length from a Native Hawaiian account, by M. L. Napihelua ("Uala uala Kalaupapa"), published in the Hawaiian language newspaper *Ka Hae Hawaii* for March 4, 1857, prior to the establishment of the leprosy settlement, of which we give excerpts here:

> These are sweet potatoes from ancient times. Most of mine seen here in Kalaupapa are of these kinds. There are nineteen varieties . . . Kalaupapa is a good land because the crops planted are successful and the gain is large. They are not eaten by caterpillars and cut worms.
>
> Many sweet potatoes are being planted now, four or five patches to each man. Most of the crops are watermelons, and some small and big beans and onions. Be on the watch, you traders, for Kalaupapa is the best in all the islands for good prices and fast work. All the California traders come to Kalaupapa. (in Handy 1940:158).

The account, of course, was written only a few years after the California Gold Rush had created a huge demand for sweet potatoes and other produce from the Hawaiian Islands in the port town of San Francisco (Morgan 1948:155-56).[3]

Less important crops worth noting include *wauke*, the paper mulberry (*Broussonetia papryrifera*) which provided bast for bark cloth, and which Handy (1940:199) notes was grown extensively in upland areas (see also Meilleur et al., 1997:33-35). We have an early land claim from Kalaupapa which mentions *wauke* cultivation in the mountain, and it is probable that the crop was grown throughout the wetter zones of all four *ahupua'a*. Also noteworthy is the *hala*, *Pandanus tectorius*, a dominant species in the windward coastal mesic forests such as characterize the Ko'olau district of Moloka'i (Gagné and Cuddihy 1990:63). *Hala* was extensively planted by Hawaiians around house sites, especially for its leaves which were used to produce mats and canoe sails, but for other uses as well (Meilleur et al. 1997). Nathaniel B. Emerson, in his classic work on the Hawaiian *hula*, recorded a *hula pa'i-umauma* ("chest-beating hula"), in which one line in the *mele* refers to the especially fragrant *hala* of Nihoa, the landshelf west of Kalaupapa:

> *A Molokai, i ke ala-kahi,*
> *Ke kula o Kala'e, wela i ka la;*
> *Mauna-loa la, Ka-lua-ko'i, e;*
> *Na hala o Nihoa, he mapuna la ...*
>
> On Molokai I travel its one highway;
> I saw the plain of Kala'e quiver with heat,
> And beheld the ax-quarries of Mauna-loa.
> Ah, the perfume of Nihoa's pandanus exhales!
> (Emerson 1909:203).

The *Pandanus* groves of Nihoa are still extant, and later in this volume we will report on our own observations of the distribution of *hala* throughout the Kalaupapa region, and its possible significance for archaeology.

CHAPTER 2 ENDNOTES

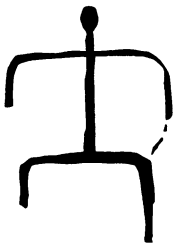
[1] A further redistribution of Moloka'i lands was undertaken by Kamehameha III in 1837.

[2] The debate on pre-contact Hawaiian population levels, and the extent to which the indigenous population was quickly decimated by foreign diseases is nowhere near resolution (see Stannard 1989).

[3] Morgan (1948:155) provides data on the export of agricultural products indicating that sweet potatoes increased from only a few barrels in 1848, to 9.6 thousand barrels in 1850, and an astonishing 56.7 thousand barrels in 1851. The boom ended almost as quickly, however, and by 1851 export was down to 6.1 thousand barrels.

CHAPTER 3

TRADITIONAL LANDS OF THE KALAUPAPA REGION: ANALYSIS OF THE MAHELE LAND RECORDS



Well known to scholars of Hawaiian history and historical ethnography are the complex series of legal acts and associated political and social developments that go under the rubric of "The Mahele" or "The Great Mahele" (Kuykendall 1953; Chinen 1958; Kirch and Sahlins 1992; Kame'eleihiwa 1992). These included: the establishment of a Board of Commissioners to Quiet Land Titles, generally known as the Land Commission (1845); the development by this Commission of a set of *Principles* (1846) for the conversion of a traditional land tenure system into a system of allodial rights; a formal division among the King (Kamehameha III) and some 252 *ali'i* and *konohiki* of the major land units (*ahupua'a*) of the Kingdom (1848); and, the subsequent passage of the Kuleana Act (1850) authorizing the award of individual land claims (Land Commission Awards, or LCA) to the *maka'āinana* or commoners. The work of the Land Commission, which spanned a full decade, resulted in an extraordinary archive of documentation, including the famous Mahele Book, some 12,000 individual land claims entered by ordinary Hawaiians, as well as corroborating testimony presented to the Commission (e.g., NT, native testimony recorded in Hawaiian; FT, foreign testimony recorded in English). These documents, preserved in the Archives of Hawai'i, and recently made available on-line as an internet database (Waihona 'Aina), provide a remarkable "snapshot" of the complex network of land rights and obligations that existed in the Kingdom of Hawai'i in the mid-1800s. Depending on the particular location—as the extent and detail given in the land records varies greatly from district to district—the Mahele records often provide the framework for a historical ethnography of land tenure, kinship relations, economic infrastructure, and other facets of social and political life at mid-century. Such potential has been particularly well illustrated in the cases of the Anahulu Valley, O'ahu (Kirch and Sahlins 1992), and of the Hālawa Valley, Moloka'i (Anderson 2001).

For the Kalaupapa region, the Mahele records are reasonably rich, and we have therefore consulted them in an effort to extract information relevant to an understanding of traditional Hawaiian land organization, economic structure, and other details that may aid in the interpretation of the archaeological landscape. Our examination of these records has not been exhaustive, however, and had to be limited to sources readily available to us, including the Waihona 'Aina database commissioned for the National Park Service. Further archival research (especially in the Archives of Hawai'i) will doubtless allow others to extend and amplify our tentative analysis.

CHIEFLY CONTROL OF THE *AHUPUA'A*

Some obscurity clouds the issue of chiefly title to, and control of, the four *ahupua'a* comprising the Kalaupapa region at the time of the Mahele. In its comprehensive alphabetical lists of lands awarded under the Mahele, the *Indices of Awards* (Commissioner of Public Lands [CPL] 1929) does not list any *ali'i* as having been awarded these *ahupua'a*, nor are any of the *ahupua'a* included in the list of lands belonging to the more important *ali'i* and chiefs (CPL 1929:58-81). Only Kalawao *ahupua'a* is included in the *Indices'* lists, specifically in the list of Government Lands, under the Act of 1848 (CPL 1929:40). From Barrère's analysis of the Mahele Book itself, however, we find that Kalawao *ahupua'a* was under the control of Samuel Kuluwailehua at the time of the Mahele, and was relinquished by him in exchange for the *'ili* of Kamoku in Waikīkī, O'ahu (Barrère 1994:389; see Mahele Book 47-48). Kuluwailehua was of *konohiki* rather than *ali'i* status, a grandson of Kahikaheana, who was a *kahu* or retainer of the high chiefess Kekāuluohi (the latter ruled as *Kuhina Nui* under the title of Ka'ahumanu III).[1]

The *ahupua'a* of Makanalua was among the lands received by high chiefess Miriam Kekau'ōnohi in the King's Mahele (Mahele Book, 25-26, 27-28), and later listed under LCA 11216.[2] Barrère says that Kekau'ōnohi, an *ali'i nui* (she was a granddaughter of Kamehameha I by Peleuli [Kame'eleihiwa 1992:fig. 22]) and heir of her uncle Kalanimōkū, was born in 1805 and died on June 2, 1851, to be survived by her second husband Levi Ha'alelea.[3] Goodwin (1994:30-35) traces the title of Makanalua in some detail, inferring that Kamehameha I held the *ahupua'a* from his conquest of the island in 1795 until his death in 1819, after which it would have passed to Liholiho (Kamehameha II) and his *Kuhina Nui* (regent) Ka'ahumanu. Ka'ahumanu is presumed to have awarded Makanalua to Hu'eu Kalanimōkū, a chief counselor to Kamehameha I and cousin of Ka'ahumanu, who was also the mother's brother of Miriam Kekau'ōnohi. Kalanimoku left all of his lands to Kekau'ōnohi, who therefore was awarded Makanalua during the Great Mahele of 1848. When Kekau'ōnohi died on June 2, 1851, her will (given in full in Goodwin 1994:33) designated that her "entire estate from Hawaii to Kauai, the lands, houselots, including real properties . . ." were to be left to her second husband, Levi Ha'alelea. Ha'alelea, who was somewhat younger than his wife, passed away at 42 years of age in 1864, and most of the lands he had inherited were sold during probate to pay off a debt of $40,000 (Goodwin 1994:35). During probate, the *ahupua'a* of Makanalua was deeded to the Hawaiian Government in 1866, to help create the leprosy settlement (Goodwin 1994:35; Greene 1985:50).

The entire *ahupua'a* of Kalaupapa was claimed by the chiefess Kaunuohua, a *kahu*, or attendant, in the court of King Kauikeaouli (Kamehameha III), and a *kaukau ali'i*, or chiefess of lesser rank (Kame'eleihiwa 1992:263). Her claim is entered in the Mahele Book (p. 91-92), and in a claim (LCA 6450) dated 5 February 1848 (NR 372v5), further confirmed by testimony of King Kamehameha III himself (NT 728-729v3), on January 21, 1851. This claim included several parcels at Mokauea and Waikīkī on O'ahu, as well as Kalaupapa. However, the *Indices* (CPL 1929:1169) list only the O'ahu claims under LCA 6450, leaving open the question of whether the Kalaupapa portion of the claim was actually awarded. Kaunuohua died in 1849, survived by her second husband Moehonua, and Barrère (1994:290) cites the 1852 probate, in which witnesses affirmed that she died possessed of the *ahupua'a* of Kalaupapa as well as her O'ahu lands (see also Kame'eleihiwa 1992:264). Yet Kame'eleihiwa (1992:233) cites a pre-Mahele, 1847 listing of the King's lands as including Kalaupapa, so it is possible that the tenure of Kalaupapa was disputed, and that the King ended up reserving Kalaupapa for the crown. More research is needed to resolve this question.

The *ahupua'a* of Waikolu has proven especially refractory from the point of view of chiefly control. We can find no listing of Waikolu in the *Indices*, and in Barrère's detailed summary of the King's Mahele, the only reference we could find to Waikolu is with respect to Ilae Nāpōhaku, who relinquished an *'ili* named Maniania (also spelled Manienie) within Waikolu Valley, during the original Mahele division (Mahele Book, pp. 168-169, see Barrère 1994:490). Nāpōhaku's control over Maniania is validated in the claim (No. 10108, not awarded) of Mali, as indicated in his testimony in 1848: "I am the *konohiki* of the Ahupua'a of Maniania; Ilae is the head, over me, also, I have an

'ili whose name is Leponui" (NR 290v7).[4] The *Indices* (CPL 1929:40) lists "Manienie" as an "Ili of Waikolu" among the Government Lands, which would be consistent with Nāpōhaku having relinquished his claim, in exchange for Pūko'o, Moloka'i which he received. It seems unlikely that Nāpōhaku would have had control of the whole of Waikolu *ahupua'a*; and it is also curious that Mali lists Maniania as an *ahupua'a*, with the *'ili* of Leponui within it. Perhaps additional research in the Archives of Hawai'i will clarify these questions regarding the chiefly title to Waikolu at the time of the Mahele.

Greene's comprehensive historical study of KNHP does little to clarify the matter of *ali'i* title to lands, stating only that the lands acquired by the Hawaiian Government for the leprosy settlement, in 1865, included Waikolu and Wai'ale'ia valleys which are reported to have been purchased, but it is not noted from whom (Greene 1985:49). Greene goes on to state that "a short while after the initial land purchases, the large tract of Makanalua, 'belonging to the estate of the late Haalelea' and adjoining the settlement of Kalawao, was purchased" (1985:50). Greene further notes that "the *ahupua'a* of Kalaupapa would not be purchased until 1873" (1985:50), but she again gives no further details of this transaction.

In sum, from what we have been able to determine, the *ahupua'a* which make up the current KNHP region were variously under the control of a high-ranked chiefess (*ali'i nui*) descended of Maui Island *ali'i* and related to Ka'ahumanu, Kekau'ōnohi (Makanalua); a chiefess of middle rank (*kaukau ali'i*), Kaunuohua (Kalaupapa); and, a *konohiki*, Kuluwailehua (Kalawao). All of these individuals had close relations to the Kamehameha ruling line, either as consanguineal kin (in the case of Kekau'ōnohi), or as *kahu* (retainers). Their claims to these *ahupua'a* can therefore be traced back to the conquest of Moloka'i by Kamehameha in 1795. For Waikolu, we have reference only to an *'ili* section (Maniania) under the control of another *konohiki*, Nāpōhaku.

LAND CLAIMS OF THE *MAKA'ĀINANA*

Far more informative—from the point of view of teasing out the reticulate net of relations between land and people that formed the fabric of traditional Hawaiian society—are the land claims of the commoners (*maka'āinana*), and varied testimony associated with them. For the four *ahupua'a* that make up the KNHP, there are a total of 101 Mahele land claims, although only 66 of these were actually awarded by the Board of Commissioners to Quiet Land Titles (Table 2).

The claims vary considerably in the style and detail with which they were presented to the Commission. That of Haula, a taro cultivator of Waikolu Valley, presented to the Land Commission on February 1, 1848, is among the simpler and more direct:

> I, the one whose name is below, hereby state to you, the Commissioners to Quiet Titles, that I have a claim for a *lo'i* [taro pondfield] in the *mo'o* [land subsection] of Kapalaha, *'ili* [land section] of Makaluahau, Ahupua'a of Kalawao, Island of Molokai. There are some witnesses. The length is 528 feet on the west, the width is 66 feet. These are my claims.
> Aloha to you all.
> HAULA
> Waikolu, Molokai, February 1, 1848
> (NR 229v7, LCA 8104).

Haula evidently saw no need to recite a long litany of how his land had been held through the successive tenures of various *konohiki*, or land stewards, as did one Kaaikapu of Kalaupapa *ahupua'a*, who entered his claim for 9.5 acres:

> For your information, O Land Commissioners, I have a claim in the Ahupua'a of Kalaupapa, Island of Molokai, an *'ili*, named Kokipohaku. This *'ili* lies from the *pali* of Keolewa to the Church of Kalaupapa, Makai by at the back of the house of Kauhi, which is the boundary. It is bounded as follows: Kaiaka is *makai* adjoining the sea, Kokipohaku is one side. Here are these claims: a "jump" [*lele*] from within Kokipohaku, but it is still Kokipohaku. This "jump" of mine is in the *kula*. It is situated as follows: Ohia is in the sea [sic], Ahuli is *mauka*, Kakaanalua is *makai* and Kokipohaku is the eastward. I received this *'ili* when Kaneikapuahakea was *konohiki* here in Kalaupapa—he gave it to me, Koiole, this *'ili* of Kokipohaku.
>
> Kanekapuahakea was dispossessed, Kanaina was appointed, and I still have my *'ili*. Kanaina was dispossessed and Heeia was appointed and I still had the *'ili*. Heeia was dispossessed and Puaaloa was appointed and I still had the *'ili*. Puaaloa was dispossessed and Kekua was appointed and I still had the *'ili*. Kekua was dispossessed and Kanakaole was appointed and I still had the *'ili*. While Kanakaole was *konohiki*, I, Koiole, became feeble, therefore I gave my *'ili* to my *keiki*, Kaaihapuu, to care for it forever. The witnesses are: Kaoha, Kainaina, and Kaikai. I request you, the

Table 2 Summary of Mahele Land Claims, KNHP.

Ahupua`a	No. of Claims	No. of Awards	*Kalo* lands (*mo`o* or *lo`i*)	*Kula* lands
Waikolu	24	21 (87%)	20 (83%)	6 (25%)
Kalawao	14	11 (78%)	10 (71%)	6 (43%)
Makanalua	12	1 (8%)	2 (17%)	2 (17%)
Kalaupapa	51	33 (65%)	14 (27%)	28 (55%)

Commissioners to Quite Land Titles, to award this land to Kaaihapuu.
KAAIHAPUU (NR 270-271v7, LCA 8963).

The wording of Kaaihapuu's claim is especially interesting, for it exhibits a wonderful example of what anthropologist Marshall Sahlins (1985:47, fn19) has called the "kinship I," or the "heroic I," a characteristic aspect of Polynesian cultures, in which the living assume the voice of their ancestors. Thus, although it is Kaaihapuu making the claim before the Commissioners, he speaks in the first person singular for his deceased father, Koiole. We know, indeed, from the testimony of Mahoe, given before the Land Commission on October 3, 1853, that Koiole had passed away in 1850:

> Mahoe, sworn, I know his land in the 'Ili "Kokipohaku", Kalaupapa, Molokai.
> Mauka, land of Moeimua
> Waikolu and Makai, land of Konohiki
> Kaluakoi, house lot of Maino.
>
> It was from his parent, Koiole, in 1850. At the time he died he bequeathed it to Kaaihapuu, and he had had it in the time of Kamehameha I. He stayed there and cultivated this land partially, most of the land was overgrown, and he stays there now—I never heard that it had been objected to by the Konohiki, and he is now objecting. (FT 147v15)

We also find, on pursuing the Foreign Testimony in this case, why Kaaihapuu was as pains to relate how the land had been held in his line since the time of Kamehameha I, for the *konohiki* (presumably Kanakaole at this time) was disputing the size of Kaaihapuu's claim:

> Kamaipelekane, sworn, (Deputy Konohiki). This claim was disputed at the time it was formerly surveyed, because of the excessive size, and I object to it today—it is better to reduce it. I agree that he should be given nine acres, and the remainder is for the *konohiki*.
>
> It was decided that the Konohiki was right, and Kaaihapuu agreed to it. (FT 147v15).

These were the local politics of the Mahele for Kaaihapuu, the *keiki* of Koiole.

Yet Kaaihapuu may be counted among the fortunate, for he received his 9.5 acres, as LCA 8963 from the Land Commissioners. Not so fortunate were many others, whose claims were entered and denied, or simply lost. In Makanalua *ahupua'a*, especially, only one claim out of 12 submitted was awarded (Table 2). Pulihi, Naone, Kaaea, Lai, Wahia, Kekolohe, Kawelo, Mauikoaole, Paele, and Puuone all duly entered their claims, some (such as Kawelo, NR 271-272v7) reciting the usual litany of *konohiki* under whom they had held their title for decades. Kawelo was not awarded his claim to the *mo'o* named Mahana, nor were the others given their claimed parcels. In all of Makanalua, only one Kekinolau was to receive the land he claimed "from past remembrance", an "inherited land" (*'āina ho'oilina*). We can only now speculate as to why only Kekinolau, out of 12 claimants within Makanalua *ahupua'a*, should have been awarded his 6.01 acres. Does this history correlate in some manner with the fact that this *ahupua'a* was held by a true *ali'i nui*, or ranking chiefess, Miriam Kekau'ōnohi? Did Kekau'ōnohi, through her *konohiki*, or through her other political connections, in ways not recorded in the documentary history, exert pressure to keep her "native tenants" from receiving their lands? In that vein, does one push the evidence too far to note that Kalaupapa *ahupua'a*, where 35% of claimants were denied awards, was under the control of the chiefess Kaunuohua, not a great *ali'i* such as Miriam Kekau'ōnohi, but nonetheless an *ali'i* of some influence, an important *kahu* in the court of the King Kauikeaouli? The contrast with Kalawao, in which 11 of 14 claimants received their lands, and with Waikolu in which only three out of 24 were de-

nied, does call out for an explanation. Kalawao, we know, had been given up by a *konohiki*, Samuel Kuluwailehua, at the time of the Great Mahele, and thus he would have had no further interest in deterring any of his "native tenants" from receiving lands on which they resided and cultivated. For Waikolu, where the greatest percentage of *maka'āinana* claimants received their lands, the relationship between commoners and *ali'i* remains unclear.

THE HIERARCHY OF LANDS

In pre-Mahele Hawai'i, the land (*'āina*) was divided and redivided by a complex hierarchy of categories of varied size and economic importance, categories which corresponded to a socio-political hierarchy of persons and groups.[5] At the apex of this hierarchy was the island or district, *moku*, the term itself being derived from the ancient Proto Polynesian word **motu*, meaning an island or islet (Kirch and Green 2001:105). At the time of European contact, most Hawaiian Islands were divided into several (often six) *moku*, each of which may at previous times have stood as independent political units, but which were by then under the control of a single paramount chief (sometimes referred to as the *ali'i 'ai moku*, or 'district-eating chief'). In the case of Moloka'i Island, there were two such *moku*, the leeward district of Kona and the windward district of Ko'olau, the latter including the lands of KNHP. As related above, these had at one time been independent political units—frequently at war with each other—but both had been brought variously under the control of the more powerful Maui and O'ahu chiefs in the decades prior to European arrival. After Kamehameha I's conquest in 1795, they had come under his control.

The Ko'olau *moku*, as was the pattern everywhere, was subdivided into a series of major units—the *ahupua'a* —which in theory were independent or self-sustaining economic units, each under the control of a chief (called the *ali'i 'ai ahupua'a*) or a *konohiki*. Often *ahupua'a* corresponded to a valley drainage basin, as in the case of Waikolu, and typically these ran from the mountain peaks, radially outwards to the shore and reef, thus cross-cutting the ecological grain of the land. In the case of the Kalaupapa Peninsula, the three *ahupua'a* of Kalawao, Makanalua, and Kalaupapa subdivided the peninsula from south to north, thus incorporating a range of terrain from mountain and cliffs, across the talus slopes and peninsula itself, out to the shoreline (Fig. 5). But these *ahupua'a* were by no means equivalent in their specific environmental characteristics and resources. Kalawao incorporated within its boundaries the sizeable valley of Wai'ale'ia and the most generous portion of colluvial slopes, but its coastline is largely one of wave-lashed cliffs which makes fishing or shellfish gathering risky much of the year. Makanalua took in the narrow valley of Waihānau, giving it some freshwater resources, and also incorporated the crater of Kauhakō, running then across the center of the peninsula. Kalaupapa, in the west, included the lower extent of Waihānau Stream where it ran into the sea, and also enjoyed the more sheltered western coastline where fishing and marine resource gathering are the best.

Ahupua'a were further subdivided into subsections called *'ili 'āina* or simply *'ili*, and these latter were again subdivided into smaller units called *mo'o 'āina* or *mo'o*. Typically, a given *'ili* might contain several *mo'o*, each *mo'o* held by a single residential group who worked the land either as irrigated taro pondfields (*lo'i*), or as dryland fields (*kula* lands, often referred to also as *kīhāpai*, or sometimes as *māla*). Complicating this hierarchy were the additional categories of *kō'ele* or *pō'alima* lands, agricultural plots which were held by the chief or *konohiki*, but worked by the commoner tenants, as well as *'ili kūpono* (or *'ili kū*), the latter being *'ili* which were held independently of the *ahupua'a* in which they were located. Moreover, some *'ili* and especially *mo'o* fell into a category known as *lele* (from the verb 'to jump'), meaning that they were situated within a separate land section. Thus, a land claimant might refer to his main lands within a particular *ahupua'a* and *'ili*, but then claim a *lele* lying within another *'ili* or *ahupua'a*. The result was a highly complex mosaic, simultaneously hierarchical and reticulate in nature.

The land records of the Mahele allow us to partially reconstruct the particular mosaic of lands within the Kalaupapa region, as given in Table 3. Unfortunately, in the absence of cadastral surveys (evidently most of the LCA awards in the KNHP were not surveyed prior to the land being taken

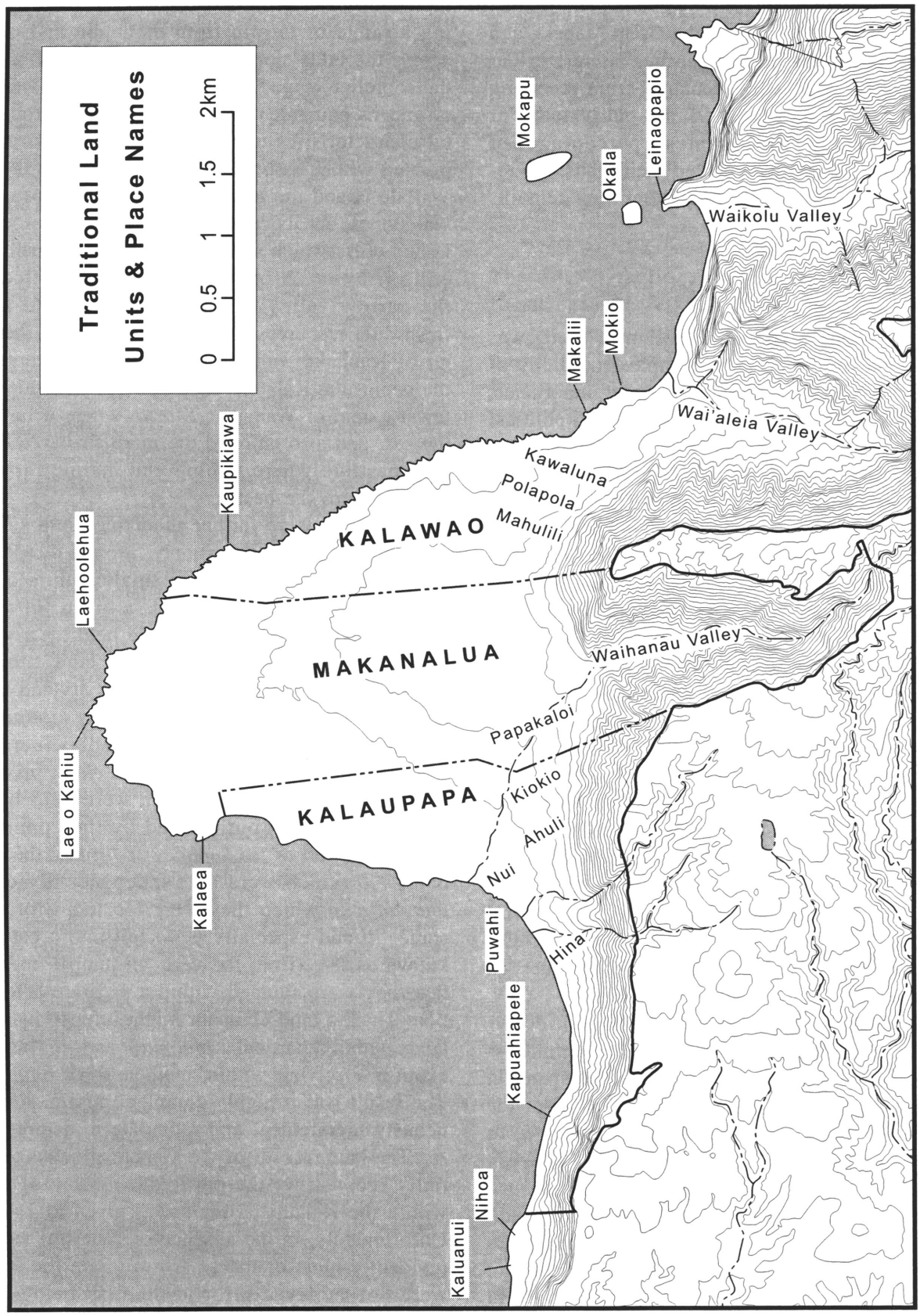


Figure 5 Map showing the traditional land units within the area of Kalaupapa Peninsula, and some of the local place names.

over for the leprosy settlement), it is not possible to situate most of these *'ili* and *mo'o* parcels on the ground. However, their relative positions can sometimes be inferred from the directions and place names given in the land claims themselves. Thus, for example, we know that the *'ili* of Maniania was situated within the "deep recess" of Waikolu Valley. Also, many *'ili* in Makanalua and Kalaupapa seem to have run from the cliffs (*pali*) to the sea. Fortunately, some of the *'ili* or *mo'o* names also appear on general maps made by surveyors for the Hawaiian Kingdom, or later for the Territorial Government. For example, a number of these names appear on the Hawaii Territorial Survey map of the "United States Leprosy Station Sites" by George F. Wright, dated June 1905 (traced from an earlier Government Survey registered map no. 1728), on file in the State of Hawai'i Survey Office (Honolulu). This and other maps have allowed us to determine the approximate locations of several key land sections, such as Ahuli and Papakailoi, the latter referred to in a number of land claims and possibly an important locus of *lo'i* (pondfields).[6] Figure 5 shows the locations of these place names, as best as we can locate them with available sources.

KONOHIKI SUCCESSION

A typical aspect of the Mahele claims of *maka'āinana* is reference to the particular *konohiki* under whom the claimant held or received rights to work and reside on the land. As noted earlier, much emphasis was often placed on naming a succession of *konohiki* under whom one had continued to hold land rights, thus validating one's claim as a land right of long standing. As Kirch and Sahlins (1992) have shown for Anahulu on O'ahu, there was a hierarchy of *maka'āinana*, with those who had been resident for some decades or generations (especially, those who could trace their claims to the time of Kamehameha I) being differentiated as *kama'āina* or *kupa* residents, as distinct from *hoa 'āina* residents who held their lands under a more recent (and often tenuous) arrangement with the present *konohiki*. In the Anahulu case, *kama'āina* claimants were favored in terms of the frequency with which their claims were awarded, and generally received larger plots as well (Kirch and Sahlins 1992, Vol. 1:187, table 8.6). In Table 4 we list data derived from the Mahele records for the claims within KNHP with respect to *konohiki* successions, or other references to *konohiki*. Makanalua and Kalaupapa seem to have had at least seven successive *konohiki* appointed and "dispossessed" within the period referred to (presumably, since the conquest of Kamehameha I, hence about 50 years); Waikolu had at least three. This would appear to be a relatively high rate of turnover for *konohiki* appointments, and raises questions concerning the stability of the local political system.

ECONOMIC INFRASTRUCTURE

More than anything, the Mahele records tell us much of significance regarding the economic organization of pre-Mahele society, data that are invaluable for the interpretation of the archaeological record. For the Kalaupapa region, a pattern that pervades the *maka'āinana* claims is that of dual land holdings, one "wet" and one "dry." This pattern can be taken as a local manifestation of the widespread Polynesian emphasis on both wet (irrigated) cultivation, primarily of taro, and dryland cultivation of yams or, in Eastern Polynesia, sweet potatoes (Kirch 1994). The claim of Kailua in Kalawao exemplifies the pattern:

> I have a taro *mo'o* which is 66 fathoms by 22 fathoms [the taro *lo'i*]. There is a kula *mo'o* for sweet potatoes which is 11,000 fathoms by a width of 33 fathoms. It was received from Malo, the *konohiki* of Kalawao. It has been continuously occupied. (LCA 4951, NR 136-137v7).

Here, as elsewhere, the two *mo'o* parcels, one wet and one dry, were situated in different and physically separate ecological zones. A similar claim is that of Haula:

> I, the one whose name is below, hereby state to you, the Commissioners to Quiet Land Titles, that I have a claim for a *lo'i* in the *mo'o* of Kapalaha, *'ili* of Makaluahau, Ahupua'a of Kalawao, Island of Molokai. There are some witnesses. The length is 528 feet, the width is 66 feet. These are my claims.
> Aloha to you all.
> HAULA
> Waikolu, Molokai, February 1, 1848.
> (LCA 8104, NR 229v7).

What comes out in the testimony accompanying Haula's claim is that there are two separate parcels (*apana*), one wet and one dry:

Table 3 Names of *Ahupua'a*, *'Ili*, and *Mo'o* as derived from Mahele Claims (1848-52).

Ahupua'a Name	*'Ili* Name	*Mo'o* Name	LCA References	Remarks
WAIKOLU				
	Aihue		5004B	
	Kailiili		11009	*Lele* of Makakupaia *ahupua'a* (Kona district)
	Kawailoa		11009	*Lele* of Makakupaia *ahupua'a* (Kona district)
	Kaleakauea		4951	May be in Kalawao *ahupua'a*
	Kiau, Kiao	Puhiula Ululoloa	8913, 8942, 10502	Said to be *lele* of Makanalua
	Kukaenui		10502	*Lele* of Kamiloloa (Kona district)
	Leponui		8942, 10108, 10502	
	Maniania		8942, 10108	"deep recess at head of the valley"
	Puupuione		10502	*Lele* of Naiwa
KALAWAO				
	Ahina	Ahina	8632, 8902, 8903	Variously given as *'ili* or *mo'o*
	Aimanu		8945	
	Akolekaihu		4540, 4951	May be *'ili* (*lele*) of Kamalo (Kona district)
	Haole	Pukialo	5020B	
	Kamaloo		4947	
	Kawaeolono		8902	Bounded by Ahina on N
	Kawaluna		4962	
	Kipapa		8946	
	Kulahuhu		4945, 5020B	Claimed as *ahupua'a* of Hālawa (4945); also named as *mo'o* (5020B)
	Kumani		4988	
	Mahulili		4962	Adjacent to *'ili* of Polapola
	Makaluahau	Ahina	8104, 8632,	Kapalaha may be *lele* of Kalawao
	Makaluakua	Kapalaha	8946	
	Polapola		4962	Between *'ili* of Kawaluna and Mahulili; taro *lele* of Halepoki in Waikolu
	Uluopuhi		176B	
	Wai'ale'ia		04723B	Claimed as *ahupua'a* of Hālawa
	----	Pohiwa	181B	*'Ili* not named
MAKANALUA				
	Kiihanailua		10124	From sea of Hoolehua to *pali* of Kiihanailua
	Makanakunahele		8909	From sea of Kahili to Pahumahana
	Ohia	Ohia Ohiaiki	1992C, 9992, 10849	From stream of Waihanau to *pali* of Kaweeku; same as Ohia in Kalaupapa ?
	Palawai		8631	Runs straight in Waikanao
	Waihanau	Momuku	8633	
	----	Kapua	5911B	No *'ili* named
	----	Kahalakoma	00000Mo19	No *'ili* named
	----	Kiao	182B	No *'ili* named
	----	Lihau	00000Mo16, 8631	No *'ili* named
KALAUPAPA				
	Ahuli	Moomuku	197B, 5010B, 9836, 10475	Niu on one side, Hauola on other
	Hauula, Hauola	Hauola	198B, 8066	From Kapoloa to *pali* of Keolewa
	Hina, Mahina	Moohueoloole	8028, 10126	Has *lele* named Halemanu in Waikolu
	Kawahine		10499	Cultivated *kula*
	Keahua		10476	Bounded by Ohia and Hauola
	Kiokio	Kahuku Papaele	00000Mo12, 8960, 10850	
	Kokipohaku	Kuamoo	8962, 8963	From sea of Iliopii to *pali* of Keolewa
	Niu, Niunui	Kauhiokalani Niuiki Niunui	7776B, 10572	7776B: N is Keolewa, E is Ahuli, S is Kaiaka, W is Niniki; 10572: Kokipohaku on W, Niuniu on E, Kaiaka on S
	Ohia	Kauamanu Iliilikaa Ohianui	8533, 8605, 8914, 10151, 10850B	Same as Ohia in Makanalua ?; from *'ili* of Naale to *ahupua'a* of Makanalua; has 2 *lele*, a fishery named Papaloa, Kenopano in Waikolu
	----	Hulula	10830	*'Ili* not named; has *lele* in Makanalua named Namae (a *mala*)
	----	Kahakuma	185B	*'Ili* not named
	----	Kaiaka	184B	*'Ili* not named
	----	Kaiwiiki, Kaiuiki	00000Mo14	*'Ili* not named
	----	Kaulu	9900	Cultivated kihapai named Kualele; *'ili* not named
	----	Mahaka, Alahaka	196B	*'Ili* not named

> Kii, sworn, I know his *apanas* of land at "Kakaluakau", Kalawao, Waikolu.
> *Apana* 1: *Apana* of taro land. [*apana aina kalo*]
> *Apana* 2: *Apana* of sweet potato land. [*apana aina uwala*]
> *Apana* 1 is bounded as follows:
> *Mauka, kula* land Kalaupapa and *Makai*, a stream Pelekunu, land of Haula 2.He received this land from Apiki when Kinau was alive and has had quiet and undisputed possession until the pr esent. 2 Government [*Aupuni*] *lo'i* are in *Apana* 1.Kailua, sworn. The foregoing testimony is true—it is the same as my knowledge of it.
> (FT 139v15).

Of additional interest in Kailua's case is the reporting of two taro pondfields situated within his wetland holding, which are said to belong to the "Government" (*Aupuni*), and hence were *kō'ele* or *pō'alima* plots, those worked by the *maka'āinana* for the benefit of the *konohiki* and chiefs. There are similar references to *kō'ele* and *pō'alima* plots throughout the Mahele claims for our region, demonstrating the pervasiveness of *maka'āinana* labor in generating agricultural production for the support of the chiefly class (see Kirch and Sahlins [1992] on the general structure of tributary relations in the early 19th century). One case of particular interest is the claim of Kanakaole (LCA 5012B, FT 68v6), in which, in addition to four *pō'alima lo'i* there is one "*pō'alima* patch of *olonā*". *Olonā* (*Touchardia latifolia*) was cultivated for its fibrous bast, which produced the finest cordage for fishing lines and other uses.

Frequently, the different wet and dry *mo'o* or *'apana* claimed by a cultivator were situated within the same *ahupua'a*, particularly in Kalawao and Waikolu, which offered ecological zones favorable to both kinds of farming. As often, however, one of the *mo'o* is identified as being a *lele*, or "jump". This was the case with Kaluaaku of Kalaupapa, who claimed a *lele* of wet land in the *ahupua'a* of Waikolu (LCA 8914, NR 249-250v7), as well as a *lele* named Papaloa, the latter being a "fishery" in the sea. Another Kalaupapa claimant with a *lele*

Table 4 Konohiki Succession in Kalaupapa Region *Ahupua'a**

Waikolu *Ahupua'a*	
8912:	Kanakaokai *konohiki* at Mahulili, Kanakaokai dispossessed, Kanaina appointed, Kanaina dispossessed, Kaha appointed
10502:	Received land in Kiau from Kaaihapuu (in 1844), and from Kakualike (in 1837)
Kalawao *Ahupua'a*	
4945:	Paia was the former *konohiki* and Timoteo is the present *konohiki* (note: Timoteo was *konohiki* of Halawa); land was received from Kiekie, the *konohiki* of Kalauao
4947:	Received from Kekiekie, *konohiki* of Kalawao
4951:	Received from Malo, the *konohiki* of Kalawao
Makanalua *Ahupua'a*	
8631:	Succession of Makanalua *konohiki*: Nakaluha, Haawiuhane, Hemahema, Pukeke, Kekuelike, Pahia, Kaaihapuu (at present)
8633:	Succession of Makanalua *konohiki*: Makaluha, Hemahema, Pukeke, Pahia, Kaaihapuu
8964:	Succession of Makanalua *konohiki*: Nakauha (also spelled Nakaluha), Kohepukai, Pukeke, Kekuelike, Pahia, Kaaihapuu
9992;	Succession of Makanalua *konohiki*: Hemahema, Pukeke, Kekuelike, Pahia, Kaaihapuu
10849:	Succession of Makanalua *konohiki*: Pukai, Hamahema, Pukeke, Kekuelike, Pahia, Kaaihapuu (until this year 1848)
Kalaupapa *Ahupua'a*	
7776B:	Succession of Kalaupapa *konohiki*: Kawaikapuakahaaheo, Kanaina, Heeia, Puaaloa, Kekua, Kupu, Kanakaole
8533:	K Succession of Kalaupapa *konohiki*: Kawelo, Kanaina, Heeia, Puaaloa, Kekua, Kupu, Kanakaole
8963:	Succession of Kalaupapa *konohiki*: Kaneikapuahakea, Kanaina, Heeia, Puaaloa, Kekua, Kanakaole

* Numbers refer to LCA awards.

for wet taro in Waikolu was Mai:

> For your information, O Commissioners to Quiet Land Titles, I have a claim in a *mo'o* in the *Ahupua'a* of Kalaupapa. It is 77 fathoms long by 66 fathoms wide. My claim has a *lele*, named Halemanu. This is taro land, at Waikolu, bounded by Puupaneenee on the north, by Alahaka on the east, by Kiokio on the south and by the sea on the west. (LCA 10126, NR 295v7).

The claim of Nakoa (LCA 10502, NT 197v6) identifies Kiau (or Kiao) as an *'ili* in Waikolu which is a *lele* of Makanalua. Kalahili of Makanalua (one of those *maka'āinana* whose claim was denied by the Land Commission) describes his situation with a main parcel in the *'ili* of Makanakunahele, but with *lele* in the *'ili* of Palawai and Waihānau, the latter probably for wet taro, given the reference to a water source:

> Greetings to the Land Commissioners: I have a claim for land in the *Ahupua'a* of Makanalua on the Island of Molokai. It is an *'ili*, named Makanakunahele. It is situated as follows: from the sea of Kahili as far as to Puahumahana. It is bounded, as it lies from inland to the sea, by Palawai on one side, by Paoole on one side, by the sea of Kahili on one side, and by Puaakaa on the *mauka* side. The *lele* lands are: Puaaikauai, in the *'ili* of Palawai, bounded by Kapua on one side and by Palawai on one side. The *lele* of Kainahelehele is in the *'ili* of Waihanau and it is bounded on the *makai* side by Kaanopipalau, on the *mauka* side by a *kumu waihi* [literally: source oozing water], and by Kaweeku on one side and Mahanana on the other side. (LCA 8909, NR 246-247v7).

Lele were not confined to within the four *ahupua'a* making up the Kalaupapa region, and we have several references to *lele* belonging to leeward (Kona) district *ahupua'a* but situated within Waikolu, a pattern also known for other windward valleys. The *'ili* of Ka'ili'ili and Kawailoa in Waikolu are said to be *lele* of Makakupa'ia *ahupua'a* on the leeward coast (see LCA 11009, NR 321-322v7), while the *'ili* of Kūkaenui is associated with Kamiloloa *ahupua'a* (LCA10502, NT 197v6). The ecological principle here is evidently again that of allowing the leeward dwellers to have some access to the wet lands at the back of Waikolu Valley.

Additional information of some archaeological interest comes from physical dimensions reported by claimants for their various *mo'o*, espe-

Table 5 Dimensions of *Maka'āinana* Land Claims.

Claim	Type	Dimensions
Waikolu Ahupua'a		
4951:	kula *mo'o*:	11,000 x 33 fathoms (in Kalawao)
	taro *mo'o*:	66 x 22 fathoms
8913:	taro land	121 x 44 fathoms
Kalawao Ahupua'a		
4953:	sweet potato *mo'o*:	230 fathoms long
5069:	taro *'ili*:	63 x 29 fathoms
8104:	*lo'i* in *mo'o*:	528 x 66 feet
8902:	*kalo* ?	66 x 11 fathoms
8903:	*kalo* ?	77 x 55 fathoms
8946:	*lo'i*	198 x 156 x 120 feet
	kula	2131 x 93 x 78 feet
4540:	potato *kula*	788 x 22 fathoms
	taro	66 x 9 fathoms
04723B:	half taro/s. potato	242 x 8 fathoms
4945:	sweet potato land	975 x 33 fathoms
4947:	*kula*	407 x 47 fathoms
4951:	taro *mo'o*	66 x 22 fathoms
	kula mo'o (s.p.)	11,000 x 33 fathoms
4988:	*kula*	852 x 37 fathoms
8945	*kula*	900 x 48 feet; 1,000 x 28 feet
Kalaupapa Ahupua'a		
7776B:	*kula*	510 x 60.5 fathoms
10572:	?	510 x 22 fathoms

cially from the *ahupua'a* of Kalawao (Table 5). As can be seen from the available data, plots identified as for taro (*kalo*) are generally much smaller and tend to be rectangular in shape. In contrast, the *kula* or dryland plots (often identified as being specifically for sweet potato) tend to be very long and narrow. Setting aside one claim in Kalawao with a length of 11,000 fathoms as a possible exaggeration, the remaining 10 *kula* parcels have a mean length of 495 ± 291 fathoms, and a mean width of 26 ± 18 fathoms. In measures more familiar to us today, this means that an average *kula* plot on the peninsula was about one half mile long, by only 150 feet or so wide. As we will argue later, such long narrow plots fit well with the archaeological remains of a dryland field system on the peninsula, in which the stone rows or walls have a similar long, narrow orientation.

As for crops cultivated by the Mahele claimants, the majority of references are to taro (*kalo*) and sweet potato (*'uala*), in the pattern of dual wet-dry gardening already noted. However, a few claims make reference to other cultigens, such as the *pō'alima* plot of *olonā* mentioned earlier, and a reference in the claim of Kupainalua (LCA 9900, FT 66v6) of Kalaupapa to "a *wauke* patch in a watercourse in a *lele* of *Ohia*, on the mountain". *Wauke* (*Broussonetia papyrifera*) was the plant used to produce bast for barkcloth, and may have flourished better in wetter and more protected conditions "on the mountain" than on the windswept plain of Kalaupapa itself.

CHAPTER 3 ENDNOTES

[1] For the genealogical relations between Kekauluohi and the Kamehameha line of rulers, see Sahlins (1992:fig. 5.5). Kame'eleihiwa (1992:table 19) lists a "Samuela Kuluwaile", presumably Kuluwailehua, as a *konohiki* of intermediate status.

[2] There appears to be a spelling error in the *Indices* (CPL 1929:1379) where Makanalua is rendered as "Makaalua." The error is repeated under the Kekau'ōnohi listing (CPL 1929:68) of lands, where in addition "Makaalua" is identified as being part of the Kona (rather than Ko'olau) district of Moloka'i.

[3] Ha'alelea was one of the famous Hulumanu, or coterie of Kamehameha III, who sandalwooded in the mountains with the King, and among whom the King redivided the lands of Moloka'i in 1837.

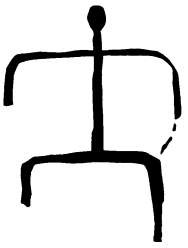
[4] Further details on Mali and his land of Leponui in Maniania is found in the Foreign Testimony: "Mali has been an old Waikolu resident in Maniania, a deep recess at the head of the valley farthest back on Moloka'i. We can get no further information about it than is written in the claim. I would advise to give him Manienie outright as no human being will buy it from the *aupuni* & [illegible] in his *kuleana* [illegible]" (FT 58v6).

[5] Some key accounts of the traditional system of Hawaiian land categories include Malo (1950:16-18), Lyons (1875), and Handy and Pukui (1958:4-5). Kirch and Sahlins (1992) examine in great detail how such land categories were related to the local socio-political system in the case of the Anahulu Valley, O'ahu.

[6] The place names Ahuli and Papakailoi also appear on the 1924 USGS topographic map of Kalaupapa quadrangle, along with a number of other local names, which have been dropped from later editions of the USGS maps. Among these names are the succession of Mahulili, Polapola, and Kawaluna, which are shown as positioned from northwest to southeast along the talus-colluvial slopes in Kalawao *ahupua'a*, thus clarifying the position of *'ili* Polapola, referred to in non-awarded claim 4962 by Kanaokai. The Waihona 'Aina database has this claim listed as within Kalaupapa *ahupua'a* when it should be indexed under Kalawao.

CHAPTER 4

PREVIOUS ARCHAEOLOGICAL RESEARCH AT KALAUPAPA



The history of archaeological research at Kalaupapa, and windward Moloka'i in general, begins in 1909, with the pioneering survey by John F. G. Stokes, then Curator of Polynesian Ethnology at the Bernice Pauahi Bishop Museum. Funded by a grant from the Carnegie Institution, Stokes had been instructed by William T. Brigham, the first Bishop Museum Director, to undertake a survey of *heiau* or temple sites in order to test the latter's theories regarding changes in Hawaiian religious practices (Dye, ed., 1991). This research project had commenced with fieldwork on Hawai'i Island in 1906, and continued with the Moloka'i field survey in 1909. Traveling in part by Native Hawaiian canoe (Dye, ed., 1991, fig. 3), Stokes covered the entire island of Moloka'i, inquiring of Native Hawaiian informants for the locations, names, and other details of *heiau* still known to them. Within the area today encompassed by KNHP, Stokes recorded three *heiau* in Waikolu Valley, a *ko'a* (fishing shrine) and three *heiau* in Kalawao, two *heiau* in Makanalua, and four *heiau* in Kalaupapa *ahupua'a* (Fig. 6).[1] Stokes' field notebooks, plans, and photographs of these sites are preserved in the Bishop Museum archives, although his manuscript report (Stokes, MS) was never published in full. However, the late Cappy Summers, in her masterful overview of the island's known archaeological resources (Summers 1971), incorporated much of Stokes' information and site descriptions. During our 2001 fieldwork, we relocated three of Stokes' *heiau* and *ko'a* sites, and remapped two of these in detail, for purposes of comparison. This component of our work only served to confirm our high esteem of Stokes' methods and reporting standards.

In the long hiatus between Stokes and more recent professional archaeology, only a few brief forays into Kalaupapa archaeology can be counted. Southwick Phelps, a Yale graduate student, was appointed "assistant ethnologist" at the Bishop Museum in 1937, and charged with carrying out a survey of the sites of Moloka'i (Hiroa 1945:57). Phelps' study (MS), never published, was hardly a comprehensive survey, although it did have forward-looking qualities in terms of its landscape and geographic perspective.[2] Phelps (MS, p. 38) listed five sites (#s 29-33) on Kalaupapa peninsula, and two more in Waikolu Valley (#s 35 and 36), but no detailed descriptions were provided. He classified Kalaupapa within his "Region III", which encompassed both the dry western half of the island as well as the peninsula. Phelps (MS., p.11, 58) drew attention to the "low walls for sweet potato patches such as those on the slopes of Kalaupapa Peninsula and Maunaloa in west Molokai", one of the first references to the vast field system of stone walls

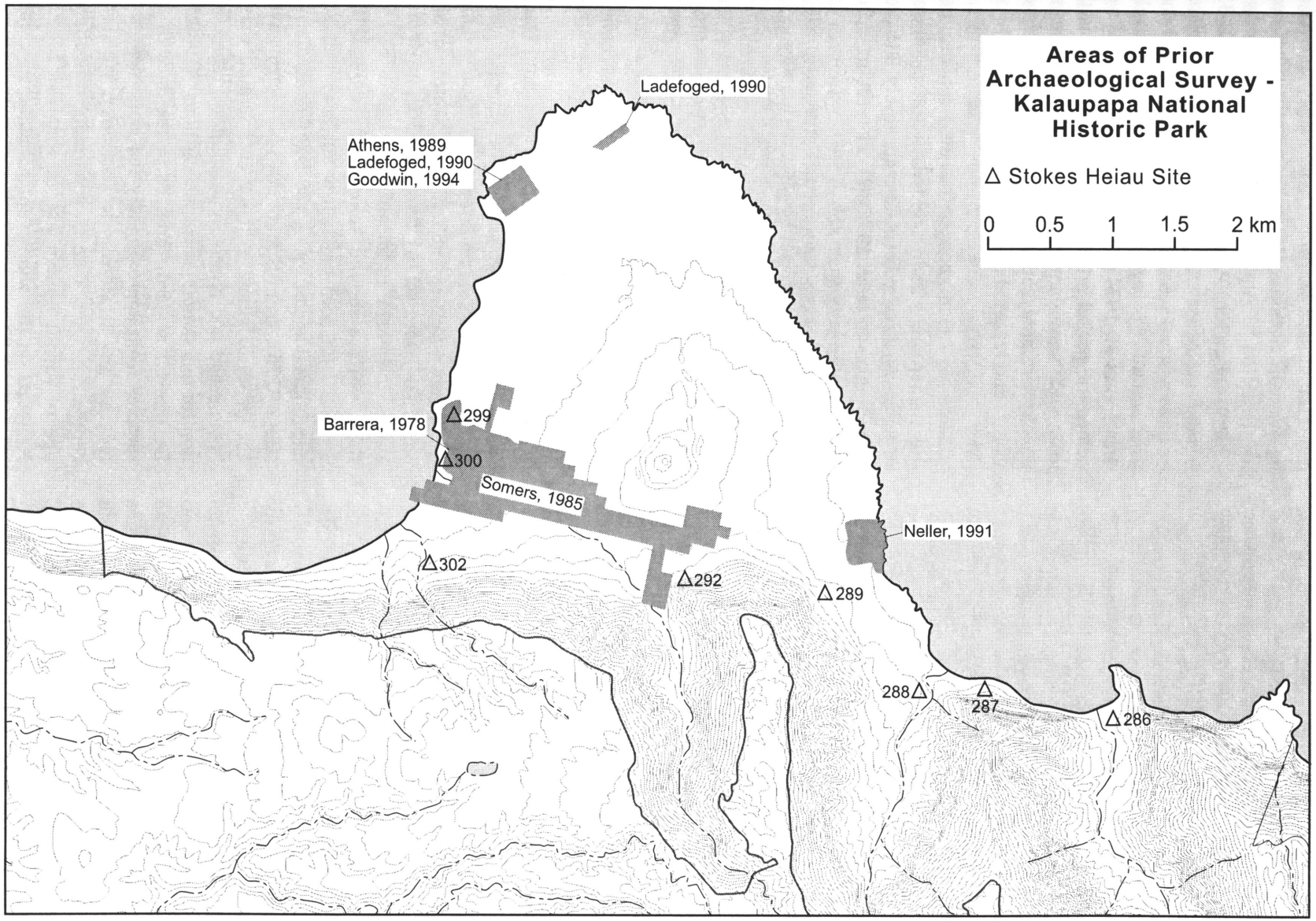


Figure 6 Map showing the locations of *heiau* sites (triangles) recorded by Stokes in 1909 (with numbers assigned by C. Summers), and areas of prior archaeological survey in Kalaupapa National Historical Park.

which covers much of the peninsula. His brief description of these is given in full here:

> In the center of the peninsula is an extinct volcanic cone the top of which is nearly 400 feet in elevation and from which the ground slopes rather evenly in all directions but the southerly. The walls are on the northeastern or windward side only and their course is almost exactly northwest—at right angle to the prevailing northeast trade-winds to which the peninsula is so exposed. These winds are often very strong and it is very likely that the walls served as partial shelters to the sweet potato plants which were probably the vegetable staple of this area. Many of the walls run for over a hundred yards and are quite straight. Their height, as much as one can infer from present conditions, must not have exceeded a foot and a half. Some of them are 10 feet apart while others are farther distant from one another. In addition to sheltering the plants from wind their building aided in clearing the rocky land and it is likely that they also served as boundary lines (Phelps, MS., pp. 11-12).

At virtually the same time that Phelps was carrying out his "regional study" of Moloka'i, one F. L. McHenry, an electrician employed at the Hansen's disease settlement, began making observations of archaeological features on the peninsula.[3] McHenry sent his notes and plans to the Bishop Museum, where they remain on file, although we have not had the opportunity to consult them. Brief quotations from McHenry's manuscripts are given in Summers (1971:188-89) and Goodwin (1994:7-8).

The heady days of archaeological renaissance in the Hawaiian Islands during the 1950s and early 60s, when Kenneth P. Emory and his colleagues were opening up new intellectual terrain with the definition of a cultural sequence based on stratigraphic excavations and fishhook typology (Kirch 2000:29-32), bypassed Kalaupapa without notice. In the spring of 1967, however, Richard Pearson—then a newly recruited member of the University of Hawai'i Anthropology Department faculty—took a small group of UH students to Kalaupapa "for a total of four days during November 1966 and April 1967" (Pearson et al. 1974:44). These trips were part of a course in Laboratory Techniques (University of Hawai'i Anthropology 421), which evidently included both field methods, and "midden analysis", the latter taught in conjunction with "Mrs. Freddy Harby".[4] Pearson selected a lava tube shelter (called by him and, others subsequently, a "cave") for "test pitting." This shelter is situated near Kaupikiawa Point, but was simply referred to by Pearson as "Cave 1"; subsequently it has been identified as "Kaupikiawa Cave" (e.g., Goodwin 1994:9), "Pearson's Cave," or as Site 50-60-03-312 in the State of Hawai'i inventory of historic places. Pearson's small team of students dug several "one yard squares" using "artificial three-inch levels" (Pearson et al. 1974:45). A few pre-contact as well as historic-period artifacts were recovered, but the main yield was a large quantity of shellfish remains, which were analyzed under Freddy Harby's supervision, and reported on in detail by Hirata and Potts (MS [1967]).[5]

Pearson's team thought that their evidence from this shelter site, which included "fragments of iron" in the upper levels, bespoke a relatively late occupation (Pearson et al. 1974:49). They inferred from this more broadly that:

> It would appear that settlement and cultivation on the Kalaupapa Peninsula were relatively late in the sequence of Hawaiian pre-history. If this turns out to be the case after adequate exploration is carried out, it would fit into the general hypothesis of human ecological succession, now being suggested, that the marginal areas of the Hawaiian Islands were inhabited late in the pre-historic sequence (1974:49).

Pearson collected several charcoal samples, which he deposited in the collection of the Bishop Museum, although he did not submit any samples for radiocarbon dating. In 1984, Marshall Weisler and Gary Somers re-examined the Kaupikiawa site, and decided to submit three of Pearson's samples for dating (Weisler 1989:137). A sample of wood charcoal (Beta-9276) from 23-30 cm depth in Square 7 yielded an uncalibrated age of 880 ± 70 B.P., while a second sample (Beta-9962) from Square 7 (at 35.5 cm below surface) yielded an uncalibrated age of 490 ± 180 B.P. The third sample (Beta-9275), from Square 3 (30-38 cm) gave an age of <120 years. Weisler commented that the "young age and relatively deep stratigraphic position [of this sample] seem incongruous" (1989:138). Despite the wide differences in the ages of three samples from approximately the same depths (and lacking any stratigraphic sections), Weisler accepted the oldest date as accurately reflecting the age of initial human use of the lava tube: "At Kalawao on the windswept Kalaupapa Peninsula, a collapsed lava tube shelter (Kaupikiawa) was initially occupied by the 11th century" (1989:126).

Others have continued to cite this date as evidence for nearly a millennium of human settlement on the peninsula.

At roughly the same time that Pearson and his students were analyzing their "midden samples" from Cave 1, Catherine C. Summers completed her inventory of the known sites of Moloka'i, a labor she had been engaged in for many years (Summers 1971). "Cappy" as she was known to her colleagues at the Bishop Museum, where she volunteered, was a member of the *kama'āina* Cooke family who owned Moloka'i Ranch, and she had been one of the early volunteer associates of Kenneth Emory when he first began excavations at South Point and other localities in the early 1950s. Her *Molokai: A Site Survey* was not based so much on original fieldwork (although she knew the island like the back of her hand), as it was a compilation and compendium of both published and unpublished information, not only on sites *per se*, but also place names, folk traditions, and oral literature. It remains the starting place for any archaeological research on the island today.

Summers (1971:188-96), drawing primarily on the unpublished Stokes and McHenry manuscripts in Bishop Museum, reported 20 sites on the peninsula, one site at Nihoa, and four sites in Waikolu Valley, all within the present boundaries of KNHP. Some of these "sites" were merely names of former *heiau* given to Stokes or others. Although Summers surely visited Kalaupapa during her long years working on the island, she appears not to have made any effort to relocate or remap any of these sites. Her report, however, includes verbatim much of Stokes' description of *heiau*, as well as two of his photographs (of site 288, a *ko'a* on the terrace overlooking Wai'ale'ia Valley), and a plan of Site 286, a *heiau* in Waikolu Valley.

In 1974, the State of Hawai'i engaged the Bishop Museum to undertake a "statewide inventory of historic sites," a project that despite its name was essentially a resurvey of known sites, and included preparation of standardized site forms for the Hawai'i Register of Historic Places. The Moloka'i team worked from Summers' recently published synthesis, but only managed to relocate a small number of the Kalaupapa sites. To quote Goodwin: "The fact that this survey team found only three sites on the peninsula, and they placed one of them in the wrong location, begs the question of reliability" (1994:9).

By the mid-1970s, "contract archaeology" or cultural resource management as it has come to be called, arrived at Kalaupapa, first with a project by William Barrera, Jr. in connection with the construction of a new hospital facility within the settlement proper (Barrera, Jr., 1978). Barrera conducted a series of test excavations that reported mixed precontact and historic period deposits.

Far more significant was the project carried out by Ed Ladd and Gary Somers, of the National Park Service, in 1982-83, the first modern, professional archaeological survey of portions of KNHP (Somers n.d. [1985]). The Park itself had been established by Act of Congress (Public Law 96-565) in December 1980, and the Ladd-Somers survey was carried out in advance of improvements to the Kalaupapa water system being planned by NPS and the State Department of Health. Their team intensively surveyed an area of about 79 hectares lying outside of the Kalaupapa settlement proper (see Fig. 6), as well as areas within the settlement (Somers n.d., p. 37).[6] In portions of their survey area, dense concentrations of stone features were discovered, including a large platform structure and a "multi-enclosure" which may be an unrecorded *heiau*.[7] Most of the remains were of mounds, terraces, alignments and similar unimpressive features that were probably associated with dryland cultivation, and were integrated with possible residential features such as walled shelters and enclosures. However, in other portions of the survey area the team found extensive evidence of historic disturbance, including bulldozing. Somers summarized the project results as follows:

> Two conclusions are obvious when one looks at the results of the survey. First, the peninsula was intensively utilized prehistorically and historically and archaeological features can be expected to be found anywhere and everywhere. Second, bulldozing and land clearing have destroyed many archaeological features and have distorted the archaeological record in and around Kalaupapa Settlement and along the road and in the pastures on the way to Kalawao (n.d. [1984], p. 103).

One outcome of Somers' report, which was tellingly titled *Kalaupapa, More Than a Leprosy Settlement*, was heightened awareness that the new Park contained extensive archaeological resources

relating to traditional Hawaiian occupation of the landscape, in addition to the obvious historical resources associated with the period of use as a leprosy settlement. Thus Somers wrote:

> The sheer number and types of archaeological resources that exist today, the possibility that there has been 900 to 1,000 years of occupation and use within the park, and the excellent state of preservation of the resources combine to make Kalaupapa National Historical Park one of the richest and most valuable archaeological preserves in Hawaii (n.d.[1984], p. 117).

Somers further recommended that:

> Archaeologists from other institutions, such as the Bishop Museum, should be encouraged to cooperate with the National Park Service and to conduct archaeological research at Kalaupapa to assist the National Park Service in its attempts to understand and interpret the prehistory and early history of the park (n.d.[1984], p. 119).

Also as a result of the National Park Service's effort to develop KNHP in the early 1980s, historian Linda W. Greene was contracted to carry out an extensive "historic resource study" of Kalaupapa (Greene 1985). Greene's impressive 737 page report, although it dealt with archaeology only peripherally, is an extremely useful compendium of historical information on the post-contact history of KNHP, including many developments which had significant impacts on the region's archaeological resources (such as the construction of water systems, the Federal leprosy research station, roads, etc.). Historical archaeologists, in particular, will find Greene's study immensely valuable.

In 1984 Marshall Weisler, then with the Bishop Museum and having several years of experience working on Moloka'i (particularly at the leeward Kawela site complex), was invited by NPS archaeologist Gary Somers to visit Kalaupapa and lend his advice to efforts at site discovery and recording (Weisler, pers. comm., Oct. 2001). Weisler spent from June 27-30, 1984 visiting the Park, carrying out reconnaissance level survey in Kauhakō Crater, on the Nihoa landshelf, and in Wai'ale'ia and Waikolu Valleys. It was at this time that Weisler and Somers re-evaluated Pearson's excavation at the Kaupikiawa lava tube shelter, and submitted three charcoal samples for radiocarbon dating (see above). Other than incorporating the results of these radiocarbon dates into his paper on Moloka'i cultural chronology (Weisler 1989), Weisler did not formally write up the results of his reconnaissance forays in KNHP.

In 1986, Martha Yent of the Division of State Parks surveyed portions of the upper valley of Waikolu, in conjunction with the development of three proposed well sites by the Division of Land and Water Development of the State of Hawai'i (Yent MS [1986]). Yent briefly documented several sets of agricultural terraces, probably for the irrigated cultivation of taro (*Colocasia esculenta*).

From 1988 to 1994, a succession of archaeological studies was initiated by a proposed realignment of the small-plane landing strip, Kalaupapa Airport, situated on the northwestern tip of the peninsula. A reconnaissance survey was first conducted by Athens (1989), who discovered a large number of surface stone structures and features in the potential zones of impact. This led to a more intensive survey by Thegn Ladefoged (1990), and ultimately to a full-scale excavation and mitigation project on an historic period house site and associated "sweet potato farm" dating to the mid-19th century (Goodwin 1994). Ladefoged's study is of particular importance, as he was the first since Phelps and McHenry to draw attention to the extensive sets of parallel stone rows or walls which form a dryland field system over much of the peninsula. In summarizing the agricultural features, Ladefoged wrote:

> There are two main types of agricultural complexes in the west end of the study area. These include alignments with enclosures around them, and alignments without enclosures. . . The density of alignments is much higher within the enclosures than the areas outside of the enclosures. . . It is possible that the agricultural enclosures are a later intensification of an earlier field system. The test excavations in the two agricultural contexts support this notion. The two test units were excavated behind agricultural walls contained in enclosure 5B. In both instances buried alignments were encountered. A radiocarbon date associated with one of these alignments [Beta-33172, 510 ± 80 B.P.] indicates that the area could have been used for agricultural purposes as early as the thirteenth century (1990:182).

Although Ladefoged clearly recognized that at least some agricultural features could have considerable antiquity, he was impressed that "the vast majority of features in the study area appear to date to the historic era" (1990:183). Aware from historical accounts that Kalaupapa had been a major

source of both sweet potatoes and Irish potatoes for export to California in the 1850s, Ladefoged advanced the hypothesis that much of the peninsula's field system had been intensified in the mid-19th century. "Of course it is possible that the occupation and agricultural intensification took place during an earlier phase of the historic era, but the historical accounts indicate that the mid-nineteenth century is the most likely period" (1990:184).

Ladefoged followed up on this hypothesis in a short paper in the journal *Pacific Studies* (Ladefoged 1993). He summarized historical data on economic trends in the islands during the 19th century, which clearly documented that the impetus for a mid-century phase of intensification was present. He writes:

> By the late 1840s there was an economic shift in Hawai'i from provisioning ships in transit to actual exportation of produce. The west coast of America experienced an unprecedented economic boom during the California gold rush. The massive influx of prospectors and merchants [to California] had to be fed. Hawai'i proved to be an excellent resource base for food staples because of its geographic proximity and low production costs. For example, Irish potatoes could be purchased for $2 a barrel in Hawai'i and sold for $27 a barrel in California . . . (1993:124).

Ladefoged concluded from this, and from the fact that the majority of archaeological remains in proximity to the landing-strip were obviously of historic age, that the extant configuration of the Kalaupapa field system dated primarily to this mid-19th century phase of intensification. Indeed, he generalized further from the Kalaupapa case, to suggest that perhaps "a later phase of historic intensification affected the surviving archaeological remains of field systems" in other areas, such as Kohala and Waimea on Hawai'i Island (1993:127-28). Ladefoged's hypothesis certainly remains a critical research question needing further work, and we will return to this later in our report.

The final stage of archaeological work associated with the airport improvement project was the data recovery excavation carried out by "Mac" Goodwin (1994) at site 1801, a "sweet potato farmstead" occupied between about 1845 and 1865. Goodwin's report, certainly one of the best documented and presented excavations of a historic-period Native Hawaiian habitation yet carried out in the islands, also makes entertaining reading in its rendering of the politically-charged controversies surrounding site 1801 (Feature 2). This large platform had been held by some to be a *heiau*, although Goodwin demonstrates without a shadow of a doubt that the structure was part of an historic period farmstead. Goodwin's excavation adds considerable fine-grained detail to Ladefoged's more general model of historic-period intensification of sweet potato cultivation at Kalaupapa.

Since the completion of the Athens-Ladefoged-Goodwin series of projects associated with the airport improvement project, some archaeological studies have continued within KNHP, largely conducted by NPS staff or by State of Hawai'i archaeologists (the latter in part through mitigation efforts carried out during the filming of the movie *Damien*). Earle "Buddy" Neller, who was resident at KNHP for several years, made extensive reconnaissance surveys and located a large number of sites, but evidently removed all of his fieldnotes when he left the employ of the NPS (D. Alexander, pers. comm., August 2000). However, two incomplete manuscript reports exist, documenting some of Neller's activities during this period. The most important, Manning and Neller (MS), presents the results of five surface surveys carried out by Neller and Elizabeth Manning (a former Berkeley student of PVK's), between June and November 1991. Evidently some 92 acres were covered. The most significant of these surveys was "an arbitrary transect across the peninsula through the agricultural fields of Makanalua and Kalawao to the coast, from Makapulapai to Kaupikiawa" (Manning and Neller, MS). This survey began at the Makapulapai benchmark and "heads due east at 90°, ending at the coast near Kaupikiawa Cave". Some 108 features, grouped into 45 sites, were recorded, in a total area of 12.8 hectares. Unfortunately, the manuscript report we consulted in the KNHP archives lacked all maps, photos, or figures, and the final report has not been published by the NPS.[8] The second manuscript (Radewagen and Neller, MS) concerns a survey of the "Kaupikiawa Lava Tube System," which incorporates the "Cave 1" site excavated by Pearson.[9]

Most recently, portions of the interior slopes of Kauhakō Crater have been intensively surveyed by archaeological consultants under contract to the

National Park Service. Final reports, if these have been completed, have not been made available to us.

To sum up, the history of prior archaeological research within KNHP has been sporadic and in large part unsystematic. Early efforts were focused on the documentation of *heiau*, while more recent work has largely been driven by cultural resource management concerns (e.g., the surveys by Ladd and Somers, and the work at the airport runway site). Very little work has been conducted with basic research questions to the fore, and there have been no systematic efforts to extensively document the archaeological landscape of either the peninsula or nearby valleys. The only excavations have been those of Pearson in the Kaupikiawa lava tube shelter site, and the data recovery efforts of Barrera and Goodwin. The latter's study of a mid-19th century farmstead is a masterful piece of historical archaeology, but no pre-contact sites have been excavated since Pearson's early tests.

The cumulative reports summarized above make it abundantly clear that KNHP contains extensive archaeological resources, both pre-contact and historic in age. At the same time, probably less than 5 percent of the habitable or usable surface area of the Park has been intensively surveyed, and most of the covered areas were subjected to heavy historic-period disturbances. The lack of chronologically-controlled data from excavations makes it impossible to even outline a long-term sequence of land use, although there are hints that the peninsula has been occupied for centuries—possibly a millennium—and that the agricultural field systems might have an early pre-contact phase. To encapsulate what we know from the work of those who have proceeded us on the terrain: the archaeological potential is enormous, the gaps in our knowledge equally so.

CHAPTER 4 ENDNOTES

[1] Goodwin (1994:7) quotes from an unpublished MS of Stokes, regarding the difficulty Stokes had in finding Native Hawaiian informants at Kalaupapa who were familiar with the local *heiau* sites. "All the native population of Waikolu, Kalawao, and Kalaupapa was removed many years ago by the government (when this was taken for a leper settlement), and I was able to find out but one man who claimed to know anything at all about this section [of the island]" (Stokes in Goodwin 1994:7).

[2] The date of Phelps' manuscript is uncertain. Summers (1971) gives it as "n.d. (1937)"; Goodwin (1994) cites it as both 1938 and 1941. It is certain that Phelps held his Yale-Bishop Museum fellowship in 1937 (Hiroa 1945:57), but the manuscript seems not to have been completed until later. The copy of Phelps MS which we have consulted is a xerox, made with permission, by the late Peter Chapman in October 1968 (missing pages 31-33), and bears the Bernice P. Bishop Museum Library stamp, dated "JAN 17 1941". It is also marked, in the distinctive handwriting of former Bishop Museum Librarian Margaret Titcomb, "Manuscript Case 3." PVK fondly recalls both Titcomb, and Manuscript Case 3, the unpublished wonders of which the former provided him access to so many years ago.

[3] Although we do not know if Phelps and McHenry met at Kalaupapa, the temporal coincidence is notable, and it might be interesting to determine whether Phelps' fieldwork in any way influenced McHenry, who was by trade an electrician and not formally trained in archaeology, to carry out his amateur observations of archaeological sites.

[4] Freddy Harby had worked extensively in California archaeology prior to moving to Hawai'i, and had amassed a sizable bibliography of publications within the field of midden analysis. During her years in Hawai'i in the late 1960s and early 70s, she volunteered her services at Bishop Museum, and PVK came to know her through numerous social events.

[5] We are in possession of copies of three reports on the 1967 and 1971 excavations at "Cave 1" (Pearson et al. 1974; Hirata and Potts MS [1967] and Hirata and Potts ("Rewritten by R. Pearson") MS [1971]. The latter seems to have been the basis for the published report by Pearson et al. (1974).

[6] At the same time, Marshall Weisler of the Bishop Museum visited Kalaupapa with Somers, and arranged to radiocar-

bon date several samples of charcoal which had been excavated by the Pearson team in "Cave 1" at Kaupikiawa (Somers, n.d., pp.42-43; Weisler 1989).

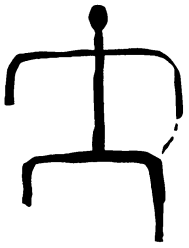
[7] Somers (n.d. [1984], p. 116) speculated that these features, lying close to the boundary between Kalawao and Makanalua *ahupua'a*, "may have been associated with the god Lono and the *Makahiki* festival."

[8] We have been told that the illustrations to accompany the report are on file in Honolulu, but have not been able to examine these. Certainly, the Manning-Neller transect survey is a major contribution to Kalaupapa archaeology, and we would urge its editing and publication as a priority.

[9] This unfinished manuscript was kindly made available to us by Erika Radewagen.

CHAPTER 5

THE 2000 KNHP SURVEY: OBJECTIVES AND METHODS



In our Scope of Work, we laid out three major objectives for our 2000 field season (see Introduction), of which the first and most important was to sample a variety of different environmental/geographical zones throughout the Park, with respect to their varied archaeological landscapes. We envisioned that this sampling would be primarily at a *reconnaissance*, rather than *intensive survey* level, although we did undertake intensive mapping of one area, the Kaupikiawa Transect. For most zones, however, our aim was more modestly to assess the range and types of surface archaeological remains present. Wherever feasible, we recorded in detail the structures and features encountered, including 1:10 or 1:50 compass-and-tape sketch maps, treating these structures and features as representative examples of the kinds of structural remains present within a particular zone. Clearly, we make no claim to comprehensiveness within our sampling areas, as our main objective was not that of inventory survey. A full-scale, intensive survey of the entire KNHP will be a major undertaking which will require resources and time far beyond what has been allocated to date. It will suffice if our reconnaissance assists in the development of such a larger project.

SELECTION OF SAMPLING AREAS

As we have documented, the KNHP encompasses an unusual diversity of terrain, soil types, hydrologic regimes, and biotic communities; indeed, this environmental variability underscores the Park's significance for cultural and natural history investigations. It is reasonable to assume—from what we know of indigenous Hawaiian society and economy elsewhere in the archipelago—that this environmental diversity would have been matched by a variety of specific, local patterns of land use and human settlement, reflected in differing sets of surface archaeological remains. It was our main aim to capture some of this variation by sampling each of several major environmental zones, these being defined by background research and initial field reconnaissance.[1]

Seven areas were chosen for reconnaissance survey, as listed in Table 6, and shown in Figure 7. Two of these were valley drainages, the large valley of Waikolu in which we spent two days, and the smaller Wai'ale'ia Valley which we explored in just a single, arduous day. Two areas are located on the colluvial-talus (taluvial) slopes at the interface between the peninsula and the cliffs; both are within the zone of important Kawaihapai-Haleiwa

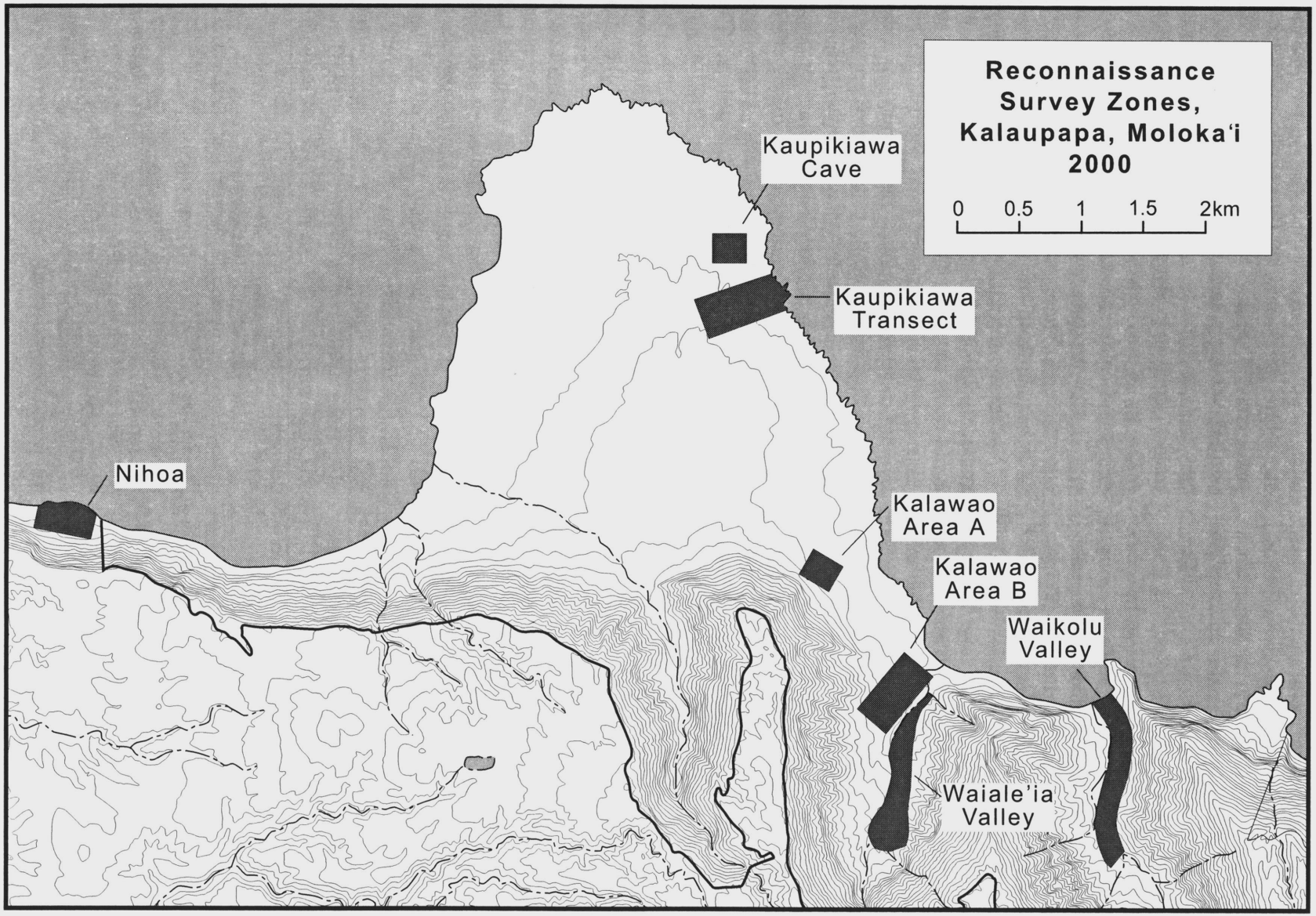


Figure 7 Locations of the reconnaissance survey zones covered during the 2000 archaeological survey, Kalaupapa National Historical Park, Moloka'i.

soils which we identified as a probable horticultural zone of some importance. One reason for suspecting that this colluvial-talus zone had been a focus of traditional land use was the distribution over this zone of four *heiau* or temple sites first recorded by Stokes in 1909 (Summers 1971). Each of these colluvial-talus areas was covered in a day of fieldwork.

The next two areas are located on the peninsula proper. The first, called the Kaupikiawa Transect, runs from the eastern coast roughly east-west up the gentle slopes of the peninsula to the long stone wall marking the boundary between Kalawao and Makanalua *ahupua'a*. This transect thus encompasses a representative part of the major Kalaupapa field system, and in order to sample this field system closely we applied more intensive survey methods, using a plane table and alidade to map the field walls and other features at 1:500. The second peninsular study area was that of surrounding "Pearson's Cave", which we reconnoitered over three days while re-excavating in the lava tube itself. Our final sampling area was the landshelf of Nihoa, a truly unique microenvironment; two trips were made to Nihoa. In all, our team covered an estimated 66.75 hectares (0.67 km^2) of highly varied terrain.

As can be seen from Table 6, these seven areas encompass much of the environmental variability within the KNHP, including key variations in geomorphology, soil type, slope, and rainfall. It would have been interesting to include another colluvial-talus slope sample area in Kalaupapa *ahupua'a*, and a brief foray onto the slopes inland of the old "rock crusher" near Puwahi demonstrated that this area exhibits many surface sites. Another zone which may yield interesting variations is the immediate coastal/littoral strip along the peninsula's shoreline, especially in areas where there are substantial sand dunes and calcareous sediments which may contain midden deposits, buried camp sites, burials, or other features. Time, unfortunately, did not permit us to sample these areas.

Access to the different sampling areas varied considerably, and influenced how much work we could do in each one. The two peninsula areas and the two colluvial-talus slope areas could be reached by van, or hiked to within a few minutes of a dirt road, so that time could be concentrated on survey work. To access Waikolu Valley, however, required more than an hour's hike along the boulder beach from the Wai'ale'ia Stream mouth, including climbing around and over two high fences where these ended on slippery wave-washed boulders.[2] The awe-inspiring hike, under towering 1,000-m high cliffs, cut down considerably on time which could be spent in the valley proper. Most arduous was the route to Nihoa, a punishing 3-km hike each way along a massive boulder/talus beach (parts of its very unstable and subject to falling debris from the cliffs). Several of the old-time Kalaupapa residents expressed amazement when we told them we had been to Nihoa, saying that they had never gone there themselves because it was too far and too dangerous.

Table 6 Some Environmental Characteristics of the Sampling Areas.

Characteristic Features	Waikolu Valley	Wai'ale'ia Valley	Kalawao Colluvium Talus A	Kalawao Colluvium Talus B	Kaupikiawa Transect	Kaupikiawa Cave	Nihoa
Geomorphology	Large valley	Small valley	Colluvial slope	Colluvial slope	Main peninsula slopes	Northern end of peninsula	Landshelf
Soil type(s)	Colluvial series	Colluvial series	Kawai-hapai / Haleiwa	Kawai-hapai / Haleiwa	Kalaupapa series	Rockland	Colluvial / Stony land
Slope	Varied, some steep	Moderate to steep	Gentle	Moderate to steep	Gentle	Nearly flat	Gentle to moderate
Elevation (masl)	1-200	4-200	60-120	60-100	5-60	10-20	20-80
Rainfall (mm, estimated)	1,000-3,0000+	1,000-3,0000+	1,500-2,000	1,500-2,000	1,000-1,500	750-1,000	1,000-1,250
Area surveyed (ha)	15.0	20.0	6.25	5.0	10.5	4.0	6.0

FIELD METHODS

Sites[3] were discovered through close walking of the terrain, generally following predetermined transects or routes. When a site was located, it was flagged and given a temporary number, and its position determined by use of a Magellan ProMARK X global positioning system (GPS) receiver. We always made an attempt to estimate map position independently of our GPS readings, as a cross-check on GPS accuracy. Site coordinates as determined by GPS were recorded in the UTM system, using the NAD83 datum. In theory, these GPS positions should be accurate to within 10 m. However, as has also been reported recently for a similar mountainous and heavily vegetated region in American Samoa (E. Su'afo'a, pers. comm., 2001), it was all too often difficult to get consistent or reliable GPS readings. This was especially the case in the deep valleys, and/or under heavy tree canopy, where the number of available satellites was greatly reduced. Differential correction with the use of a fixed base station may help to improve GPS readings somewhat, but cannot compensate for the back of available satellites. In practical terms, our experience was that GPS worked extremely well on the open plains of the peninsula, moderately well on Nihoa and on the talus slopes, and rather poorly or not at all in the valleys.

Our use of GPS was further complicated by inconsistency in the coordinate systems used on the available USGS maps, with the 1983 1:25,000 Molokai East and West sheets using the Old Hawaiian Datum, and the 1993 Kaunakakai 1:24,000 quadrangle using the 1983 North American Datum (NAD83).[4] Moreover, according to notes published on the 1983 sheets, the Old Hawaiian Datum is offset from the NAD83 datum by 357 m northing and 290 m westing. We mention these problems here because while the use of hand-held GPS units in scientific research has become *de rigueur*, at the same time insufficient attention has been paid to problems of consistency in the use of datums, and in correlating observations GPS observations to published maps. Our own experience has been that while GPS is a remarkable technology, its use still requires careful and continual ground truthing.

After a site's position was determined by GPS or map estimation, it was typically recorded by a team of two persons, using compass and tape to sketch map the site (usually at 1:10 or 1:50 scale). Time constraints did not permit us to clear sites, and in any event we wished our impact on the local vegetation to be minimal, so we doubtless missed minor architectural features when these were obscured by plants. A pre-printed recording form was filled in (we used our well-established Kahikinui, Maui project form as a template), and a free-form verbal description written out. The standardized form included two pages of structured observations, on feature form, probable function, dimensions, wall construction, pavements, entryways, hearths, uprights, presence of coral, artifacts, and surface midden, as well as altimeter readings and GPS data points. Sites were photographed when feasible, but dense vegetation precluded most sites from being adequately photographed. In a few cases, sites were also mapped in detail with plane table and telescopic alidade at 1:100. For the Kaupikiawa Transect, the entire landscape was mapped at 1:500, including the densely packed, low, stacked-stone field boundary walls. Copies of our recording forms have been deposited in the KNHP archives.

CHAPTER 5 ENDNOTES

[1] In this we were aided by the fact that PVK had been able to visit the Park twice prior to the 2000 field season, and had already covered much of the peninsula by vehicle or on foot, including visits into Kauhako Crater and up the colluvial-talus slopes in Kalawao.

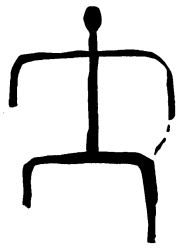
[2] We still cannot understand why the Park employees who installed these fences for much-needed deer and goat control did not bother to install pedestrian gates for the safety of rangers, researchers, or others who must from time-to-time pass along this beach.

[3] The term "site" has a wide range of definitions in archaeology. Here we use the term in a flexible manner to indicate any archaeological feature treated for recording purposes as a discrete entity. Most of the sites referred to in this report are therefore individual stacked-stone architectural features.

[4] We were also informed by USGS Menlo Park, prior to our field season, that no quadrangles were available for the eastern section of KNHP (the old Kamalo quadrangle was out of print), and that it was uncertain when a new edition using the NAD83 datum might become available.

CHAPTER 6

OVERVIEWS OF SAMPLING AREAS



We turn now to the seven sampling areas, giving for each an overview of the local environment and archaeological remains recorded, as well as ethnobotanical observations. Detailed data on individual sites, including sketch plans of all sites, have been deposited in the KNHP archives, and are also available in the Oceanic Archaeology Laboratory, Berkeley. The Appendix to this volume provides a list of site numbers, basic site types, and GPS positions as recorded.

WAIKOLU VALLEY (WK-)

GENERAL OBSERVATIONS

Waikolu is the easternmost and largest valley located with KNHP, one of the four great amphitheater-headed valleys of windward Moloka'i, all of which formerly comprised the Ko'olau chiefdom in ancient times. Waikolu is much larger than Wai'ale'ia, extending some 5 km into the central spine of the East Moloka'i Mountains, and with valley walls rising sheer to heights of 1,000 m. With a more extensive drainage basin, and drawing upon high rainfall on the summit of the East Moloka'i Mountains, Waikolu boasts a permanently flowing stream, with an average discharge of roughly 19 cubic feet per second. Despite the fact that the Moloka'i water tunnel diverts substantial quantities of freshwater from the upper reaches of Waikolu Stream to the island's west end, Waikolu Stream still has permanent flow at the valley mouth. These hydrologic conditions made Waikolu ideal for traditional Hawaiian taro irrigation, and our survey found abundant evidence of irrigation works.

The Mahele land claims likewise reinforce the view of Waikolu as a valley dominated by taro irrigation. Of 24 claims submitted to the Land Commission, 83 percent refer to *lo'i* or to *mo'o* which were clearly for wet taro cultivation (Table 2). Thus it seems certain that the valley landscape was significantly modified by pondfield irrigation within the protohistoric period of Hawaiian history. However, the later 19th and early 20th century history of Waikolu was closely linked to the Kalaupapa leprosy settlement, and this adds a complicating factor in that Waikolu became a major source of taro and *poi* for the settlement, supplied on a contractual, commercial basis. As early as 1870, the Board of Heath reported efforts to extend taro cultivation in Waikolu, and to manufacture *pa'i 'ai* (hard taro paste) in order to supply the leprosy patients (Greene 1985:58-59). Twenty-one pounds of *pa'i 'ai* were supplied to each of the villagers per week (1985:61), which certainly would have stimulated the development of Waikolu irrigation works

well beyond the level required for local consumption alone.

Greene (1985) further relates how Waikolu Valley continued to be a major source of food supply for the Kalaupapa Settlement:

> During 1891 pressure was put on the Board of Health to allow further cultivation and settlement in Waikolu Valley. In the fall of that year, R. W. Meyer notified William H. Tell, new superintendent of the settlement, that the Board of Health wanted to provide suitable and remunerative labor for all able-bodied residents at the settlement and would allow them to cultivate taro in Waikolu Valley (to be known as the Waikolu Taro Plantation) under certain conditions (1985:207).

In 1901 a *poi* house was built at Kalawao for steam cooking of taro, and reference is again made to Waikolu as a major source of the taro provisions (1985:313). In 1905, a steam *poi* factory was constructed within the Kalaupapa Settlement itself. A 1906 map of the "East Side of the Leper Settlement, Molokai, T.H." prepared by Marston Campbell and reproduced in Greene (1985, map no. 3) delineates "taro patches" and "taro terraces" on both sides of Waikolu Valley extending well inland.

Of particular interest with respect to early 20th century development of the Waikolu irrigation systems, is Greene's comment that

> because the residents [of the settlement] were unwilling to cultivate Waikolu Valley, the superintendent again urged in 1908 that the taro land there be leased to a hui of Hawaiians or Chinese to work for the board (1985:362).

This raises the possibility that taro cultivation in the valley was not exclusively being carried out by Native Hawaiians, and that Chinese farmers may have been involved. This resonates with our own observations that some of the archaeological remains of pondfield systems which we saw during our reconnaissance (see below), appeared to reflect the influence of non-Hawaiian construction techniques.

Other early 20th century developments in the valley also had some impact on the archaeological landscape. These include the major water supply system which redirected water from the valley to the settlement via a pipeline running along the base of the towering cliffs, the ruins of which are still extant. This system was extensively improved in 1937 (Greene 1985:513-22), replacing the 1,800 foot long old wooden flume which descended the valley from the 520 foot elevation, with an 8-inch cast iron pipe system. At the same time new concrete dams, steel tanks, and other infrastructure were installed. The project took 15 months to complete, and materials were off-loaded from steamers at the valley mouth. Evidence of this extensive project can still be seen throughout the valley.

Greene (1985) unfortunately provides no information on when Waikolu ceased to be a main source of *pa'i 'ai* and *poi* for the Kalaupapa Settlement, although it appears that by mid-century most food supplies were now coming in to Kalaupapa from other sources. A major tsunami slammed into the northern coast of Moloka'i in 1946, salting and severely damaging the taro pondfields of Halawa Valley, and is known to have been responsible for a drastic depopulation of that valley shortly thereafter (Anderson 2001). This tsunami also affected Kalaupapa and Waikolu (Greene 1985:525) and may well have been a critical factor in the abandonment of Waikolu. Certainly by the early 1960s, the valley was completely uninhabited.

SITES RECORDED

Intensive survey of a valley the scale of Waikolu, which today is cloaked in dense vegetation, and which confronts the archaeologist with dramatically rugged and difficult terrain, will be a truly daunting task. We were able to make two one-day forays into the valley, penetrating inland only about 1-1.5 km. These reconnaissance trips, however, were sufficient to reveal the presence of extensive sets of formerly irrigated pondfield terraces, situated on both sides of the stream. Some of these terraces on the eastern flank of the lower valley are remarkable constructions, with terrace embankments frequently 1.5-2 m high. It is possible that some of these terrace sets reflect Chinese influence in the late 19th century, as there are indications in the historic record that both Hawaiian and Chinese cultivators provided taro for *poi* production in Kalaupapa Settlement. Some of the terrace sets, however, exhibit distinctly Hawaiian architectural features.

This is particularly the case with an extensive pondfield complex (Site WK-1) located at the mouth of Waikolu Valley, on the eastern bank of

the stream. Portions of this pondfield complex (about 15 individual fields) which were covered in low grass and sedge were mapped with plane table and alidade at 1:600, reproduced here as Figure 8. The two fields closest to the beach are very large, about 50 m long and more than 25 m wide. The fields are rectangular in plan, and are separated by earthen embankments or bunds, ranging in width from 1 to 3-4 m, and in height from 0.5-2 m. These embankments incorporate some basalt boulders, and are partially stone-faced in places. Water channels between fields are also visible.

That part of the pondfield system inland of the beach is covered in dense lantana, Christmas berry, and guava, making it impossible to map without extensive clearing. However, from the plane table station we managed with some difficulty (having no bush knives with us) to make our way inland, crossing over 9 sets of pondfield terraces, these becoming increasingly narrow as the slope increased (the uppermost terraces were about 5 m wide). At the interface of the steep slope and the uppermost terraces, traces of what was probably the main irrigation canal (*'auwai*) were observed, although this has largely been filled in with slope wash. This *'auwai* evidently tapped the main Waikolu Stream slightly farther up valley.

A major *heiau* site, named 'Ahina, first recorded by Stokes (Summers' site 286) was also relocated on the bluff overlooking the pondfield complex. Stokes' plan map (reproduced in Summers 1971, fig. 83) shows this to be a somewhat irregular terraced structure, with a substantial retaining wall "8 ft high on the outside". Today the *heiau* is heavily overgrown with guava, sisal, lantana, and other vegetation, and its features were impossible to trace in detail without substantial clearing. We did observe that the main terrace wall is well constructed, of stacked basalt boulders, at least 8 courses high (1.5-2 m exterior height). From this *heiau* one commands a superb view of Waikolu Bay, and of the Site 1 pondfield complex directly below (see Fig. 8).

Waikolu Sites WK-2 through -6 each consist of a pondfield terrace complex constructed along narrow ridges on the eastern side of the valley. Unlike traditional Hawaiian *lo'i* systems, which were typically constructed on alluvial terraces or on gently sloping colluvial slopes (Kirch 1977), these sites were literally carved out of steeply descending ridges, and as consequence have terrace facing heights of 2 to 3 m. Site 6, for example, consists of at least 14 descending terraces with faces of up to 3 m high between terraces. Many of these faces are cut deeply into the hillside, and are only partially stone faced. From our brief reconnaissance, it is not possible to determine the age of these pondfield systems, but we speculated that they may date to the later 19th or early 20th century period of intensive taro cultivation for supplying the Kalaupapa Settlement. If so, then the unusual topographic setting and construction techniques might reflect the influence of Chinese or other immigrant cultivators.

In contrast to Sites WK-2 to -6 are another set of pondfield terrace complexes (Sites WK-7, -8, -10, -11) situated farther inland, and recorded during our second reconnaissance foray into the valley. These three complexes are situated on gentler slopes, and have stone facings of 2-3 courses, averaging 0.6 m high (although site 10 has some higher facings). Site WK-11, in particular, located the furthest inland, impressed the survey team as appearing more consistent with traditional Hawaiian irrigation techniques. The Site WK-11 complex is very extensive, with more than 24 terraces and extending well over 100 m in an east-west direction.

One site other than an irrigation system was also recorded in the valley interior. Site WK-9 is a terraced enclosure, 8.9 by 4.2 m, situated at the base of a small ridge and near a dry stream bed. A rough entryway exists on the western side. The structure likely had a residential function.

WAIKOLU SITE WK-1 STRATIGRAPHY AND DATING

The Site WK-1 pondfields extend right to the edge of the boulder beach at the mouth of Waikolu Valley, and at the interface between beach and alluvial terrace high storm surges have cut an embankment about 2 m high (it is possible that this bank was initially cut by the 1946 tsunami which hit the northern coast of Moloka'i at full force). Examining this wave-cut bank, it was possible to discern a stratigraphic sequence underlying the pondfield complex, thus providing an excellent

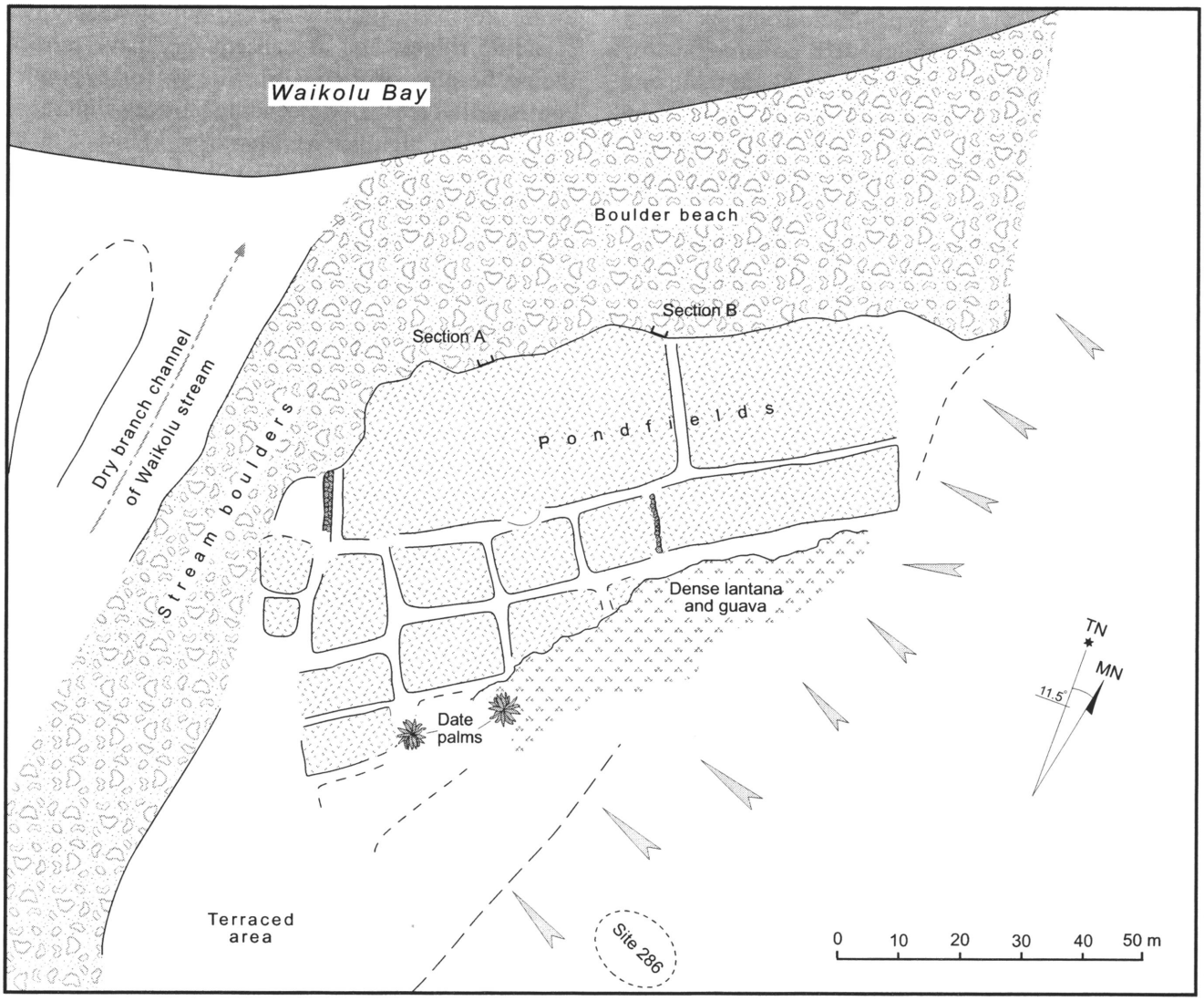


Figure 8 Plan map of Site WK-1, at the eastern mouth of Waikolu Valley. The site consists of an extensive irrigated pondfield complex, part of which is covered in dense vegetation and could not be mapped. Note the location of Stokes' *heiau* 286 on the ridge overlooking the terraces.

opportunity to gain some information on the history of this large site without engaging in excavation. On our first reconnaissance, an exposed section (Section A on Figure 8) was examined, suggesting the presence of two separate pondfield cultivation horizons, separated by a deposit of unsorted gravel (0.5-5 cm size range) possibly representing a flood event.

The possibility that Waikolu Site WK-1 had a stratified sequence of pondfield activity clearly deserved additional investigation, and therefore on our second trip to the valley, one team devoted the day to cleaning a stratigraphic section (Section B, Fig. 8) of this wave cut bank (Fig. 9), photographing and recording the stratigraphy (Fig. 10), which revealed a classic set of oxidation-reduction zones associated with taro irrigation (see Kirch 1977). A stratigraphic diagram of Section B is given in Figure 11. The stratigraphy was recorded in the field as follows:

Layer I. Black (Munsell color 5YR2.5/1), silty clay, penetrated by grass rootlets, and moist from recent rains.

Layer II. Thin lens of gravel, grains 0.5-3 cm diameter and rounded; colors variable. Interpreted as a single flooding episode from

the nearby Waikolu Stream.

Layer III. Dark reddish brown (5YR3/2), very fine sandy loam, with less clay content than Layer I. Limonite tubes are present but infrequent. Small charcoal flecks present but not obvious. The boundary with Layer IV is diffuse.

Layer IV. Dark gray (10YR4/1) very fine sandy loam, with infrequent (<10%) subrounded gravel clasts (0.5-1 cm diameter range). Fairly heavy charcoal flecking and limonite tubing present. Limonite tubes are yellowish red (5YR4/6) thus contrasting with the matrix. Also present are a few larger

Figure 9 View of the wave-cut bank (Section B) along the seaward edge of Site WK-1, Waikolu Valley. James Coil at work recording the stratigraphic section. Stokes' *heiau* site 286 lies on the ridge above the date palm, in the upper left-hand portion of the photograph.

Figure 10 The cleaned stratigraphic section (Section B) at Site WK-1, Waikolu Valley; compare to the stratigraphic section shown in Figure 11.

cobbles (~15 cm diameter), as indicated on the section drawing. Boundary between layers IV and V is sharp.

Layer V. Dark brown (7.5YR3/2) deposit of coarse volcaniclastic sand and gravel, with subrounded particles. No visible bedding; poorly sorted; no clear imbrication. Interpreted as a high-energy storm surge deposit, rather than an alluvial depositional event. Limonite tubes moderately frequent. Very light charcoal flecking. Boundary between layers V and VI is sharp.

Layer VI. Very dark gray to dark reddish brown (5YR3/4-2) silty clay loam with much included charcoal (both small flecks and larger pieces ~1 cm^3). Some subrounded gravel inclusions; limonite tubes present. The boundary between layers VI and VII

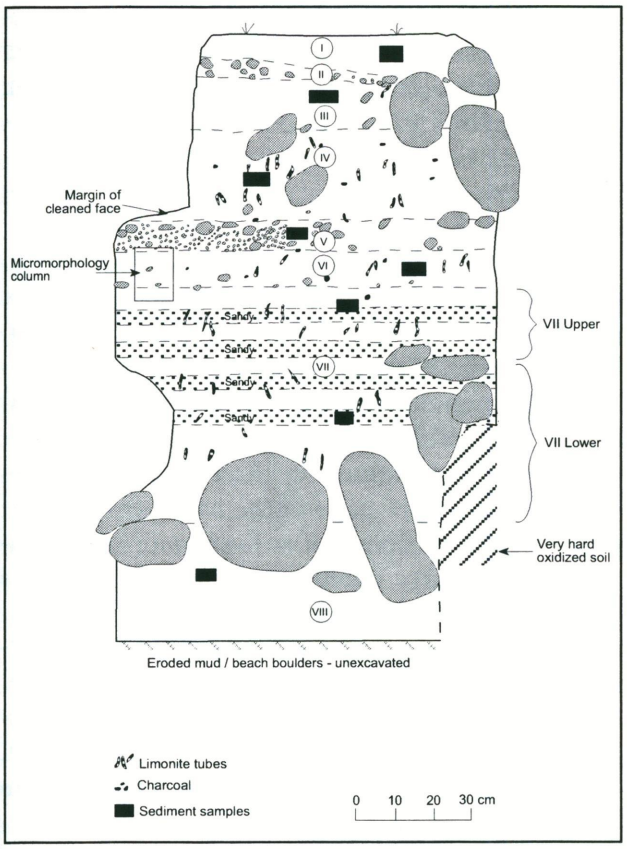


Figure 11 The recorded stratigraphic section (Section B) of Site WK-1. See text for description of individual stratigraphic units.

diffuse over ~2-3 cm zone. Interpreted as a pondfield cultivation horizon.

Layer VII. Dark brown (7.5YR3/2), massive deposit of silty clay, devoid of larger gravel clastics. Vague horizontal sorting/bedding with sandier lenses (not clearly defined) suggests multiple alluvial depositional episodes. Some charcoal was noted in the upper portion of the deposit, but none in the lower part. Limonite tubes are present throughout the deposit (color dark reddish brown, 5YR3/4) but are more heavily concentrated in the uppermost 20-30 cm. This deposit represents alluvial deposition, possibly through human agency (intentionally in-washed fill during pondfield construction) rather than an over-bank flood of the Waikolu Stream.

Layer VIII. This basal layer was not clearly exposed in our cleared section, but appeared to be a silty clay similar to Layer VII in texture, but with large water-rolled boulder clasts (~20-60 cm diameter). This deposit may represent alluvium deposited over and incorporating an original boulder beach.

The stratigraphic sequence can be interpreted in light of what is known of the geoarchaeology of Polynesian pondfield soils, where continual waterlogging under irrigation "creates an eluviation, reduction state in the upper A horizon and an illuviation, oxidation state in the lower B horizon" (Kirch 1977:254). The geochemical process consists of the downward percolation of water from the irrigated pondfield soil, transporting exchangeable ferrous and manganous ions (mobilized in the reductive A horizon) to the underlying B horizon, where oxidation results in ion precipitation and the development of iron-oxide (limonite) tubes around the roots of taro (*Colocasia esculenta*) plants. As first recognized by Yen et al. (1972) and by Morgenstein and Burnett (1972) for a pre-contact pondfield system in the upper valley of Makaha, O'ahu, this creates a characteristic stratigraphy, with an upper dark reduced horizon underlain by a mottled, oxidation horizon with limonite tubes.

In Waikolu Section B, the basal Layer VIII may represent a pre-human phase of alluvial deposition, followed by a second alluvial event (Layer VII) which was presumably within the period of Polynesian occupation given the presence of charcoal flecking. Indeed, Layer VII may represent an anthropogenic, purposive deposition of alluvium in order to form a base for construction of the pondfield system. Layer VI is the first pondfield (reduction) horizon, and during the period of its use for irrigated cultivation extensive limonite tubing developed in underlying Layer VII. This first phase of pondfield cultivation was terminated by a high-energy deposit (Layer V) of gravel and other clastics, interpreted as a storm surge event. The pondfield system was not abandoned, however, but rebuilt, probably by anthropogenically-induced deposition of additional alluvium (Layers IV-III) upon which pondfield irrigation recommenced. This resulted in a second phase of reduction-oxidation development, with limonite tubing in Layer IV and reduction in Layer III. Layer II represents a small flooding event, and Layer I may then represent a terminal phase of pondfield cultivation. In

sum, at least two and possibly three phases of pondfield use are indicated in Section B.

Wood charcoal fragments were recovered from several of the stratigraphic layers, and one of these was submitted for AMS dating. The dated sample came from the lowest of the pondfield cultivation horizons (Layer VI), and was tentatively identified by J. Coil as charcoal of the endemic Hawaiian *loulu* palm (*Pritchardia* sp.). *Pritchardia* palms have been identified by Athens (1997) as formerly comprising a major component of the lowland forests of O'ahu Island, and they may also have been abundant in Waikolu prior to human occupation. This sample was AMS dated by Beta Analytic (Lab No. 153426), with a measured ^{14}C age of 780 ± 40 B.P. ($^{13}C/^{12}C$ ratio of –25.7 $^{o}/_{oo}$), yielding a conventional age of 770 ± 40 B.P. Calibrating this ^{14}C age yields a "true" age of 1240-1280 A.D. at one standard deviation, or 1200-1290 A.D. at two standard deviations (95% probability).

We stress that this sample does not directly date the earlier period of taro pondfield cultivation at Site WK-1, as the palm charcoal must have derived from a burning or land clearance event pre-dating the construction of the pondfields. Nonetheless, in this wet valley environment the burned palm wood almost certainly represents human activity, and at a minimum indicates a Polynesian presence in Waikolu by the 13th century A.D. Construction of the pondfield system may well have commenced during the same period, but dating of additional samples will be required to establish the age and construction/use sequence of this large and impressive pondfield system.

ETHNOBOTANICAL OBSERVATIONS

Much of the vegetation now covering the lower valley slopes and ridges consists of historically-introduced species, such as lantana and Christmas berry near the coast, and guava which forms extensive stands inland. However, various plants of traditional Hawaiian significance were also observed. These included some dense stands of *'awapuhi* ginger along the eastern valley slopes, *Pandanus* stands, and even small quantities of naturalized *Colocasia esculenta* taro along the banks of Waikolu Stream. The *kī* plant (*Cordyline fruticosum*) is ubiquitous throughout the valley, while *kukui* trees (*Aleurites moluccana*) form typical monostands in the narrow ravines, their light colored foliage contrasting with the darker green of surrounding *'ohia* trees.

SUMMARY

Above all, our brief reconnaissance forays into this dramatic and impressive valley confirmed that it was a land once dominated by the irrigated cultivation of taro. With the exception of a single probable house enclosure and the 'Ahina *heiau* near the coast, all of the constructed features we encountered were unquestionably the remains of extensive pondfield irrigation systems. The large Site WK-1 pondfield complex at the mouth of the valley is particularly noteworthy, having a stratified construction history. Our analysis of the exposed section and samples we collected from it are continuing, and will be presented in due course elsewhere. However, the first radiocarbon sample that we have dated yielded a surprisingly old result, suggesting that the time depth for intensive taro cultivation in Waikolu could be on the order of several hundred centuries at least.

Waikolu Valley adds a remarkable dimension to the archaeological landscape of KNHP, and could not be more contrastive with that of the peninsula proper. The valley and its sites exemplify the extremes of windward valley adaptation in the Hawaiian archipelago. Certainly, Waikolu Valley deserves a full-scale archaeological survey and investigation, but it is daunting to consider the resources that this will require, given the valley's extent, its rugged and heavily vegetated terrain, the high rainfall, and general logistical difficulties.

WAI'ALE'IA VALLEY (WL-)

GENERAL OBSERVATIONS

Wai'ale'ia is the central of three valleys situated with the KNHP park boundaries, a classic "amphitheater-headed" valley some 2.5 km deep, with very steep sides rising to heights of 900 m (Fig. 12). Wai'ale'ia Stream flows only intermittently, due to the limited drainage basin from which it draws water. During most of our stay in KNHP, Wai'ale'ia Stream was dry, but it turned into a raging torrent

following heavy rains on the night of August 20, 2000. This hydrologic regime—dry stream conditions alternating with flash floods—has probably been a major factor conditioning Hawaiian land use in Wai'ale'ia Valley, for it would have made traditional irrigation difficult if not impossible.

Furthermore, during our reconnaissance foray into the valley, we were impressed by the extensive geomorphological evidence for rampant flooding. The valley's colluvial slopes are dominated by gravel screes (much of this in the form of unsorted, subangular pebble to cobble-sized material) and rills indicating major surface water flow in times of heavy rainfall. Indeed, in more than 30 years of field experience in Hawaiian valleys, Kirch has never seen a valley with such extensive surface evidence of flooding and erosion. The implications of such a hydrologic regime are at least twofold: first, that Native Hawaiians would have found farming on the valley's slopes a risky proposition, for one's crops would be likely to be inundated or washed away during periods of heavy rainfall; and second, many archaeological features, such as low alignments or terrace walls, are likely to have been destroyed or buried.

Wai'ale'ia Valley has also been significantly affected by major earth-moving activities dating to the late 19th and 20th centuries. As early as the 1870s, water supply for the Kalawao settlement was being obtained from Waimanu Gulch via Wai'ale'ia through one-inch iron piping (Greene 1985:130), and this water system was expanded and further developed over time, including access routes. Other modifications to the landscape were probably associated with the construction of the Federal Leprosy Investigation Station (begun in 1905), which was situated on the plateau overlooking the mouth of the valley. A 1908 map of the Station (Greene 1985, fig. 52) shows a "road to Waialeia Valley" running from the Station inland on the plateau. We found this bulldozed roadbed, now heavily overgrown with rose apple and other plants, and traced it well back into the valley, where it appeared to have crossed the stream and continues for some distance on the east side (in one area on the east side, this road is supported by a high facing of massive boulders, a fairly impressive construction). Other earth-moving activities have taken place across the Wai'ale'ia Stream mouth in connection with building and maintaining the water supply line from Waikolu Valley. All of these activities are likely to have destroyed archaeological sites.

SITES RECORDED

During our one-day reconnaissance, which focused primarily on the eastern side of the valley and reached the 200-m elevation about 1.2 km inland of the bay, we located and recorded nine archaeological sites (see the Appendix for a listing of sites). Site WL-1, near the valley mouth, is a small overhang shelter under a large boulder, with an enclosing wall; the structure seems too small for a habitation, but might have been used as an animal pen. Upslope of WL-1 we also observed some minor stone stacking (modified outcrops) and possible dryland agricultural features, but this landscape was truncated about 100 m above WL-1 by the historic-period bulldozed roadbed.

Sites WL-2 to -4 make up a small complex on the western side of the valley. Site WL-2 consists of two adjacent, rectangular stone-walled enclosures, probably an historic period house site and adjacent house yard (*pā hale*). The larger enclosure surrounds a *hala* tree. Possible dryland agricultural features are again found in the vicinity. Site WL-3 is a U-shaped stone shelter about 20 m from Site WL-2, and may be associated with the former as a cookhouse or similar ancillary structure. About 10 m from Site WL-3, Site WL-4 is a rough terrace of boulders with clinker fill, possibly a burial.

Sites WL-5, -6, and -7 are probable house terraces situated on the eastern side of the valley, all associated with stands of *hala* trees. Site WL-7 consists of two stone-faced terraces and a flat area (probably artificially leveled) on a ridge which would have had a good view out over the valley when the terrain was more open. On this site we found a mold-made bottle of amber glass, a small volcanic glass core, and a basalt flake.

Site WL-8 is a substantial stone terrace built at the base of a small slope, and with a wall extending to the south and upslope. On the slope above the terrace, over an area of about 100 by 150 meters, a mono stand of coffee trees (*Cafe arabica*) still struggles to survive. The terrace may have been a house foundation used by the farmer who cultivated this small coffee plantation.

Figure 12 View of Wai'ale'ia Valley from the taluvial slopes of Kalawao. This photo was taken on the morning after a major rainstorm, during which the valley's waterfalls were at full force and the stream was in flash-flood.

The farthest inland site encountered was Site WL-9, a large long free-standing wall some 3-9 courses high which parallels and then crosses the stream bed, at an elevation of about 690 ft asl. Next to this wall we found part of a hand-blown glass bottle (thick, light blue glass) with an embossed "L" on it. In the course of returning to the valley mouth late in the afternoon, we also passed by another stone platform on the west side of the valley, on which an old, rusted iron cooking pot was sitting; time precluded us from formally recording this final site.

ETHNOBOTANICAL OBSERVATIONS

Early historic photographs suggest that in the late 19th and early 20th centuries, much of Wai'ale'ia Valley was fairly open, in grass or fern

lands. Today the valley floor and colluvial slopes are largely covered in closed canopy secondary forest, dominated by historically-introduced taxa, although some of the ridges are still in *Dicranopteris* fern with stands of *Pandanus* here and there. The trees which dominate the valley today include Java plum, Christmas berry, and rose apple, the latter forming particularly dense stands in interior portions of the valley. Mango trees are distributed in parts of the valley. We also observed significant numbers of sisal, introduced to the islands for its use in rope making. To a large degree, then, the exotic vegetation which today dominates Wai'ale'ia Valley mirrors the major landscape transformations associated with the period of the leprosy settlement at Kalawao, and continuing on into the 20th century.

Nonetheless, we did note two interesting associations between plants and archaeological sites in the valley. The first was a strong association between stands of *Pandanus tectorius* (*hala*) and habitation sites, as at Sites WL-2, -5, -6, and -7. Our impression was that these *hala* trees had probably been planted by the former occupants of these sites, and had survived to the present, rather than being adventives.[1] The second association was at Site WL-8, where a mono stand of coffee trees still survived in association with a stone terrace and wall. This was doubtless an historic period Hawaiian coffee plantation.

SUMMARY

Our overall impression, based admittedly on just a single day of reconnaissance up and back down this valley, was that there has been a great deal of historic-period disturbance (road bulldozing especially), coupled with the evidence of massive slope wash and erosion, which combine to limit the extent of archaeological remains. Large expanses over which we struggled through oppressively dense and dank stands of rose apple showed no signs of stone constructions, while other areas were active gravel screes clearly recently awash in floods. We were surprised by the lack of evidence for permanent irrigation on the alluvial flats, although this may well be a function of the valley's highly unstable (fluctuating) hydrological regime. Nonetheless, we did find the habitation complexes on both the west and east sides of the valley, and there are doubtless other sites to be discovered.

KALAWAO TALUS-COLLUVIAL SLOPES

GENERAL OBSERVATIONS

Lying between the peninsula proper (formed of volcanic flow slopes emanating from Kauhakō Crater) and the abrupt 600-m high cliffs to the south is an extensive zone of talus and colluvial slopes, approximately 300-500 m wide; this extends from the plateau at the mouth of Wai'ale'ia Valley westwards to the area inland of Puwahi. As noted earlier, soils in this zone consists of Kawaihapai/Haleiwa type clay loams which have been noted to be excellent for dryland as well as irrigated cultivation (Kirch 1977). Indeed, the potential importance of this zone in the overall Kalaupapa regional settlement pattern is hinted at by the presence of at least five ritual structures or *heiau* within the zone (Summers' [1971] sites 288, 289, 292, and 302 plus a putative *heiau* recorded by Somers [1985]). Some of these *heiau* may well have been agricultural temples (*heiau ho'o'ulu'ai*) dedicated to important deities such as Lono or Kane. Their position high on the talus slopes and overlooking the peninsula is noteworthy, and is reminiscent of the pattern of agricultural temples in Halawa Valley, also found on the higher slopes within the dryland agricultural zone (Kirch 1990).

SAMPLING AREA A (KA-)

Although time did not permit us to sample this zone as extensively as we would have liked, especially in Makanalua and Kalaupapa *ahupua'a*, [2] we were able to spend two days in intensive reconnaissance of the talus and colluvial slopes within Kalawao *ahupua'a*, specifically in two sample areas. The first area selected is a 250 x 250 m area (Sampling Area A) surrounding Summers' Site 289, a substantial terraced *heiau* first recorded by pioneer archeologist J. F. G. Stokes in 1909. We reconnoitered this 6.25 hectare block on the steep colluvial slope south and east of the heiau, to determine if other archaeological features were associated with this large ritual structure.

The large *heiau*, Site 289, was reputedly named

Kawaha'alihi according to Stokes, who described it as "a terrace of waterworn stones, with a broad slope to its retaining walls" (in Summers 1971:192). Summers also cites a Hawaiian author of 1877, Puna, as reporting that "the sacred heiau of Kapo [sister of the volcano goddess Pele] stands here [at Polapola] to this day. No woman is allowed to climb onto it, only men" (1971:192). This is most likely the same structure as Site 289. We remapped Site 289 with plane table and alidade, as shown in Figure 13, and described it in detail (see records filed in KNHP archives). As can be seen in Figure 14, the *heiau* structure is quite impressive when viewed from below, with the terrace surface standing some 6-7 m higher than the colluvial slope. Not all of this is formally faced, as the builders cleverly made use of the natural slope and talus accumulation, but the upper 3 m or so has been very well constructed, with closely fitted basalt boulders. Certainly, when in the past this area was devoid of large trees, the *heiau* would have commanded a superb view out over Kalawao, and in turn would have been visible from much of the eastern side of the peninsula.

The main terrace has been somewhat disturbed, in part probably by ungulates and also by the actions of Java plum tree roots, but several internal divisions are still evident. One upright stone, and one piece of branch coral (presumably a ritual offering) were noted in the central portion of the terrace along with some low facing alignments. On the eastern end of the terrace stands a substantial free-standing wall (Fig. 15), also noted by Stokes; just west of the wall is what appears to have been an enclosed space, possibly the location for an *aunu'u* or oracle tower. The northeastern corner of the main terrace has also been purposively extended and buttressed to the northeast, and the eastern face has a secondary terrace supporting it. The massive construction and elaboration of the eastern end of the *heiau*, as opposed to the western end which is low and amorphous, leaves little doubt that the

Figure 13 Plan map of Site 289, a *heiau* first recorded by J. F. G. Stokes in 1909.

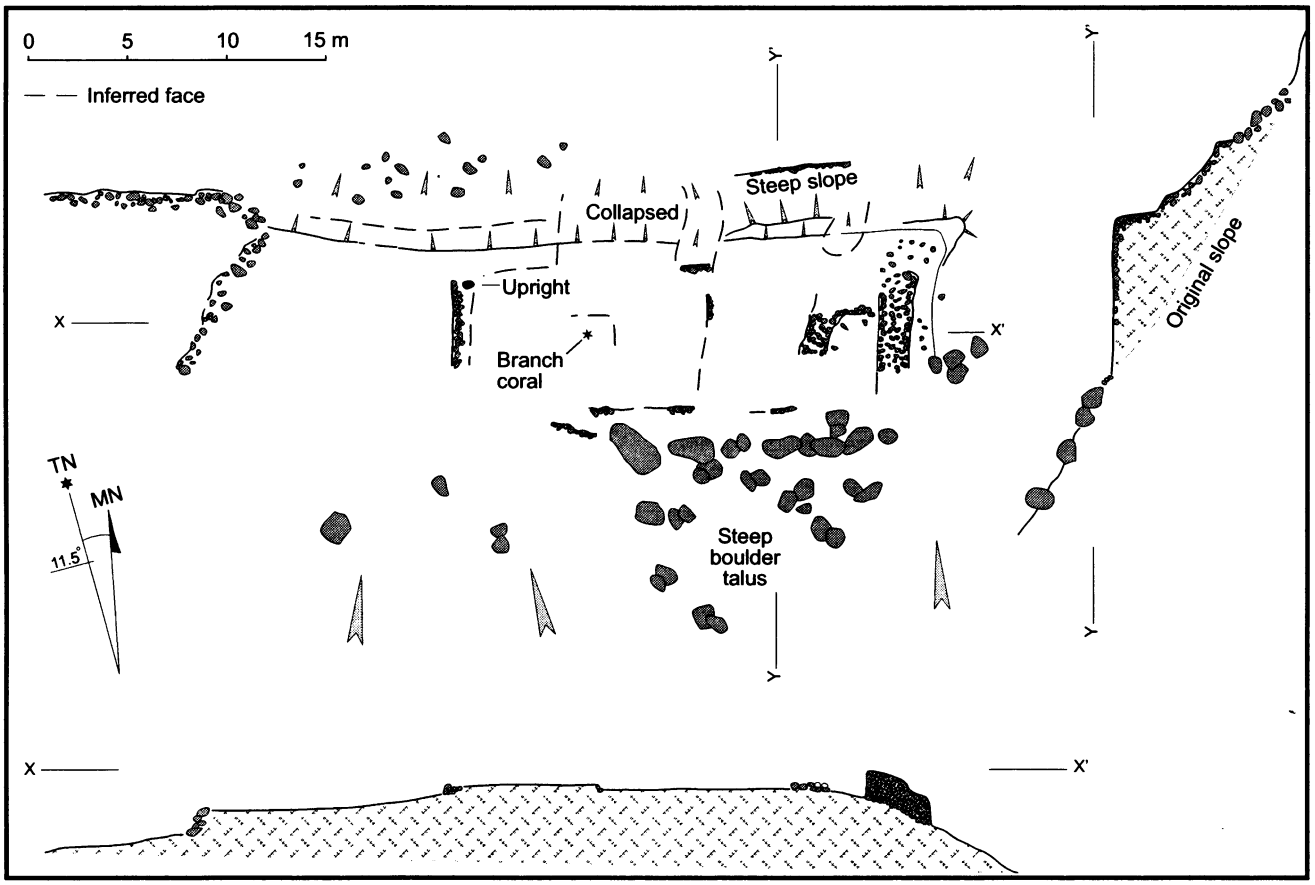


Figure 14 View of the main front facing of Site 289. Note how the well-constructed upper facing has been positioned atop a steep natural talus of basalt boulders, to further elevate the platform above the ground level.

heiau was oriented to the east (its main axis is roughly true cardinal east). This corresponds with a pattern of east-oriented *heiau* in the Kahikinui district of Maui (Kirch, in press), tentatively interpreted as indicating an association with the major creator-deity Kane.

A steep mass of large talus boulders lies directly upslope of the *heiau* terrace, but a few meters higher than the boulder concentration is another, smaller structure not noted by Stokes, but which we thought was quite likely an adjunct to the *heiau* itself. Recorded as Site KA-5, and shown in plan view in Figure 16, this consists of a set of three stone-faced, earth-filled terraces surrounded by a low enclosing wall of boulders, the whole structure covering an area of about 21 by 10 m. As this

Figure 15 The well-constructed eastern wall on top of the Site 289 platform.

structure is both close to the *heiau*, and overlooks it, we judged it unlikely to have had a strictly secular function, although it might possibly be the residence of a priest (*kahuna*) or guardian (*kahu*) of the temple immediately below.

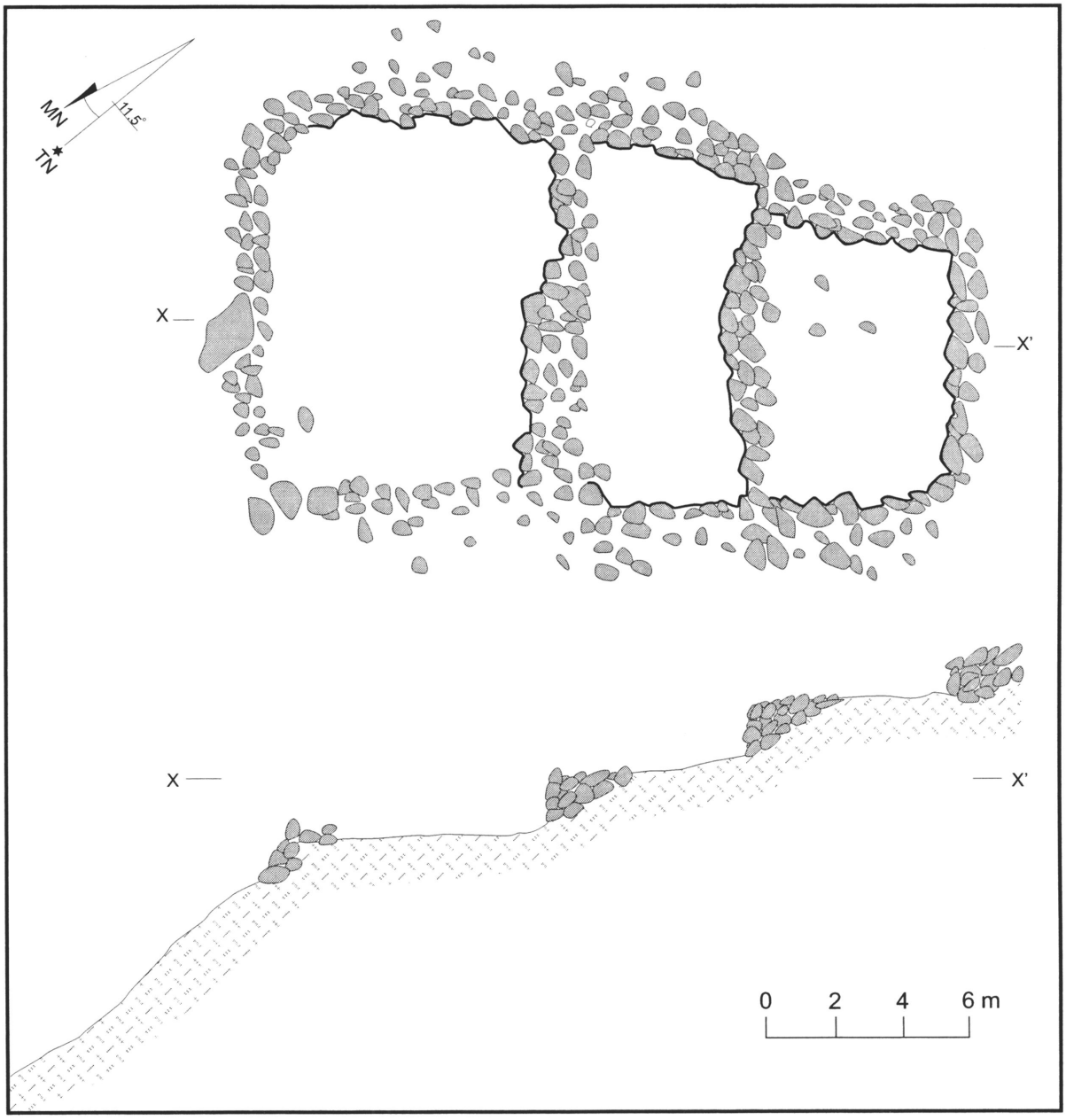
Downslope of Site 289, between the *heiau* and the road to Kalawao, in a zone where the colluvial slopes are relatively gentle, are a number of stone-faced terraces and free-standing stone walls forming a large, quadrangular enclosure (this is in the area locally known as "Lang-lang"). We recorded and mapped one wall complex (Site KA-1) in this zone, shown in Figure 17, because this was associated with one of the few petroglyphs known within the KNHP. The petroglyph itself (Figure 18), a single anthropomorphic figure about 25 cm high and 17 cm wide, had been pecked into the face of a large rectangular basalt boulder. This boulder is part of what appears to be an older wall which had been robbed of much of its upper courses when the

higher free-standing walls crossing it were constructed. It appeared to us that there was thus a potentially complex sequence of wall construction in this area, likely spanning the pre-contact to historic periods, with the latest phase dating to the period of the leprosy settlement at Kalawao. The petroglyph itself, however, most probably dates to the pre-contact period. Excavations in this complex would be highly desirable to sort out the construction sequence and to attempt to place the petroglyph in a datable context.

Also notable within the general area of Kalawao Sampling Area A, on the lower colluvial slopes, are a number of extensive stone retaining walls and terraces, as shown for example in Figure 19. These terraces are likely to have been used in extensive dryland cultivation, possibly of dryland taro, banana, and other crops.

Our Sampling Area A extended east and southeast from Site 289, on the inclined colluvial slopes

Figure 16 Plan and cross-section of Site KA-5, a set of three stone-faced terraces up-slope from Site 289, and probably related to the *heiau*.



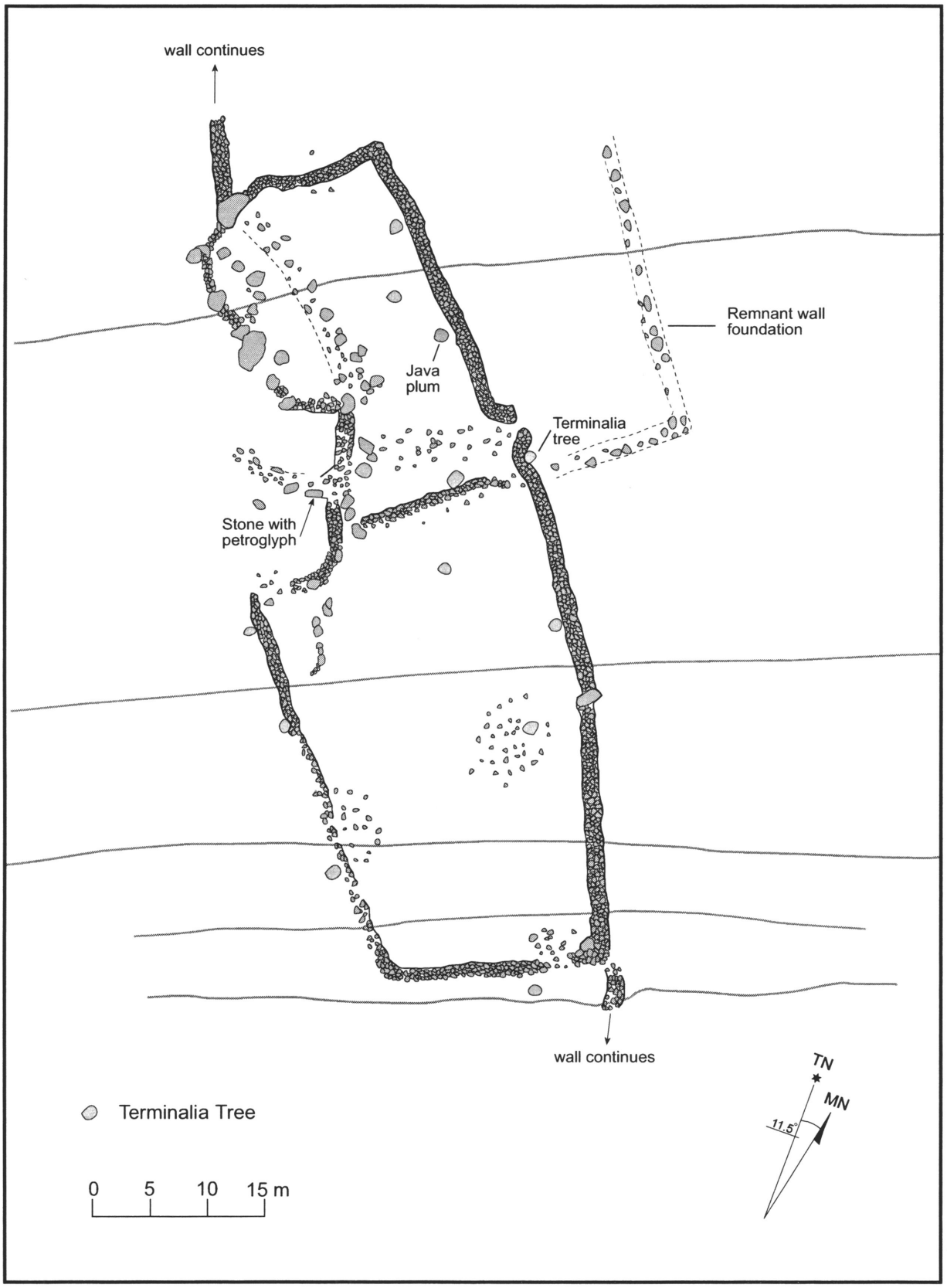


Figure 17 Plan map of Site KA-1, a wall and terrace complex incorporating a petroglyph.

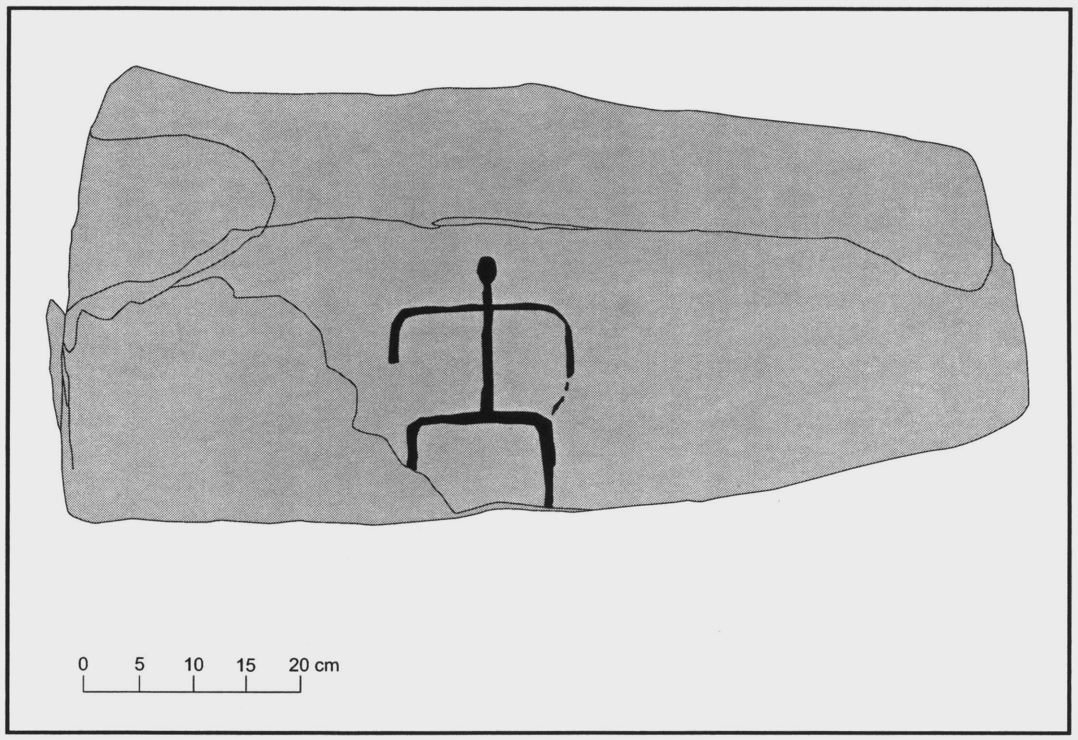


Figure 18 Scale drawing of the anthropomorphic petroglyph at Site KA-1. See Figure 17 for the location of the petroglyph boulder.

which give way to boulder talus accumulations as one climbs higher toward the cliffs. This slope was shaded by large trees, mostly introduced Java plum (*Syzgium jambos*) but also with some *kukui* (*Aleurites moluccana*), false *kamani* (*Terminalia catappa*), and *kamani* (*Calophyllum inophyllum*) trees, the latter concentrated in the vicinity of the *heiau*. The ground under this canopy was relatively open (with the ethnobotanically significant exception of occasional large *noni* [*Morinda citrifolia*] and *kī* [*Cordyline fruticosum*] plants), and showed signs of active downslope transport of soil and gravel; gravel screes and erosional channels were noted throughout the area reconnoitered. There is a good possibility that this active geomorphic landscape may have disturbed, obliterated, or buried older archaeological features. Features recorded on this slope include a rectangular enclosure about 9 by 7.5 m in size, with stacked walls, the eastern side having collapsed (Figure 20). This was probably a habitation site, quite possibly of historic age. Sites KA-3 and -4, near each other, consist of terraces which may have had either residential or agricultural functions.

SAMPLING AREA B (KB-)

A second reconnaissance was carried out on the gently-sloping colluvial slopes which form a "bench" on the west side of Wai'ale'ia Valley, another part of the zone which appeared highly suitable to dryland cultivation. We began our reconnaissance at Summers' Site 288, a fishing shrine or *ko'a* described by J. F. G. Stokes as "the most striking *ko'a* of any that I have come across" (in Summers 1971:189). We then reconnoitered the area inland (south and southwest) from Site 288, discovering 12 more sites in a zone extending about 300 m southwest from the *ko'a*. This area is covered today in densely-concentrated strawberry guava trees (*Psidium guajava*), which made progress over the terrain difficult, and reduced visibility. We were left with no doubt that there are more sites on this extensive talus slope, and that the entire area would warrant an intensive-level archaeological survey.

The *ko'a* (Site 288), which Stokes so admired, had been cleared of vegetation (mostly Christmas berry in this area) a few years previously by Buddy

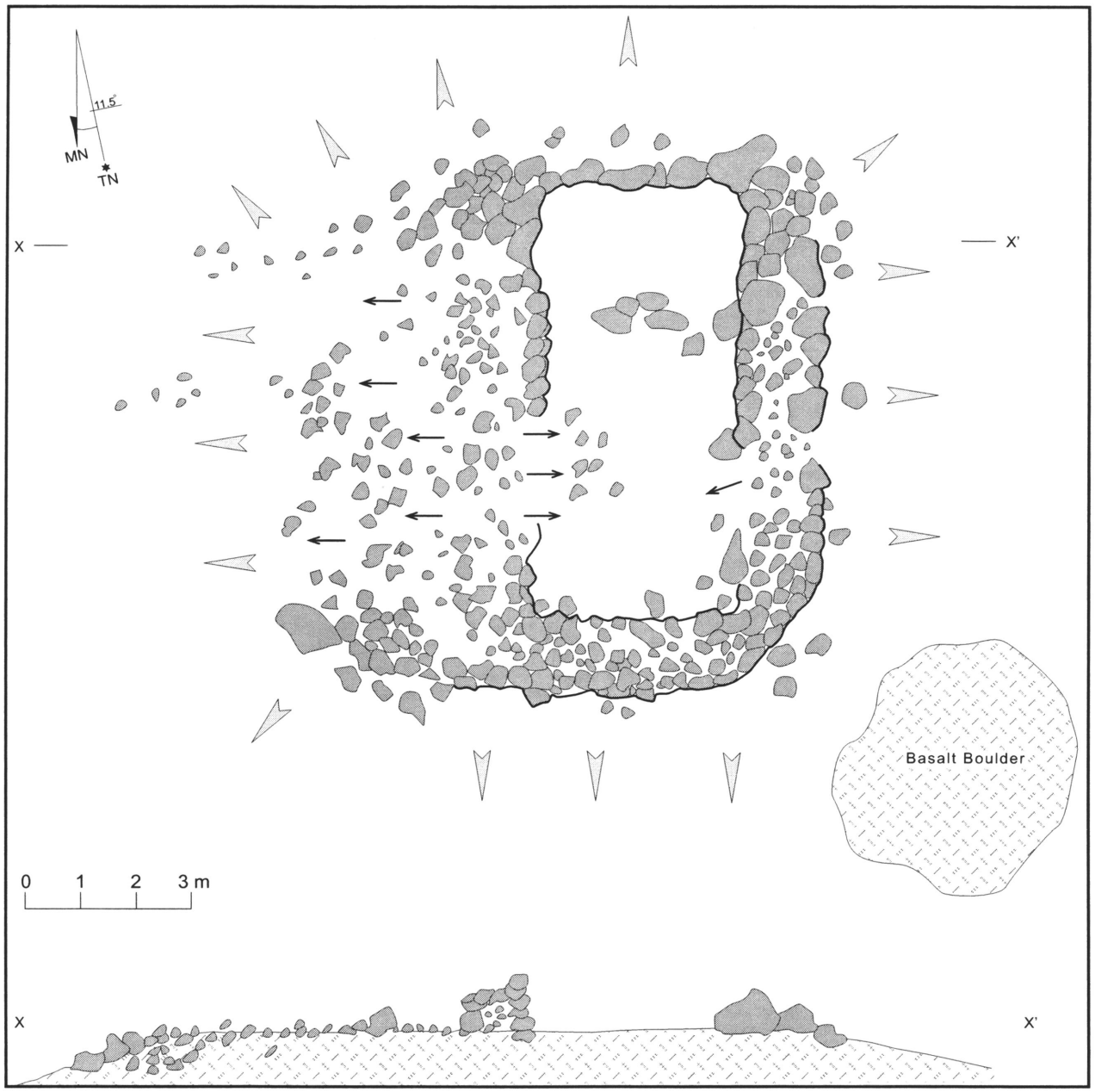
Figure 19 View of stacked basalt retaining walls for probable agricultural terraces in the Kalawao Sampling Zone A area.

Neller and we took advantage of this to remap it with plane table and alidade at 1:100 (Figure 21) and to photograph it (Figure 22). Comparing our photo with those taken by Stokes in 1909 and published by Summers (1971, fig. 84 a, b), it is evident that the structure has retained its integrity, although the contrast in surrounding vegetation is striking. As Stokes aptly put it, "the principal motif for the selection of this site" was a main boulder some 5 m long and 2 m high, to the west of which was constructed a small, nearly square enclosure with a stacked boulder wall. A kind of rough pavement made up of large, subrounded stones with smaller cobbles and gravel chinked in the interstices adjoins the boulder on the inland (south) side. We observed a number of fist-sized waterworn river stones, one atop the large boulder, and the others scattered over the slope immediately north

(downslope) of the boulder. These waterworn stones were probably offerings.[3] When the area surrounding the site was clear of vegetation (as in Stokes' 1909 photographs), a commanding view of Wai'ale'ia Bay would have been enjoyed by those officiating or worshiping at this shrine. The location would also have afforded an excellent vantage point to observe weather and sea conditions, to spot schools of large fish or flocks of feeding seabirds, or to watch for the movement of people and canoes along the coast between Kalaupapa and the windward valleys.

Stokes did not mention that only a few meters southwest of the *ko'a* lies a rectangular enclosure (Site KB-6) measuring about 5 by 8 m (Fig. 23). The enclosure has a formal entryway on the south, and may have an interior slab hearth. A core-filled wall extends south from the enclosure, becoming a terrace towards its end. This feature may possibly predate the enclosure which appears to be built

Figure 20 Plan and section of Site KA-2, a possible habitation feature.



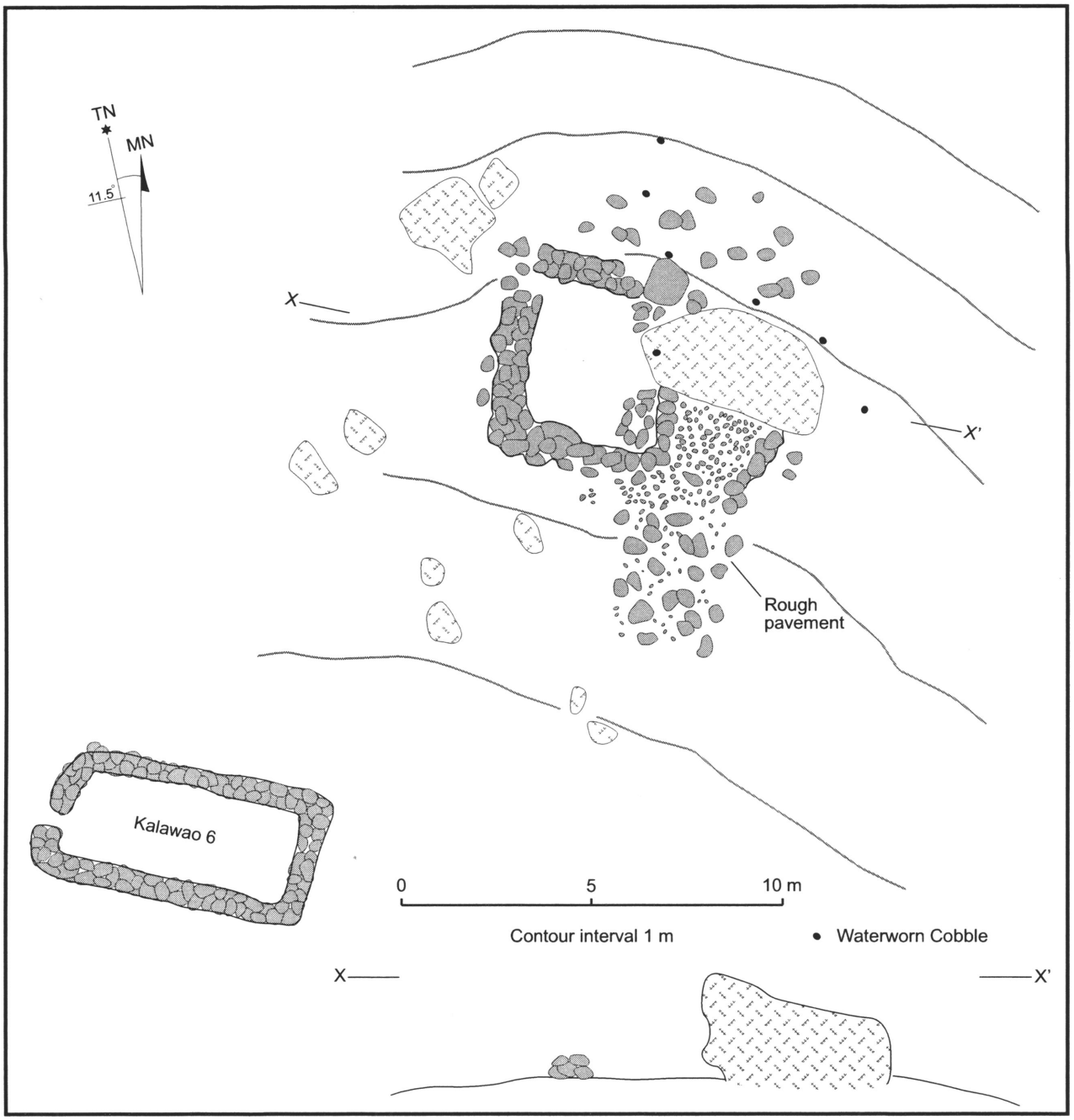


Figure 21 Plan map and cross-section of Site 288, a *ko'a* or fishing shrine first recorded by J. F. G. Stokes in 1909.

over it; we surmised that the enclosure is likely to be of historic age, but that the wall and terrace could be substantially older, and possibly associated with the *ko'a*. Excavation would, of course, help to evaluate these hypotheses.

Other sites recorded on the gentle colluvial slope inland of the *ko'a* included a small stone-faced terrace (Site KB-7), a stone mound which quite likely incorporates a burial (Site KB-8), a simple stone alignment (Site KB-8b), a double enclosed terrace complex (Site KB-9a) probably of residential function (Fig. 24), a cluster of irregular stone walled "clearings" probably of agricultural function (Site KB-9b), parallel single-course stone alignments (Site KB-10), a stone-faced terrace adjoining a boulder wall (Site KB-11), and a circular

terrace with stacked stone walls (Site KB-12). Toward the inland-most extent of the area reconnoitered, we also came across several long parallel stone rows, each about 30 cm high and 1 m across, with some evidence of formal facing or edging in places. Low stone mounds of pebbles and cobbles are distributed between the stone rows. These features, which we believe are more extensive than just the small area we observed, gave the impression of a formal horticultural field system.

ETHNOBOTANICAL OBSERVATIONS

Sample Area B was largely dominated by historically introduced vegetation, such as Christmas berry, Java plum, and strawberry guava. However,

Figure 22 View of Site 288 from the southwest, showing the larger boulder and low stone enclosure on its western side. Mōkapu and ʻŌkala Islands are visible in Waikolu Bay.

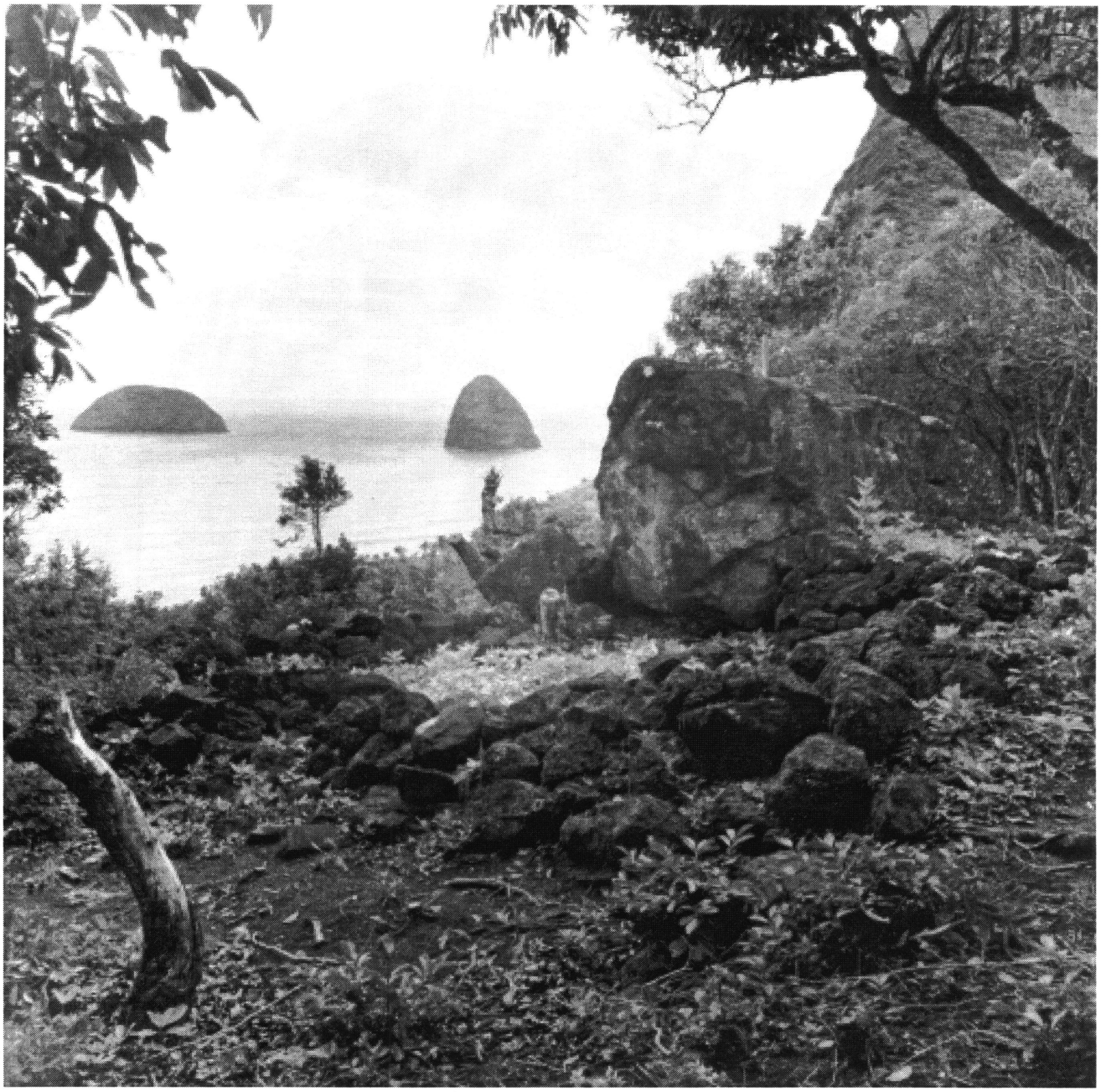


Figure 23 Plan of Site KB-6, a rectangular enclosure constructed atop a larger stone-faced earthen terrace.

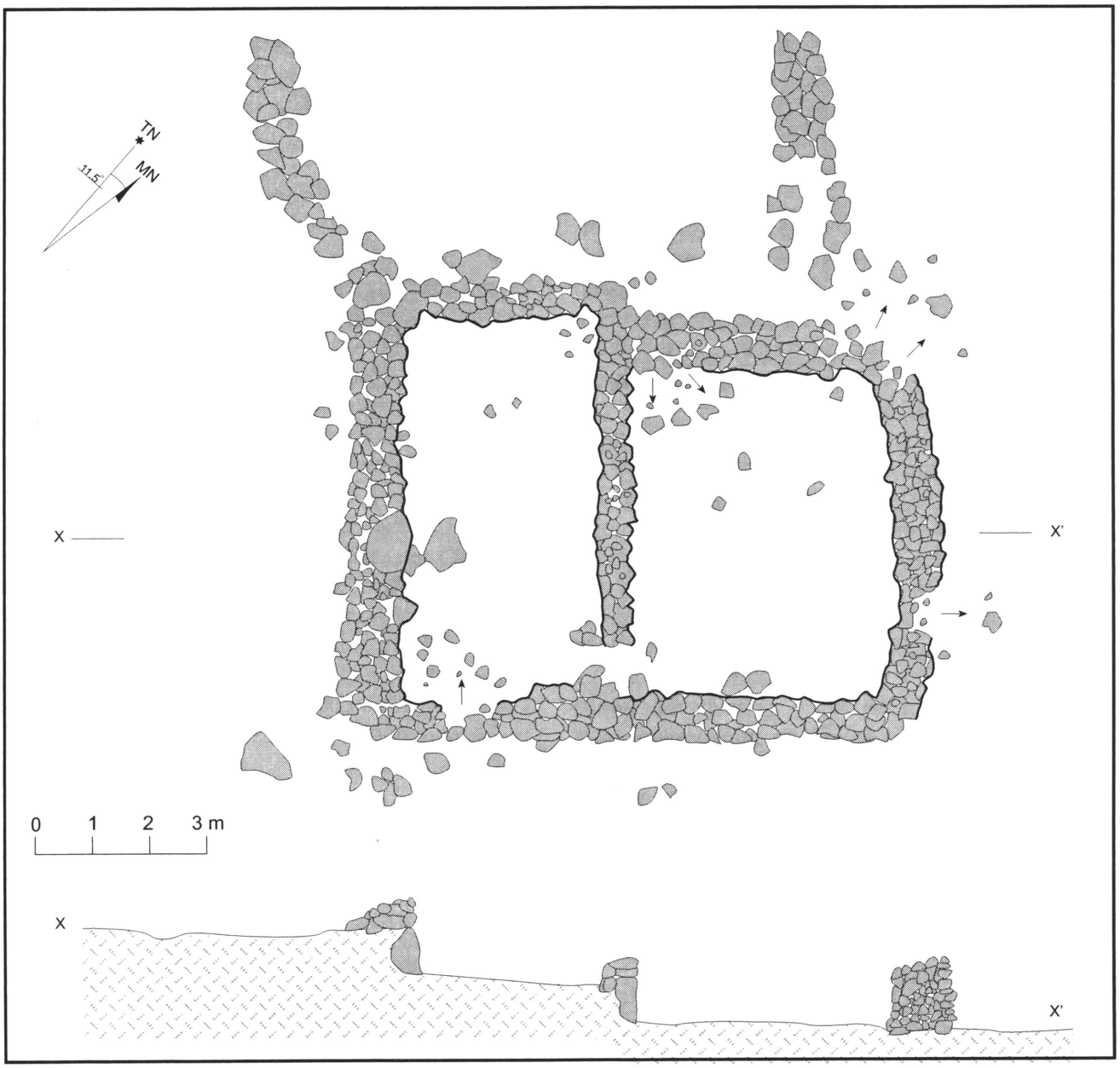


Figure 24 Plan and section of Site KB-9a, a possible residential site.

we did observe some *Pandanus* stands especially in close association with stone structures (as is also the case in Wai'ale'ia Valley). Sample Area A, while also dominated by a forest canopy of Java plum, exhibited several species of ethnobotanical interest. This included the *noni* and *kī* plants on the talus slopes, both of these probably being naturalized survivals of former cultivation on the slopes. Trees noted in this zone include *kukui* and the stand of large *kamani* near Site 289. *Kamani* or *Calophyllum* trees are relatively rare in the islands, and produce a prized carving wood; they were also known to have been associated with temples (Neal 1965:584).

THE KAUPIKIAWA TRANSECT (KT-)

GENERAL OBSERVATIONS

One of the most remarkable features of the archaeological landscape of the Kalaupapa Peninsula is an extensive system of low, parallel stacked-

stone alignments which cover large parts of the gentle slopes descending from Kauhako Crater. These alignments, which are highly visible from the air, as when approaching the Kalaupapa landing strip, have been interpreted as the remains of an extensive dryland field system, and some scholars have associated them with a phase of intensive sweet potato cultivation during the mid-19th century (see Ladefoged 1990 for a literature review). During this period, the Hawaiian Islands shipped large quantities of both sweet potatoes and Irish potatoes to San Francisco, in response to the needs of the "49ers" and other immigrants into California (Morgan 1948:155-56).

In order to sample a portion of this intriguing aspect of Kalaupapa's archaeological record, we decided to survey closely a sample transect across the eastern part of the peninsula, running from the coast slightly south of Kaupikiawa Point, and continuing westwards to the boundary wall between Kalawao and Makanalua *ahupua'a*. Our transect had a width of roughly 150 m, and a total length of about 700 m (total survey area approximately 10.5 hectares). Because of the density of field system walls within the transect, we decided to employ plane table and alidade mapping of the field alignments and site locations, combined with our normal method of compass-and-tape mapping and recording of stacked-stone architectural features other than field boundaries. The plane table mapping was carried out at a scale of 1:500, while the individual features were typically recorded at 1:100 or 1:50 scale. The overall transect map is shown in Figure 25.

The area covered by our transect runs from the coast inland up gently-sloping, undulating terrain, consisting of the lava flow slopes emanating from Kauhakō Crater. The transect thus spans an altitudinal range from sea level to about 50 m asl. The substrate consists of pahoehoe lava thinly overlain with a reddish-yellow soil; the transect lies within the Kalaupapa Series of soils defined by Foote et al. (1972). Vegetation cover varies from the coast, which is largely barren with only scattered bunch grass and low herbs, with lantana becoming more prevalent in the midsection of the transect, and with relatively low but dense Christmas berry, Java plum (here growing as a stunted shrub-like form), and lantana in the upper reaches of the transect. In significant parts of the transect the vegetation was sufficiently dense to obscure the low field system walls, and these areas could not be properly mapped.

SITES RECORDED

A total of 38 architectural features were discovered and recorded within the transect, along with approximately 80 parallel stacked-stone field alignments. The latter are of particular interest, as they comprise part of the vast network of field walls that covers much of the Kalaupapa Peninsula. The walls run primarily in a north-south direction, which is thus perpendicular to the dominant trade winds that relentlessly sweep across the peninsula (Fig. 26); one surmises that a windbreak function was thus a primary (though probably not exclusive) function of the walls. The alignments are roughly stacked (not core-filled), usually about 30-60 cm wide and with an equivalent height. Some are more substantial than others, but all appear to have been constructed by simple heaping up of the abundant loose pahoehoe and a'a rocks, without much attention to careful placement or positioning of stones. In this regard, they contrast strikingly with the more substantial walled features scattered throughout the area, which have generally higher and better constructed, core-filled, and faced constructions.

The lengths and spacing between walls varies considerably over the area we mapped intensively. A few run for more than 100 m, while others are considerably shorter. Some sets of walls appear to have been constructed at the same time, and abut to a short segment of wall running east-west. One example of this can be seen with a group of four long north-south walls that all abut a short east-west wall segment just inland (west) of Site 17. Spacing between walls ranges from as great as 15 m to as narrow as 2 m.

One can envision at least four functions for these walls, and these need not have been mutually exclusive: (1) windbreaks; (2) soil retention; (3) stone clearance; and (4) plot boundaries. The windbreak function seems particularly clear, especially after one has spent a day exposed to the continual blast of the trade winds, and also observes how well the lantana bushes grow in the immediate lee of the walls. Likewise, soil retention seems to be enhanced on the immediate lee side of the walls. Given the highly

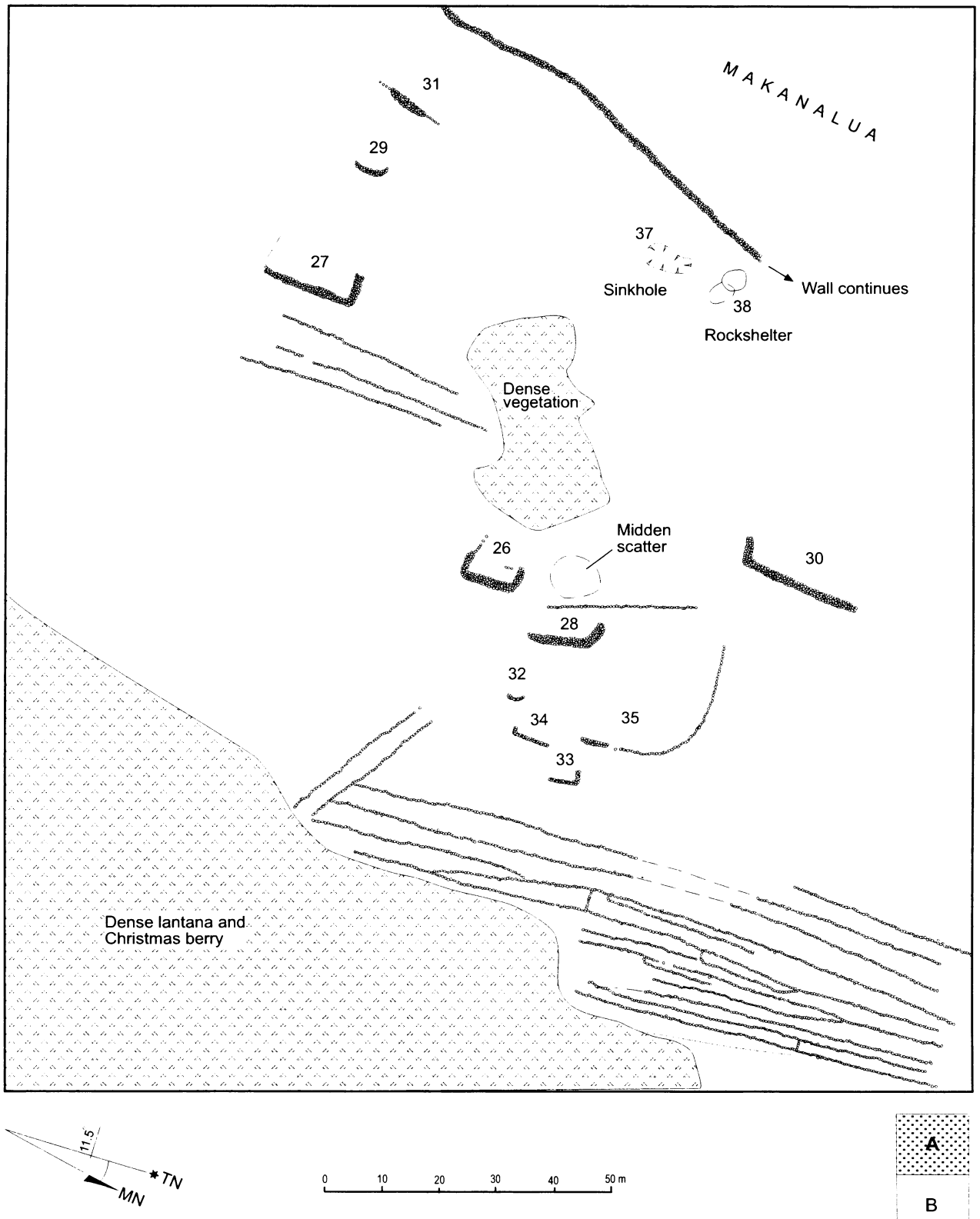
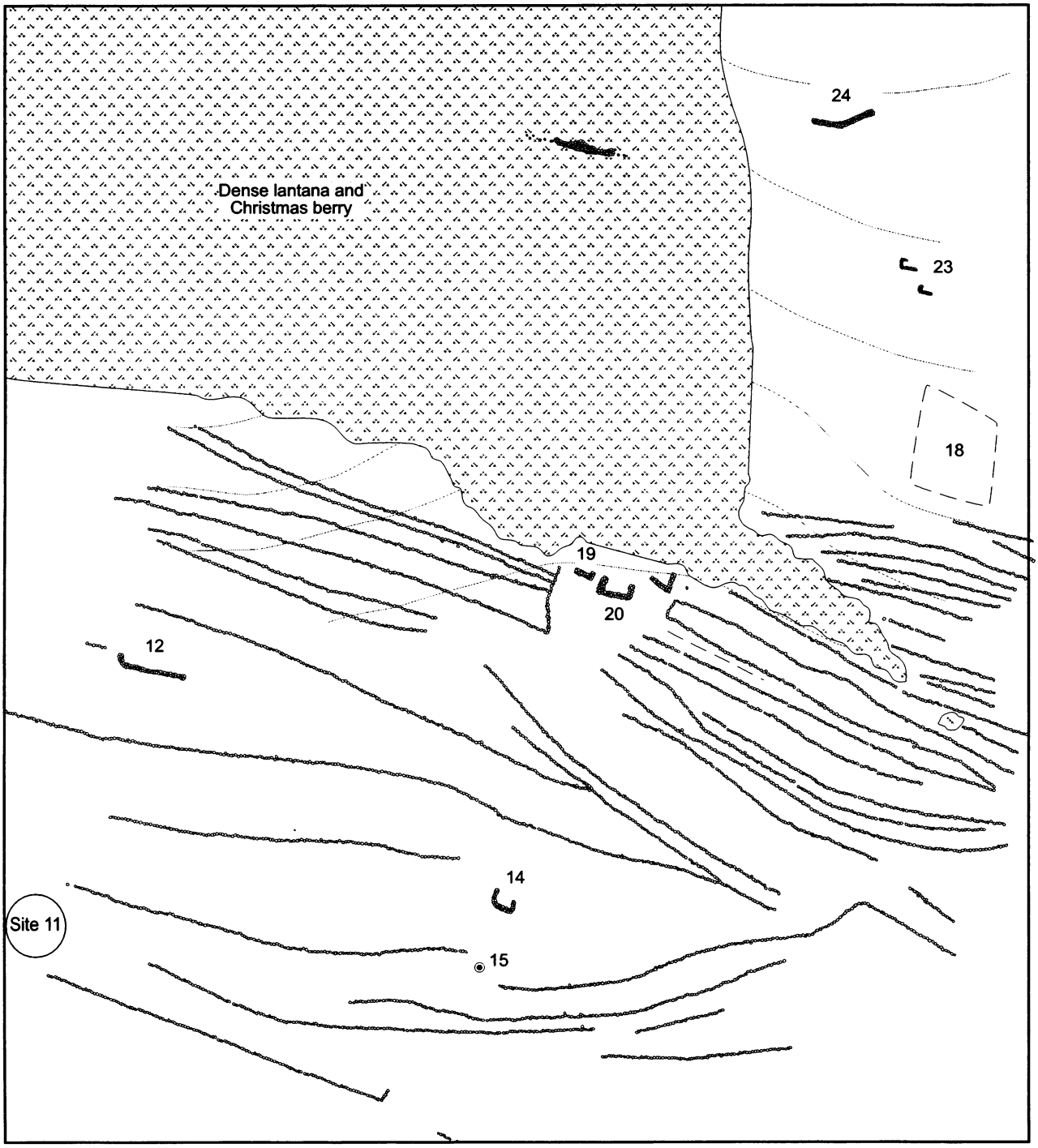
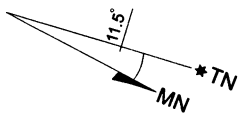
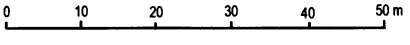
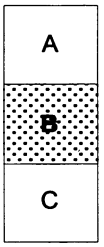


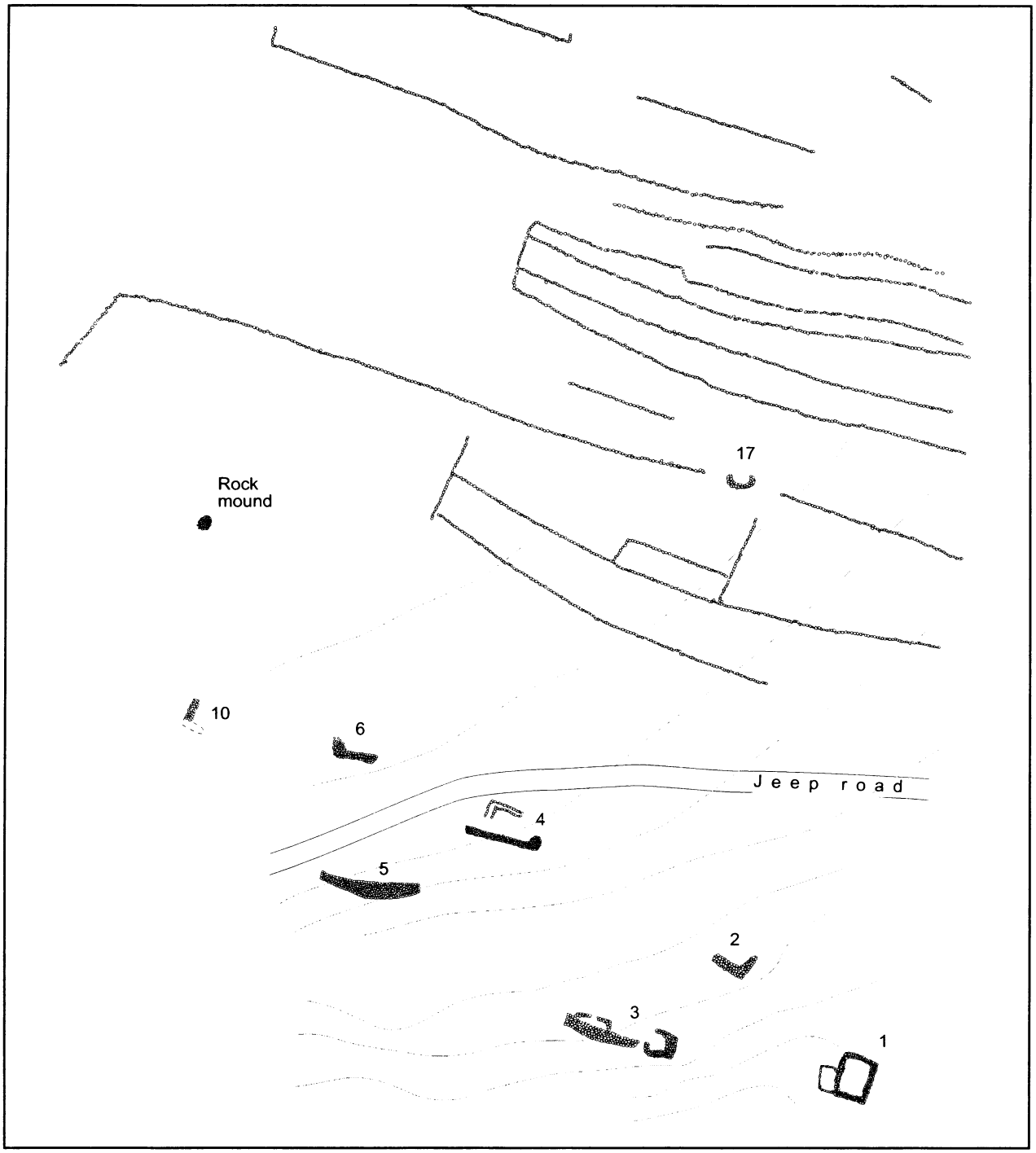
Figure 25 Map of the Kaupikiawa Transect, showing the stone field alignments and other architectural features. Based on plane table and alidade survey at 1:500 scale.

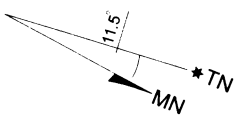

Dense lantana and
Christmas berry
24
23
18
19
20
12
14
15
Site 11

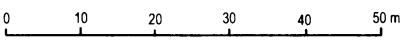

11.5°
TN
MN


0
10
20
30
40
50 m


A
B
C


Rock
mound
17
10
6
Jeep road
4
5
2
3
1


11.5
TN
MN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50 m

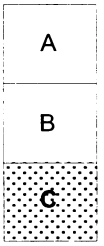

A
B
C

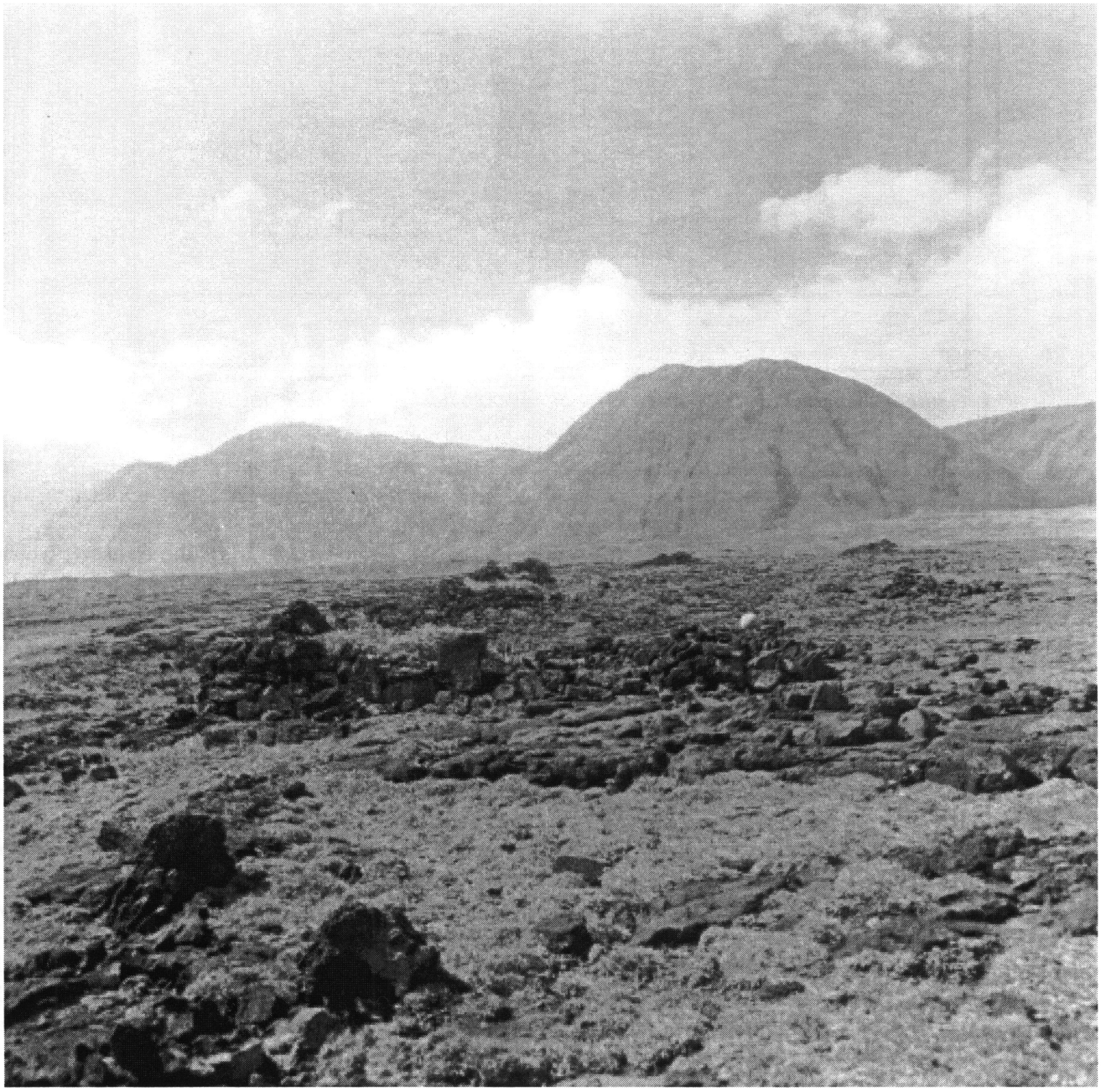
Figure 26 View along one of the low stone field alignments in the Kaupikiawa Transect. Several other field alignments are visible in the near distance. The valley in the center rear of the photo is Waihānau Valley.

stony nature of the peninsula, simply clearing away a significant quantity of surface rock in order to exposure more soil area for planting, would have been another likely function of the walls. Finally, it is likely that the walls served as individual garden plot boundaries. The Mahele records give dimensions for *kula* plots that are unusually long and narrow (see above), and would seem to correspond closely to the long north-south and narrow east-west orientation of the field walls. Of course, an individual *kula* plot probably included several parallel sets of fields, and may indeed correspond with walls sets which terminate or abut to a common east-west wall segment.

Distributed among the field system, either isolated or as discrete cluster groups, are a number of other architectural features, most of which appeared to have a residential function. One group of struc-

tures is situated at the eastern end of the transect, just above the rocky shoreline, and about 30 m seaward of the first field system wall (Sites KT-1-6). This cluster (Fig. 27) appeared to represent a classic *kauhale* or household group comprised of multiple structures, possibly with two or more nuclear family groups. At the northern end of this cluster, Site KT-1 (Fig. 28) is likely a household or fishing shrine (*ko'a*), based both on architectural form (rectangular enclosure with attached exterior pavement) and on the presence of branch coral. Nearby Site KT-2 is a simple L-shaped shelter with upright slabs facing a core-filled wall; a light midden scatter extends in the lee of the wall. Sites KT-3, -4, and -5 are larger and more complex architecturally, and were probably all residential sites. At these struc-

Figure 27 View of the Sites KT-1 to -6 cluster in the seaward portion of the Kaupikiawa Transect. The plastic fishing float lies on Site KT-1. In the distance, Wai'ale'ia Valley is visible on the left, and Waihānau Valley on the right.



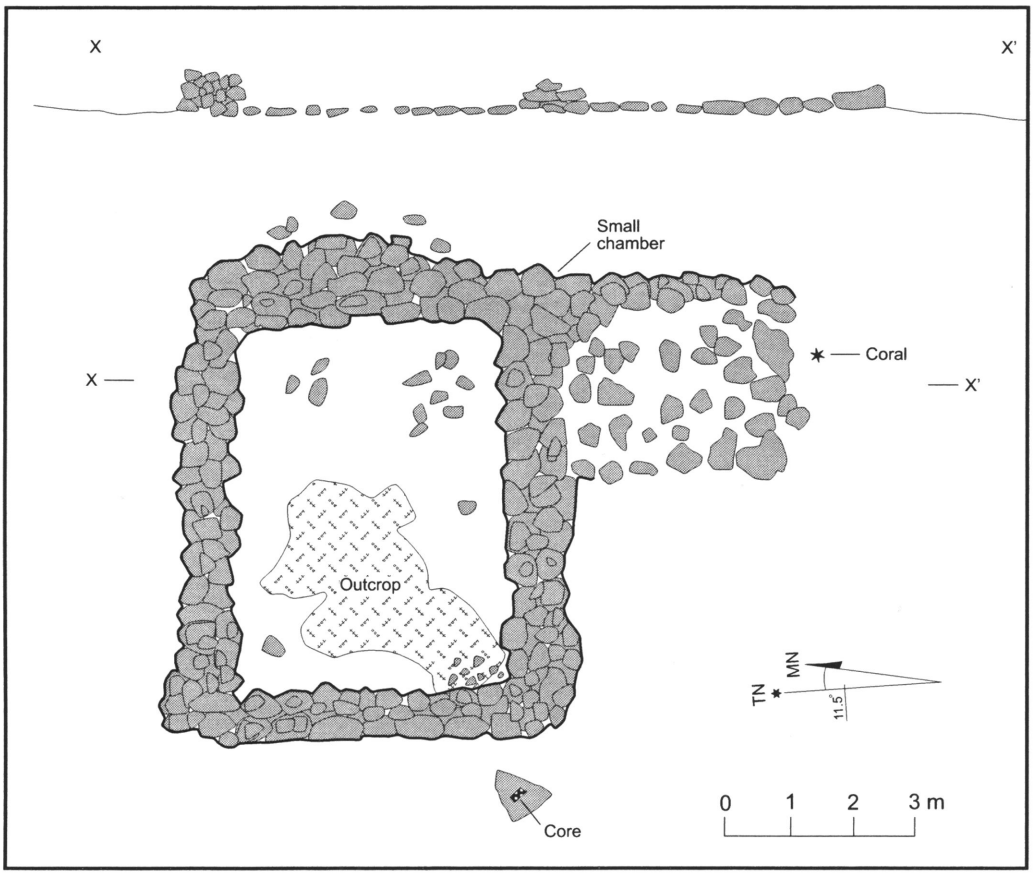


Figure 28. Plan and section of Site KT-1, a probable fishing shrine (*ko'a*).

tures we noted both basalt flakes and early post-contact period artifacts (metal and glass fragments, and a chert core), suggesting that the cluster may span both late pre-contact and early historic times.

Between about 230-260 m inland of the jeep road, another set of structures was encountered, not tightly clustered but nonetheless also likely to have comprised some kind of residential grouping. This includes a large L-shaped windbreak (Site KT-18) with an enclosed space to the lee, situated on a knoll; five pieces of branch coral were noted at this site. Site KT-19 (Fig. 29) consists of a simple L-shaped shelter with a free-standing stone mound nearby. Site KT-20 (Fig. 30) is a typical C-shaped shelter. Site KT-22 consists of a formal, U-shaped enclosure with attached wall. Other sites making up this loose cluster include C-shaped structures and a stone mound. All of these features seemed to us to be typical of pre-contact Hawaiian residential architecture, based on our experience of excavating and dating such features at Kawela, Kahikinui, and other locales. Their integration into the field system therefore suggests some pre-contact history for this landscape.

The westernmost 100 m of the transect, which lies just to the east of the long boundary wall dividing Kalawao and Makanalua *ahupua'a*, contained a substantial number of stone structures, perhaps representing two discrete residential clusters or *kauhale*. The lower cluster has a rectangular enclosure (Site KT-26), and an L-shaped windbreak shelter (Site KT-28), associated with three smaller structures (Sites KT-33, -34, -35). A number of basalt flakes, branch coral pieces, and considerable shell midden were noted on the surfaces of these features (see Fig. 32), while no historic-period artifacts were observed. A second, slightly higher elevation cluster includes a substantial elongated U-shaped shelter (Site KT-27) with a cupboard built into one wall and a *papamū* stone with pecked depressions for playing the traditional game of *kōnane* (Fig. 31).

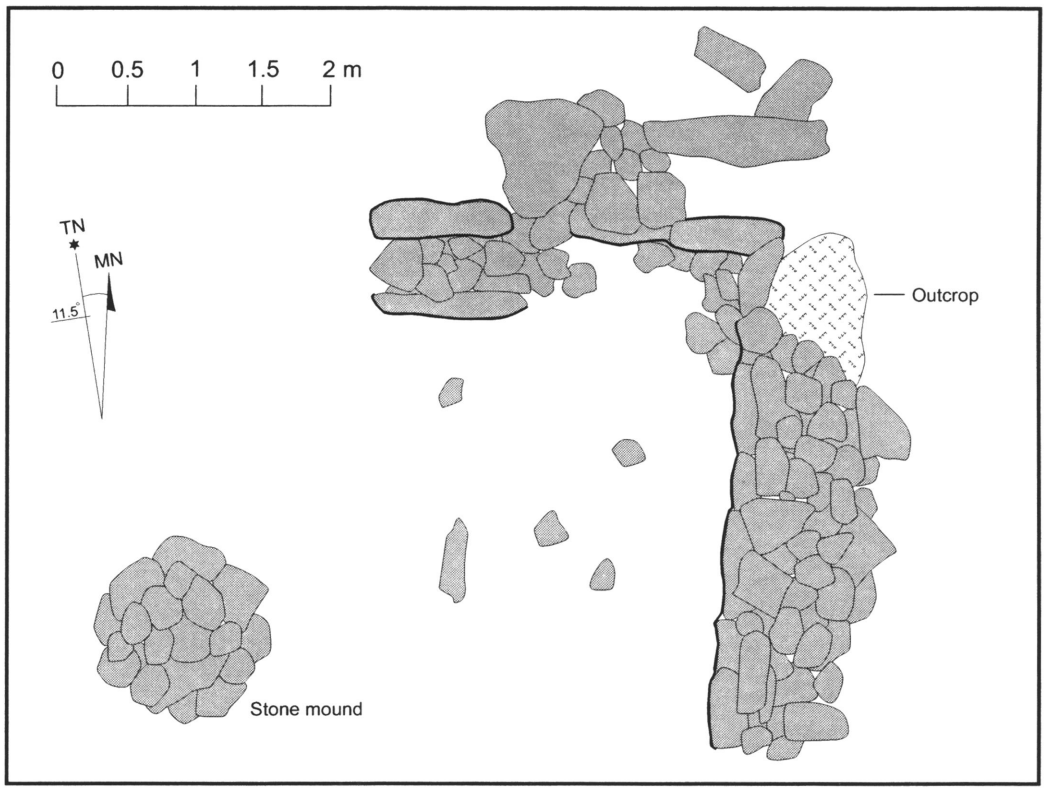


Figure 29 Plan of Site KT-19, an L-shaped shelter

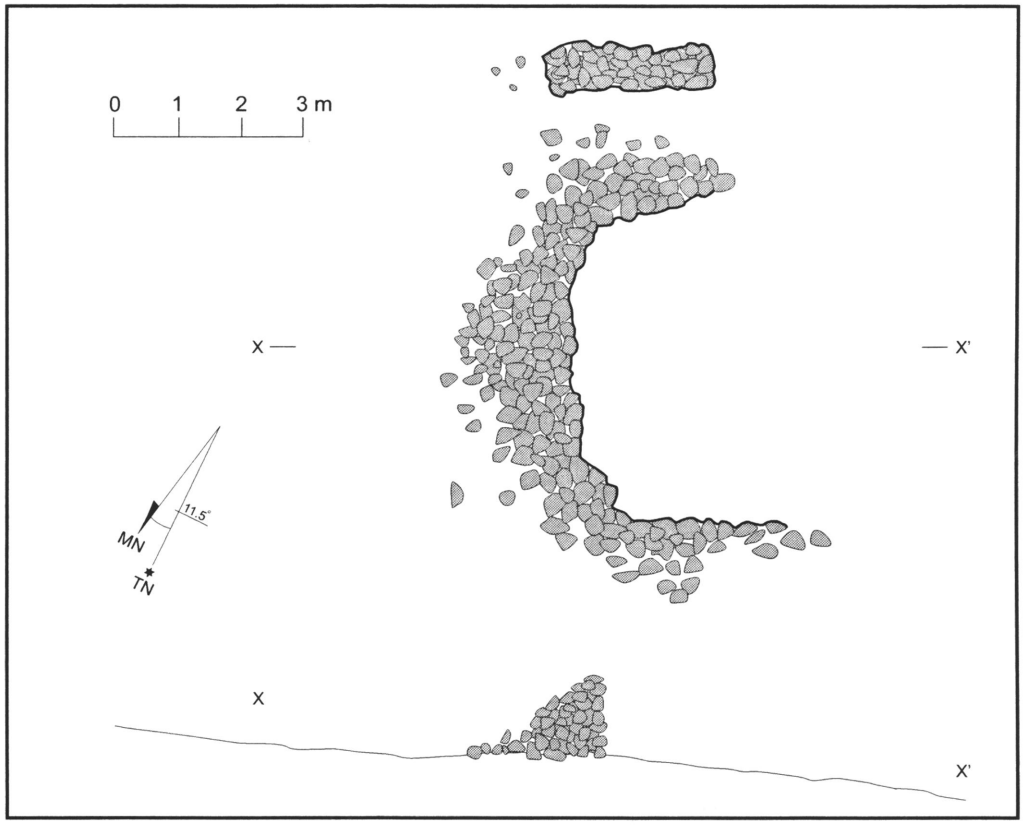


Figure 30 Plan and section of Site KT-20, a C-shaped shelter.

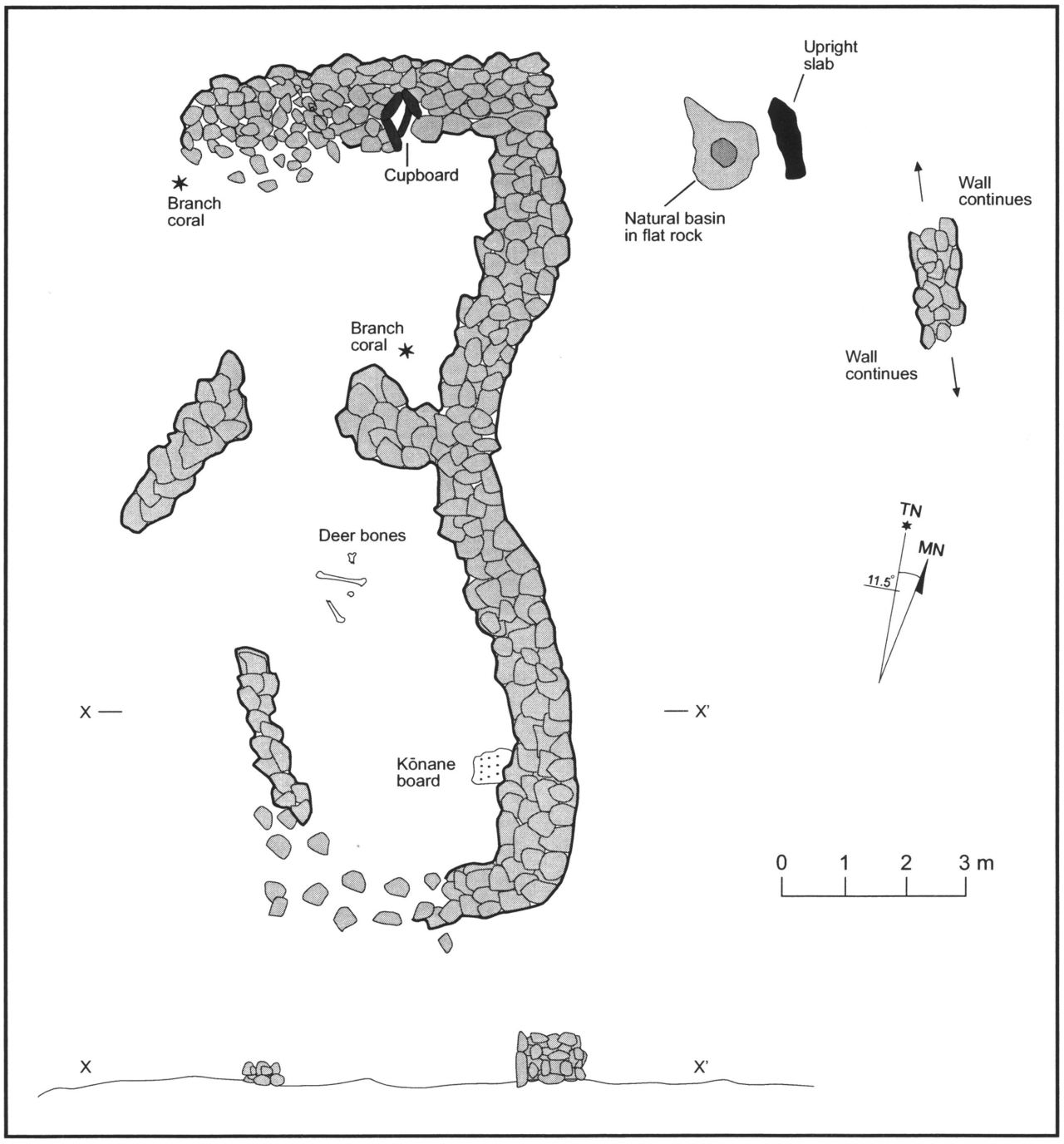


Figure 31 Plan of Site KT-27, a stacked stone shelter incorporating a cupboard feature, and also with a *kōnane* gaming stone (*papamū*).

Just a few meters east of the boundary wall, we also discovered a stone-faced lava tube sinkhole (Site KT-37), and a rockshelter (Site KT-38), both of which are probably part of the same partially collapsed lava tube complex. The rockshelter appeared to have considerable deposit in the floor with surface midden visible; we did not enter the shelter as the deposit looked soft and we did not want to disturb its integrity.

SUMMARY

What most impressed us during our survey of the Kaupikiawa Transect, aside from the remark-

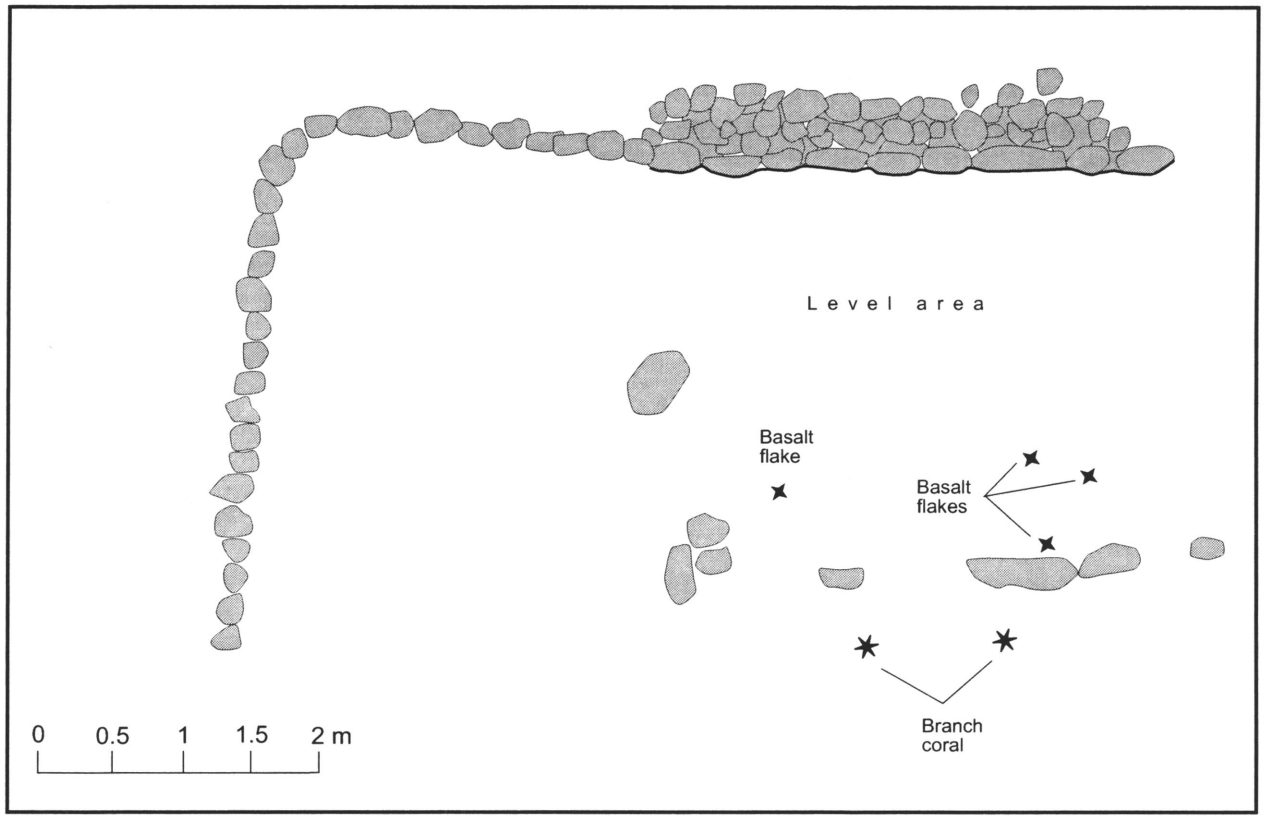


Figure 32 Plan of Site KT-34, a possible residential or activity area with basalt flakes and branch coral.

able density of field system alignments (sometimes only 2 m apart), was the close integration of architectural features apparently reflecting habitation within the dryland agricultural zone. While the easternmost cluster of features near the jeep road had a few early historic period artifacts, the more inland clusters lacked any historic artifacts. Indeed, these sites displayed architectural forms (C-, L-, and U-shaped shelters) which work elsewhere on Moloka'i and Maui has generally shown to be pre-contact in age. The presence of basalt flakes, branch coral, and shell midden associated with these structures would also argue for pre-contact occupation. Given the integration of such residential clusters within the field system, we are skeptical that the system represents simply a mid-19th century development, in response to external trade opportunities such as the San Francisco Gold Rush, as some have proposed. While there is no doubt that the Kalaupapa field system went through a short phase of agricultural intensification in response to these commercial opportunities, this may simply have been a period of re-intensification of a pre-existing system. Thus, we hypothesize that the Kalaupapa field system was an indigenous development of the pre-contact period, as with similar intensive agricultural developments now well documented throughout other parts of the Hawaiian archipelago (e.g., the Kohala and Kona field systems on the Island of Hawai'i; Kirch 1994). Testing this hypothesis will, however, require more detailed field studies, including excavation and direct dating.

KAUPIKIAWA POINT (KC-)

While undertaking the re-excavation and sampling of Kaupikiawa Rockshelter (or "Pearson's Cave"), we decided to simultaneously record surface structures within a radius of about 150 m of the lava tube, in part because space limitations within the site restricted the size of the crew that could reasonably work together in the cramped quarters. Aside from this practical consideration, we wished to determine what kinds of structures might be found within the vicinity of the lava tube, and to record a sample of the archaeological record

on this northerly fringe of the peninsula. This is the driest and most exposed of our sample areas, with a substrate consisting largely of barely weathered pahoehoe lava, with only pockets of aeolian-derived soil here and there. This survey area falls within the Rockland soil zone of Foote et al. (1972). Vegetation is limited to stunted grasses and low herbs, with a few Christmas berry shrubs or lantana surviving in the lee of structures or natural ridges.

Sixteen sites were recorded over a period of four days. There is considerable variety in the stone structures represented, with both habitation and agricultural features being present. Some sites, such as the well-constructed rectangular enclosure with formal doorway that sits atop "Pearson's Cave" (Site KC-1), are clearly historic period in age. This particular site had a small surface scatter of glass and ceramic shards (as well as shellfish midden) in front of the doorway. Other, less formal enclosures may be pre-contact in age; excavation will be necessary to test this. An example of such a possible pre-contact habitation structure is Site KC-6 (Figure 33), a subrectangular enclosure measuring 7.9 by 5.8 m, with stacked walls about 70 cm high, and lacking a formal entryway. This structure has a "cupboard" built into one wall, a feature also encountered in late prehistoric residential sites in Kawela, Moloka'i (Weisler and Kirch 1985). The presence of a hammerstone and absence of apparent foreign artifacts also suggests a pre-contact age. Yet another possible residential feature is Site KC-9, a roughly L-shaped shelter with a possible slab-lined hearth; a basalt flake was observed on the surface (Fig. 34).

Despite the aridity and exposure of this part of the peninsula, it is evident that attempts were made to cultivate some crops, most likely sweet potato but perhaps also gourds or introduced melons (after contact) in the area. Site KC-5 appears to represent a small gardening complex, almost a "mini field system" (Figure 35); here seven parallel stone rows were situated in a low soil-filled depression bounded by pahoehoe flats on one side and a free-standing on the other side. Another apparent gardening site is Site KC-8, another soil-filled depression surrounded by outcrops and enclosed by a free-standing wall with an average height of 85 cm. Inside the walled enclosure are four stone rows or alignments; pieces of coral and waterworn stones were also observed inside the enclosure. Yet another feature that may have been used for gardening is Site KC-13, with a stacked stone wall surrounding a natural depression (Figure 36).

Burial features are also possible in this area. We observed one feature (Site 14) which is a roughly constructed stone mound about 3 by 3.5 m, which may well contain an interment.

NIHOA LANDSHELF (NI-)

GENERAL OBSERVATIONS

The Nihoa landshelf occupies the westernmost extension of KNHP, some 2.5 km west of the peninsula itself. The landshelf, as with similar geomorphological features along the northern coastline of Moloka'i, was formed as a result of massive faulting along the high cliffs, leaving a "shelf" or block of land roughly 800 m long and 300 m wide, perched some 20-30 m above the sea. Nihoa can be reached during the summer months by hiking along the narrow (and treacherous) boulder beach that stretches from Puwahi to Kaluanui (Fig. 37), and then scaling the 25 m cliff up to the landshelf proper.[4] Discussions with local Kalaupapa residents suggested that Nihoa is visited only infrequently; indeed, some old-timers told us that they had never visited it.

Once one has scaled the escarpment, the surface of the landshelf reveals itself as relatively level and habitable, sloping up gently to the east and south (towards the cliff). In the central part of the landshelf is an extensive concentration of large, angular boulders, some of which range up to 2-5 m in diameter. This pile of debris, evidently the residue of a significant landslide, extends some distance, and makes walking from the eastern to the western sides of the landshelf difficult, as one must climb over this boulder field in the process. This is made all the more difficult by dense *Pandanus* and *Thespesia* groves which partly cover and obscure the boulders. One major site complex (Site NI-6) is located on the southern side of this boulder concentration.

The soil on top of the landshelf appears to consist of a mixture of unsorted angular gravel and debris flow from the cliffs, mixed with finer clay

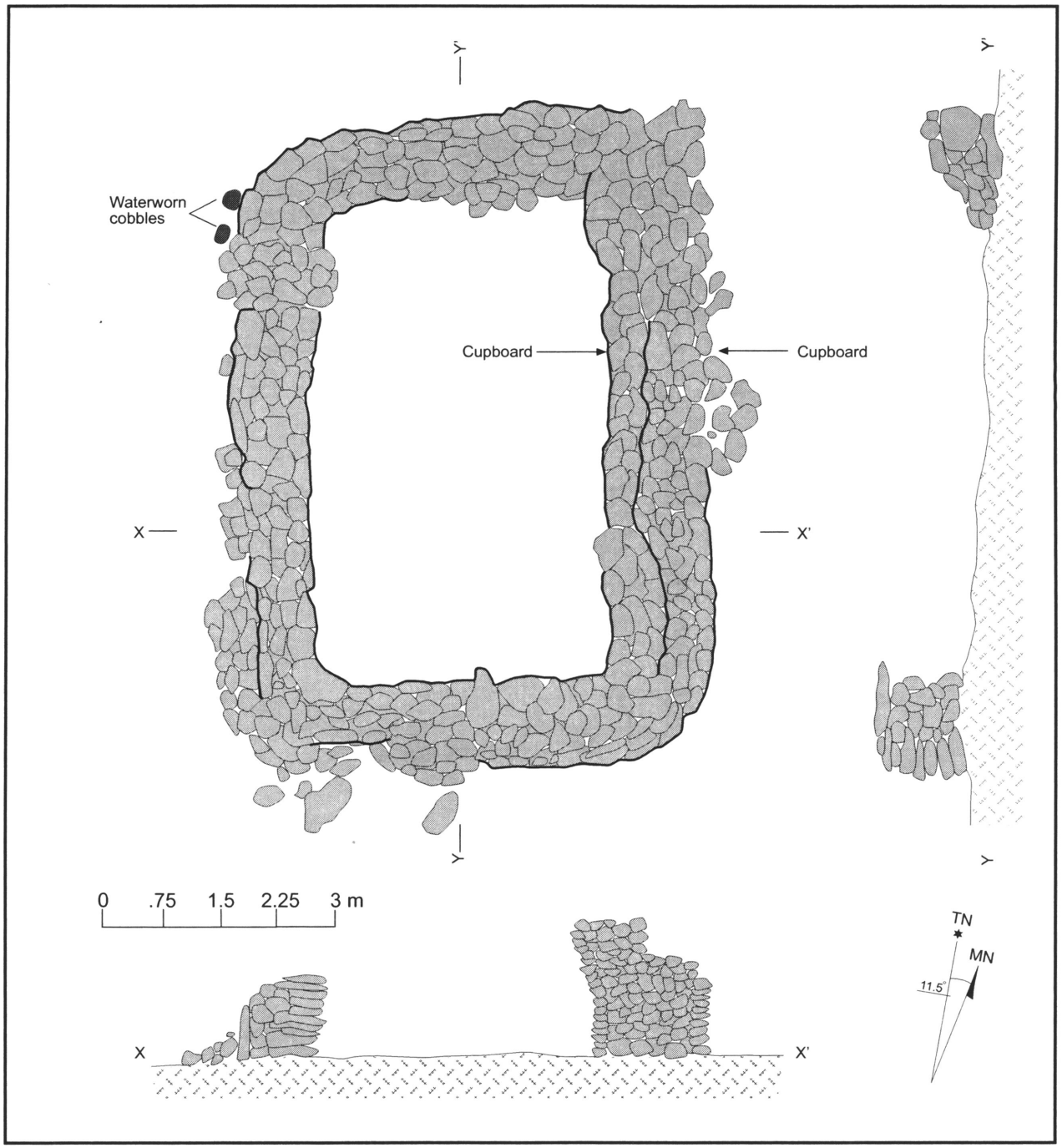


Figure 33 Plan and section of Site KC-6, a possible post-contact residential feature.

deposits that have been washed down from the higher elevations during rainstorms. There is considerable archaeological and ethnobotanical evidence that much of the landshelf surface was cultivated in the past. Water sources appear to be more limited. There is an intermittent stream channel on the eastern side of the landshelf, which was dry when we visited, but which may run during winter months. (Site NI-1 is adjacent to this stream channel.) Other springs or water sources may exist along the base of the inland cliff.

SITES RECORDED

Our team made two one-day reconnaissance visits to Nihoa, recording a total of 10 sites. These

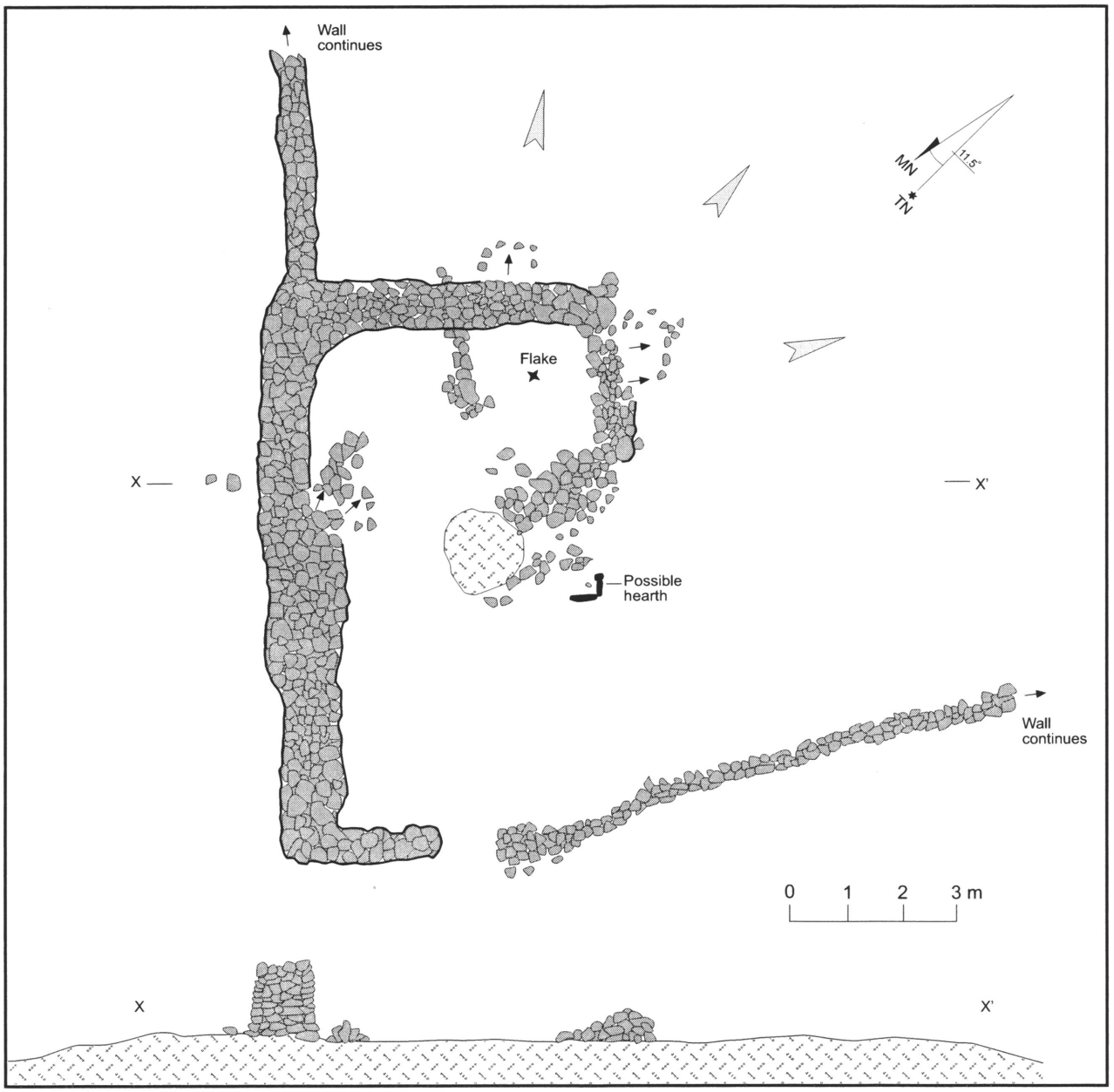


Figure 34 Plan and section of Site KC-9, a possible pre-contact residential feature.

sites include three major habitation complexes (Sites NI-1, -6, and -10), each with evidence of traditional Hawaiian occupation (i.e., probably of pre-contact age), and one with additional evidence of historic-period occupation (in the form of glass shards and a brass ornament). Two of the habitation complexes are quite extensive, with multiple terraces (Sites NI-6 and -10), and these were mapped in detail with plane table and alidade.

Site NI-1, a plan view of which is shown in Figure 38, consists of two main stone-faced earthen terraces and a smaller third terrace, adjacent to the intermittent stream on the eastern side of the landshelf. The site was largely devoid of vegetation, and numerous basalt flakes and cores were observed scattered over the surface, along with shell midden including *Cellana* sp. *Pupura aperta*, *Drupa* sp, and *Cypraea mauritiania*.

Site NI-6 was mapped with plane table and alidade, and the resulting map is shown in Figure 39. This is a complex site, constructed on the inland side of the large boulder concentration in the

middle portion of the landshelf, and consisting of several adjacent stone-faced terraces, free-standing walls, and large uprights. A cluster of three upright slabs on the highest terrace may have comprised a small shrine. Extensive shell midden deposits cover several of the terraces, and it appears that there is considerable depth of cultural deposit. Basalt flakes are also numerous, especially on the northern side of the long free-standing wall. We also found several adz fragments.

Site NI-10 is situated to the west of the large boulder complex incorporating Site NI-6, and beyond a basin-shaped swale filled with an extensive stand of *milo* trees. This complex consists of a series of well-constructed, stone-faced terraces built around and incorporating large natural boulders.

Figure 35 Plan and section of Site KC-5, a probable garden feature with parallel stone rows.

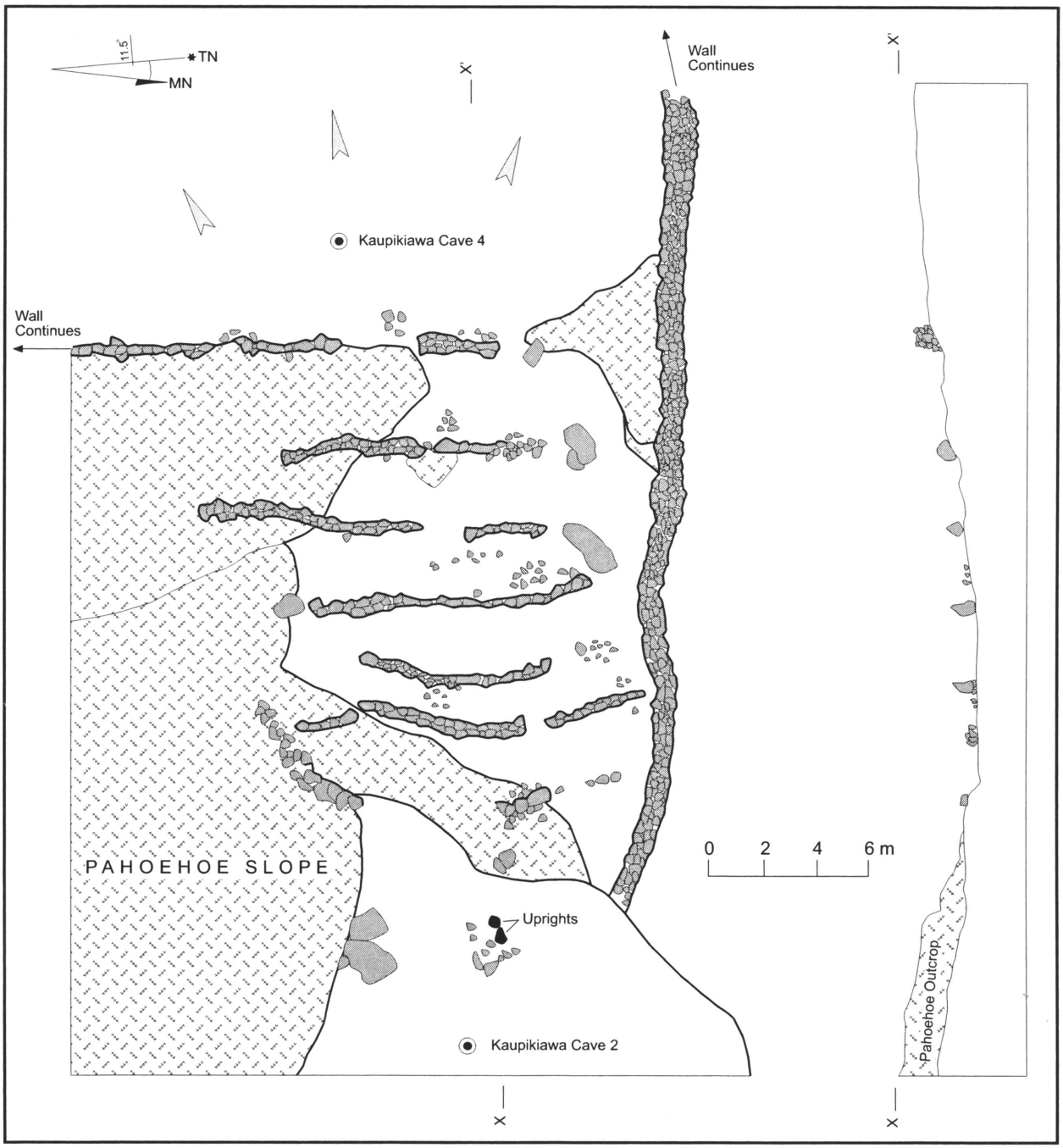


Figure 36 Plan and section of Site KC-13, a possible garden feature.

This site was also plane-table mapped, as shown in Figure 40. The highest terrace has a retaining wall ca. 1.3 m high on the south, whereas the north side of the terrace is defined by the cliff edge. Situated on this terrace, and overhanging the cliff edge some 2-3 m is a rectangular, elongate boulder some 6 m long. The site seems to have been constructed so as to incorporate this impressive boulder on the main (highest) terrace. When viewed from below the cliff, the boulder has a shark-like appearance, and may have represented an '*aumakua* or ancestral spirit. A distinct slab-lined hearth was noted on

the surface of the highest terrace, and the bevel portion of a well-ground basalt adz was found some 2 m to the west of the hearth, on the surface. Surface debris largely obscured the ground, but in addition to the adz bevel we noted another adz section on a lower terrace, as well as shell midden including *Cellana* and *Nerita*. South (inland) of the terraces and extending to the east we noted that there were some low stone walls which may be part of a former dryland field system; these are largely obscured by dense lantana. It was also in this area that we saw five large *noni* (*Morinda citrifolia*) trees.

In the central portion of the landshelf, we also recorded an extensive system of low walls and stone alignments (Sites NI-4 and -7), which appear to be a dryland agricultural field complex, suggesting that the nearby habitation sites may have been permanently occupied. Portions of this field complex were

Figure 37 View of the boulder beach approach to Nihoa. The Nihoa landshelf itself can be seen in the distance.

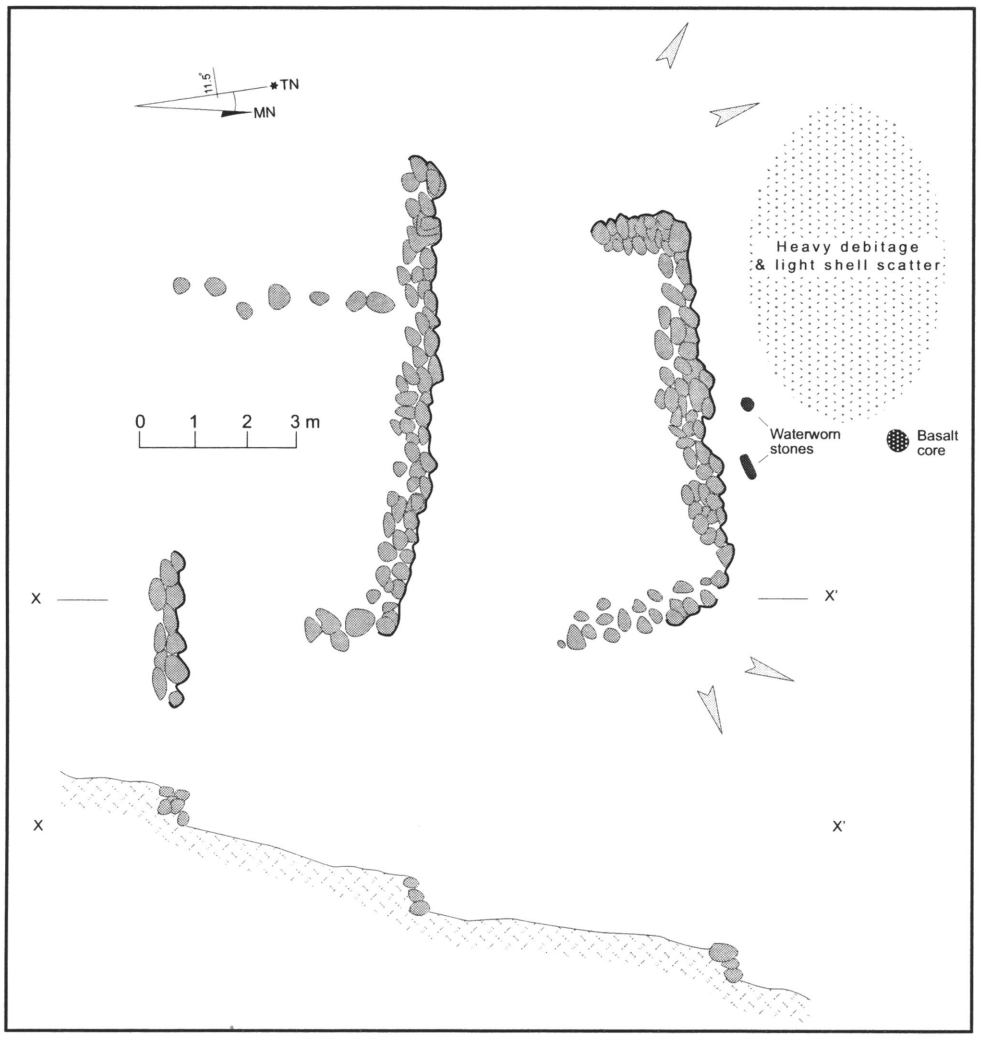


Figure 38 Plan and section of Site NI-1, a set of probable habitation terraces on the eastern side of the landshelf.

sketch mapped with compass and tape (Figures 41 to 43), but the complex extends further into dense Christmas berry vegetation, which we lacked the time and resources to clear. The mapped area included several low stone alignments, one of which incorporates a small rectangular structure. There are also a number of stone mounds, as are typically found in Hawaiian dryland agricultural complexes. Several other structures, including small enclosures (Site NI-2a, 8, 9) and C-shapes (2c, 2d) are dispersed within the field system walls, and may be habitation sites or temporary garden houses.

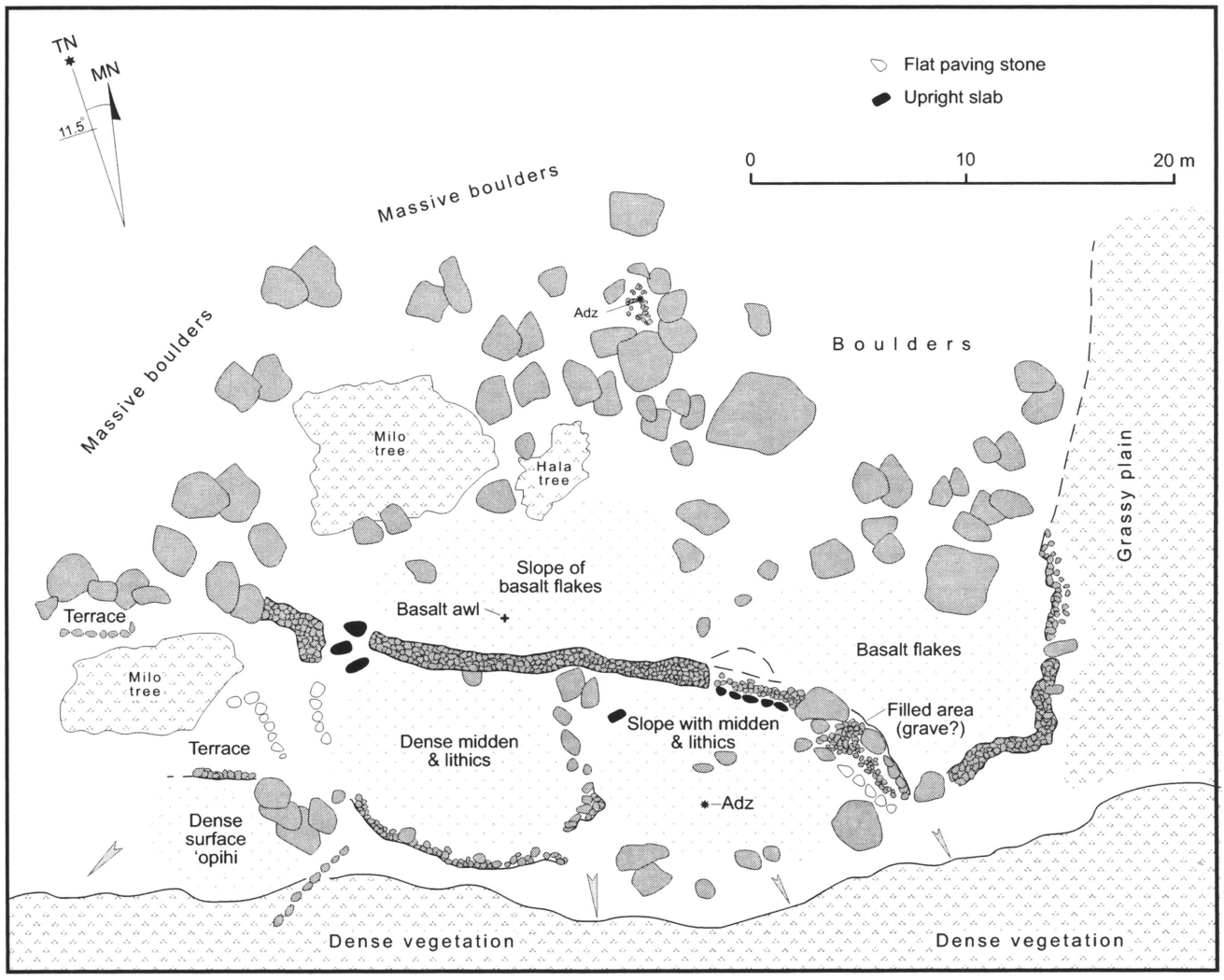
The landshelf also appears to have a number of burial sites, especially in the central portion, associated with a large natural boulder formation. There are indications of rearrangement of smaller cobbles between these large boulders, and the presence of smaller water-worn pebbles and cobbles may be an indication of burials within. We also saw what appears to be a crypt-like burial constructed within the larger boulders, which may be of historic age. Site NI-3, next to an outcropping of large boulders near the escarpment edge, is a low rectangular structure ca. 1.5 by 3 m is size. The edges are defined by stones set on edge, and the interior is partly paved. This site had the appearance of being a burial, as did Site NI-5, another low rectangular structure ca. 2 by 2.25 m, with an internal division. Site NI-5 is also situated near the escarpment edge. None of these sites has exposed human remains.

ETHNOBOTANICAL OBSERVATIONS

Of particular interest to our team were the vegetation communities found on the Nihoa landshelf. In particular, there are extensive stands of *milo* (*Thespesia populnea*), a pre-contact Polynesian introduction prized for its wood and extensively used in carving bowls and other implements. The central part of the landshelf comprises an almost mono-specific stand of *milo* trees, many of them with large trunks. It appears to us that this stand is itself an artifact, the result of purposive planting and tending of these trees. Given that we also observed significant quantities of basalt flakes and several parts of stone adzes on the three habitation sites, we hypothesize that the inhabitants of Nihoa may have had a particular economic specialization in wood carving.

Other ethnobotanical observations of interest on Nihoa include several dense groves of *hala* (*Pandanus* sp.), scattered specimens of *noni* (*Morinda citrifolia*), and of another prized wood tree, *kamani* (*Calophyllum inophyllum*). We were particularly impressed by the tree-like size of several *noni* plants near Site 10, with estimated heights of 7 m, and basal trunk diameters of 20-30 cm. This suggests these plants are quite old, possibly survivals from indigenous Hawaiian cultivation.

Figure 39 Plan map of the NI-6 site complex at Nihoa. This large complex with dense midden deposits, lithic scatters, and architectural features appears to have been a major locus of habitation.



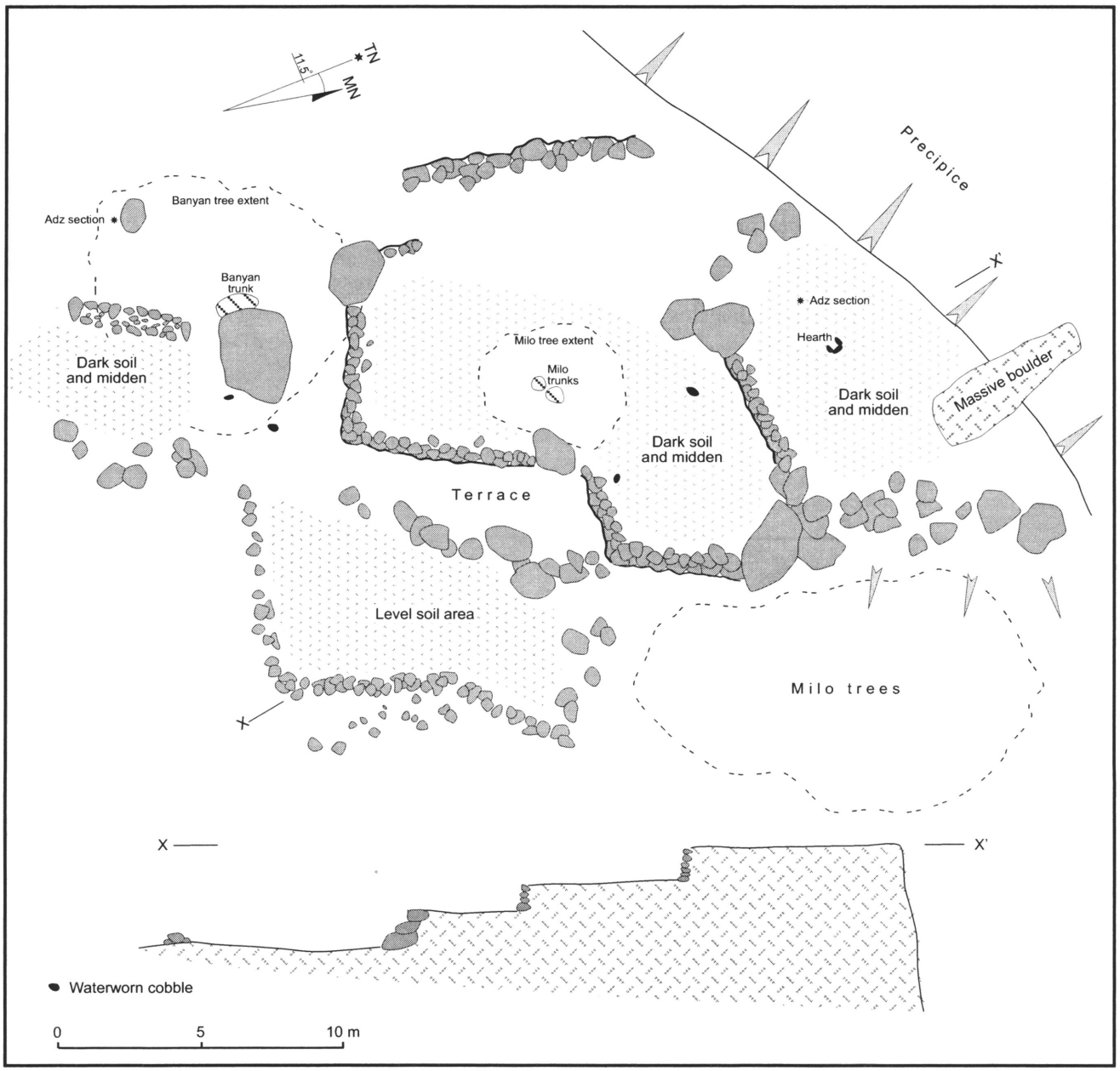


Figure 40 Plan and section of Site NI-10 at Nihoa.

SUMMARY

In sum, the Nihoa landshelf proved to have extensive archaeological remains as well as associated ethnobotanical features of considerable interest. There was very limited evidence of historic-period occupation (post-contact artifacts were found only at site NI-6), and Nihoa was probably abandoned early in the 19th century. There are several habitation complexes which may have been permanently occupied, as well as the remains of dryland agricultural fields on the central part of the landshelf. Given the numbers of basalt flakes, partial adzes, and an extensive stand of the native Hawaiian tree *milo*, Nihoa may well have been the locus of a small community which specialized in wood carving, while partly supporting themselves through dryland cultivation. These are hypotheses which deserve further investigation, and may be testable through further field investigations.

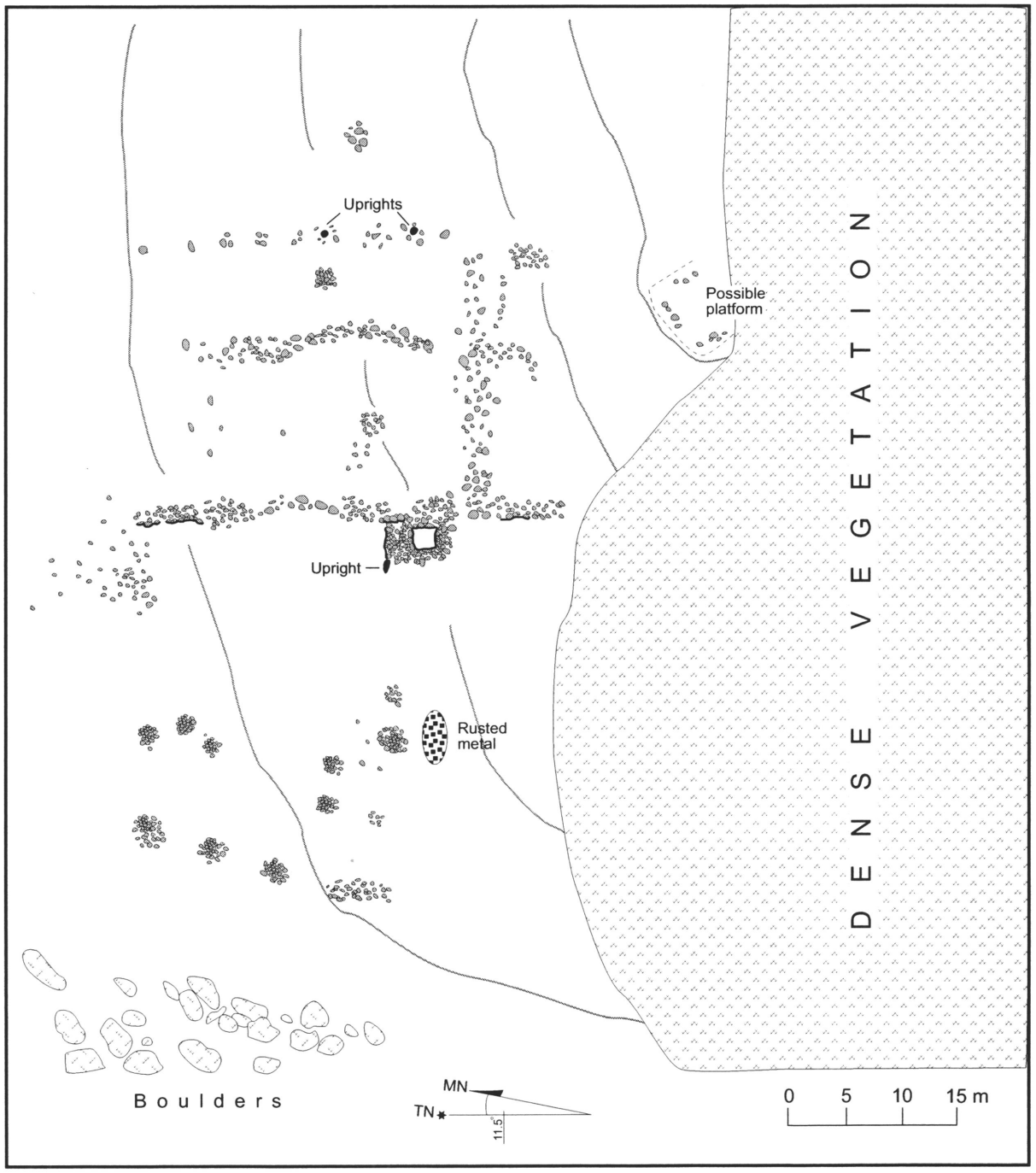


Figure 41 Plan map of the Site NI-4 complex, consisting of several low field alignments, stone mounds, and a small rectangular enclosure with upright stone.

OTHER SITES

Although our project was specifically focused on the seven sampling areas just reviewed, we did make a few observations of sites outside of these areas, which are recorded here for the sake of completeness.

KALAUPAPA TALUS-COLLUVIAL SLOPES.

A brief reconnaissance was made on the colluvial slopes inland of the abandoned rock crusher immediately south of Kalaupapa Settlement. Here we observed numerous low stone-walled terraces that appeared to be part of an extensive dryland

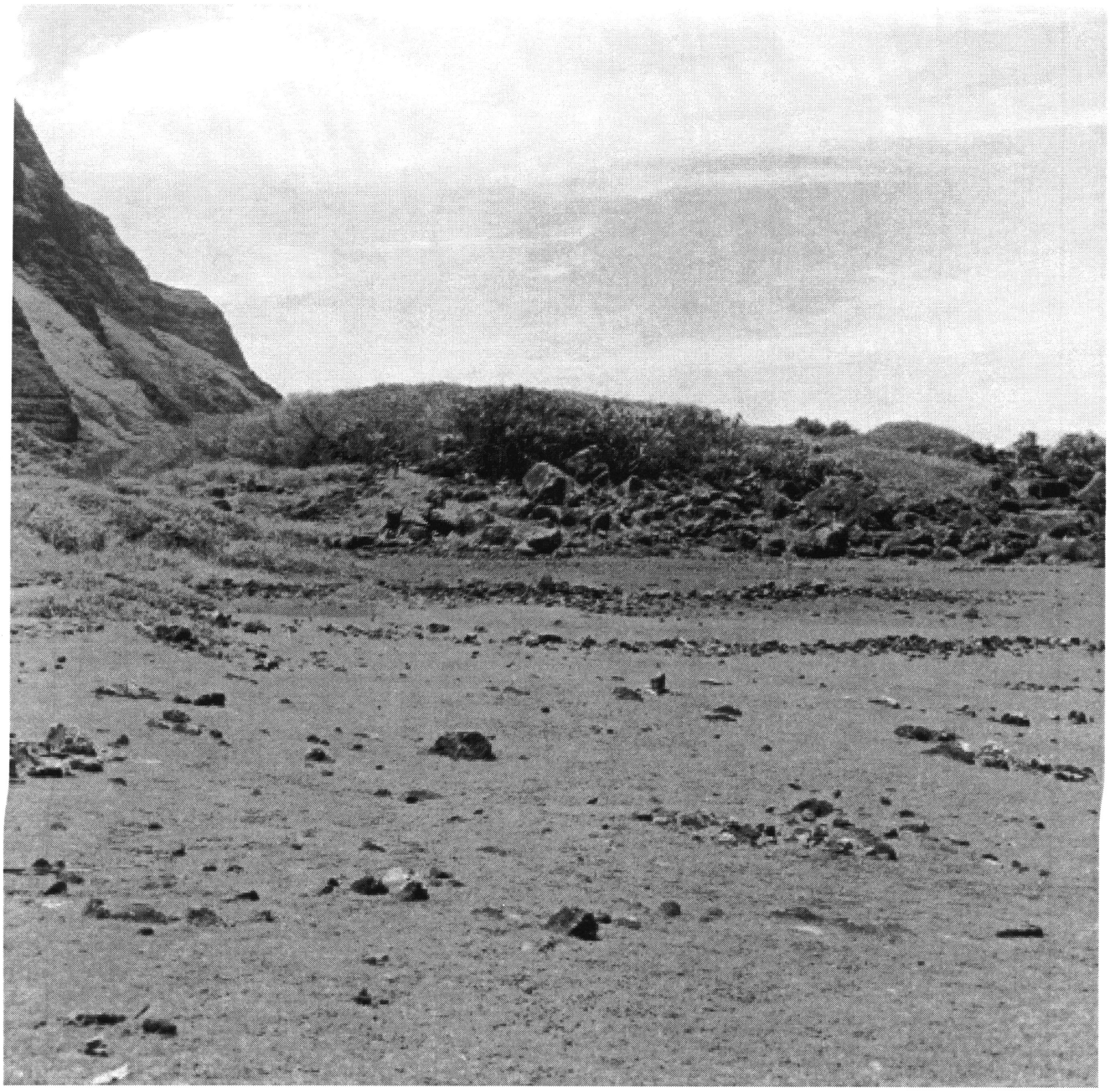


Figure 42 View of the Site NI-4 complex from the east, towards the NI-6 residential site which lies in the middle distance.

agricultural zone, along with small stone mounds (some with waterworn pebbles on them). One basalt lithic scatter with a single triangular-section adz preform was noted next to a large *kukui* tree. The higher part of the slope also had several rectangular stone walled enclosures which appeared to be residential sites. We intended to return to this area for more detailed reconnaissance and site recording, but were unable to do so prior to the end of our field season. This zone would be a high priority for continued research.

PROBABLE HEIAU SITE AT KALAWAO

This significant site, which appears to be the partially-robbed stone foundation for a substantial structure, was first shown to Kirch by Buddy Neller in 1993, who commented that the structure had

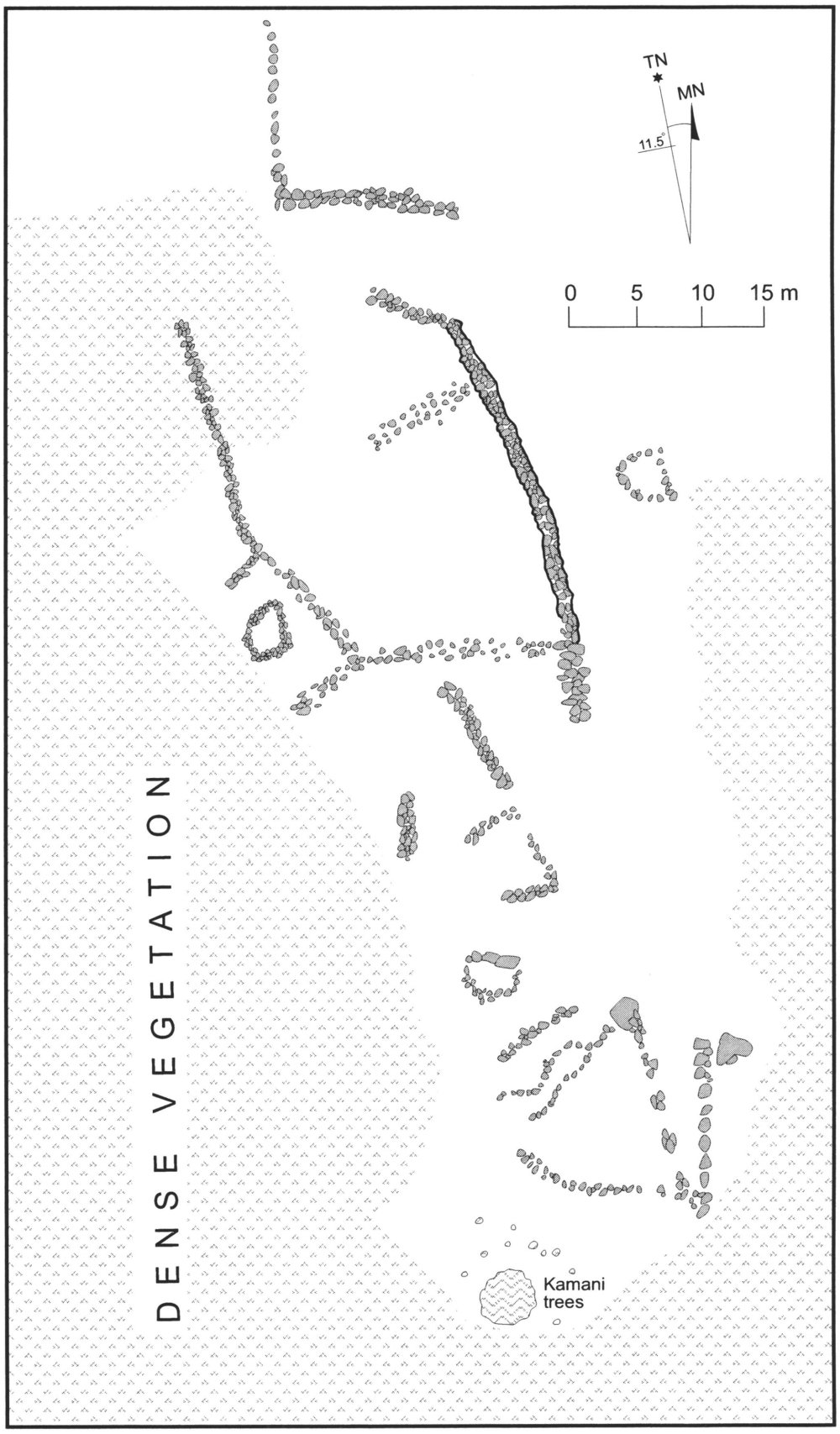


Figure 43 Plan map of the NI-7 complex, consisting of probable field walls and other structures.

never been formally recorded. Situated at Kepono, between the points of Makali'i and Mokio, the site lies only a few meters from the cliff, and commands a spectacular view eastwards down the windward coast towards Cape Halawa. A photograph of the massive, upright basalt slabs which make up the eastern face of the structure was published in Kirch (1996:44). Neller speculated, and Kirch concurred, that the core-filled walls had probably been robbed of most of their fill and higher courses, leaving only the massive base slabs, which still sit firmly into the ground (Fig. 44). This wall-stone robbing most likely occurred during the construction of the long enclosing walls around the cemetery at St. Philomena Church, a short distance away.

As can be seen in the map, which was made

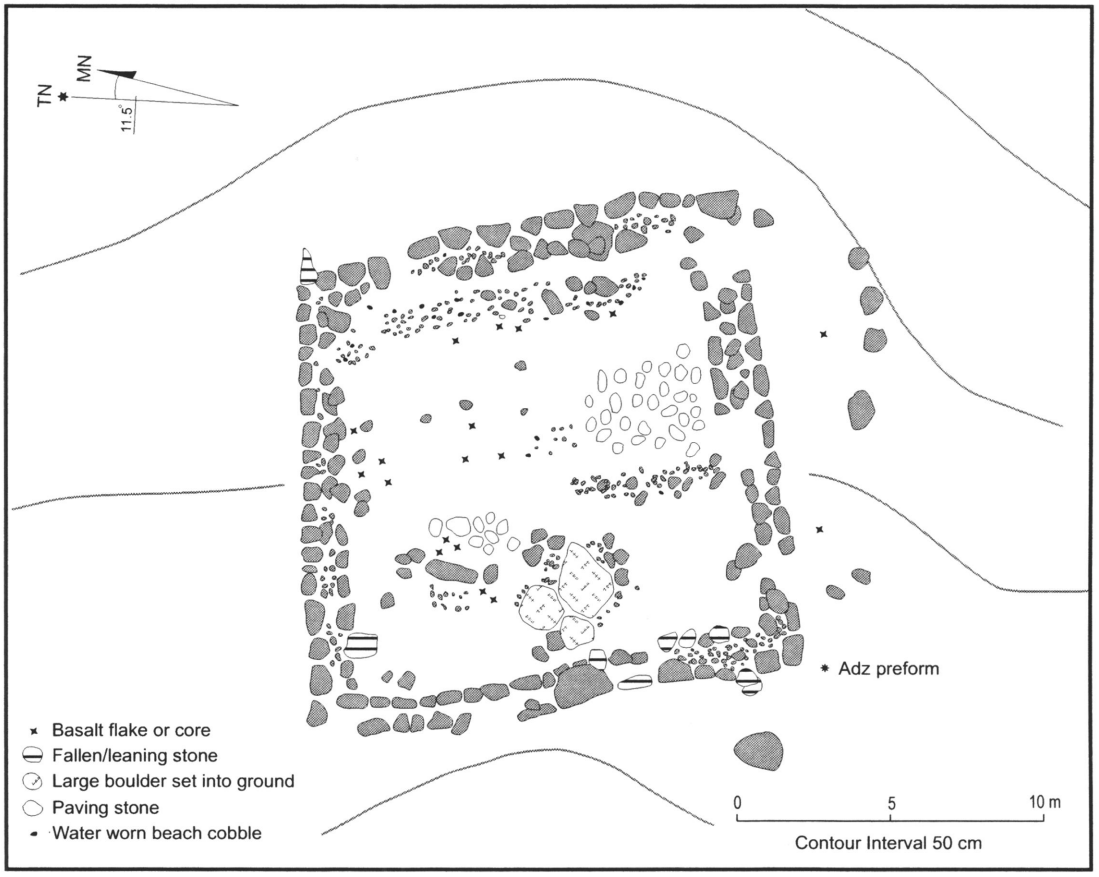
Figure 44 View of the eastern face of the probable *heiau* at Kalawao, showing the massive basal boulders with which the wall was constructed. The original upper courses of stone appear to have been robbed.

with plane table and alidade at 1:100 (Figure 45), the structure is nearly square in plan view, measuring about 15.5 m north-south and 16 m east-west. It is noteworthy that the main walls are oriented closely to cardinal north-south and east-west. Originally, the walls were well constructed with the core-filled technique, the outer facing slabs in many cases being a meter or more wide and up to 2 m high. An extensive paving of rounded stone slabs covers much of the interior on the southern side, and on the western interior several very large boulders are set flush with the ground level, with smaller cobbles and pebbles chinked in around them. Throughout the interior we noted a large number of both basalt flakes and waterworn beach cobbles and pebbles; several basalt cores and an adz preform were also noted.

There can be little doubt that this interesting site is an unrecorded *heiau*, and that it deserves to be properly recognized as such and protected. The massive nature of the basal facing stones used in its construction alone speak to such a ritualized function, as do other details of architecture such as the remnant pavings and incorporation of very large boulders in the western part of the interior. Of particular note, however, is the structure's orientation, with its walls aligned north-south and east-west. As noted earlier, the structure lies only a few meters from the cliff, commanding a view to the east, where at the equinox the sun rises directly off Cape Halawa. That the largest facing slabs are thus situated along the eastern face of the site is probably significant, and may tentatively be interpreted as indicating that the structure had a principal axis or orientation to the east. Kirch (in press) has recently synthesized data on *heiau* orientations in Kahikinui, Maui, demonstrating a class of *heiau* with eastwards orientations, which he hypothesizes are associated with the principal *akua* or deity Kāne. This previously unrecorded heiau at Kalawao may be such an instance of a Kāne temple.

One further note on the Kalawao structure: a point of land situated roughly northeast of the site

Figure 45 Plan map of the probable *heiau* at Kalawao, based on plane table and alidade survey at 1:100.



is named Makali'i, the Native Hawaiian name for the star cluster Pleiades. The Pleiades are first visible after sunset in late November, at an azimuth of about 70 degrees (i.e., northeast), and to the Hawaiians of old marked the onset of the Makahiki season. Might it be more than a mere coincidence that this particular point—which would have been in the correct position to mark the rising of the Pleiades by observers seated within the Kalawao *heiau*—is named Makali'i?

STRUCTURES BELOW PU'U UAO

At the suggestion of Dorothe Curtis, PVK made a brief attempt to relocate a *heiau* site on the slopes of Kauhakō Crater below Pu'u Uao, a site she had visited some years previously in the company of Kenneth P. Emory of the Bishop Museum. A few dozen meters to the west of the jeep road, at an altimeter-derived elevation of 390 ft asl, PVK found a complex structure consisting of a double terrace, situated on a promontory with an excellent view out over the peninsula (GPS position 7-11-400E, 23-45-000N, NAD83 datum). Continuing north another 200 m on the same jeep road, a second large structure could be seen only 20-30 west of the road. In dense Christmas berry and lantana, PVK could nonetheless make out that the site had very high (1.75-2 m) stone walls of well-stacked pahoehoe lava slabs, with vertical, well-constructed facings on the leeward side. There were a series of "rooms" or defined spaces, one of which had considerable shell midden (especially *Cellana exarata*) on the surface. One of these two sites probably corresponds to the "*heiau*" seen by Curtis and Emory; further survey work in this area is obviously warranted.

CHAPTER 6 ENDNOTES

[1] From a viewpoint out over the valley on the western side, we also observed a number of stands of *Pandanus* situated on ridge lines, and suspected that these might mark former house site locations.

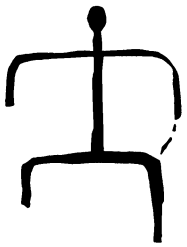
[2] We were particularly thwarted from studying this zone in Makanalua and Kalaupapa because of active deer hunting in these areas; although we inquired of the local authorities, they were unwilling to make any special arrangements for the archaeological survey to proceed.

[3] In Kahikinui, Maui, our survey team has repeatedly found associated waterworn stones and branch coral (either coral heads and or branches) placed on the altars and elsewhere on *heiau* structures. Waterworn fist-sized rocks also occur individually on agricultural mounds otherwise made up of rough a'a rocks on the landscape of the Greenwell Ethnobotanical Garden in Kona, Hawai'i, part of the Kona Field System (Kirch 2001:56-57).

[4] This cliff is an escarpment formed in the massive colluvial-talus deposit, through a combination of high-wave action in the winter months, and mass-wasting of the unstable debris. It is quite precipitous and dangerous to climb because of the loose boulders and crumbly matrix which constantly threatens to give way beneath one. It is easier to gain access to the landshelf at its far western end where the escarpment is low and easy to climb, but this entails walking farther along the boulder beach.

CHAPTER 7

RE-EXCAVATIONS AT KAUPIKIAWA ROCKSHELTER



The first archaeological site excavated within KNHP, and that which subsequently yielded the oldest radiocarbon date for the region, is Kaupikiawa Rockshelter (also known as "Pearson's Cave", and as Site 312 [State of Hawai'i inventory]), which was first test excavated by Richard Pearson of the University of Hawai'i in 1966-67. Pearson and his students excavated two units in the mouth of this lava-tube rockshelter (Pearson et al. 1974), recovering charcoal samples which some years later were submitted for radiocarbon dating by Marshall Weisler (1989). The oldest of these dates, calibrated at A.D. 1070 ± 70, is among the earliest radiocarbon ages known for Moloka'i Island, and had been taken as evidence for a long occupation sequence on Kalaupapa Peninsula (Somers 1985).

As proposed in our scope of work, we wished to re-study the stratigraphy of this rockshelter and obtain datable materials to recheck the dates obtained and interpreted by Weisler (1989), by using a minimally intrusive procedure (rather than extensive re-excavations). We also hoped to obtain additional information on prehistoric land use and economic patterns through archaeobotanical and zooarchaeological analysis of materials recovered through fine-mesh screens, not used by Pearson. Because laboratory analysis of the samples recovered from our reinvestigations is still incomplete, we present here only a summary overview of the results obtained to date. A complete report on the reinvestigation of the Kaupikiawa Rockshelter will be published separately.

FIELD METHODS

Three days were spent working within the Kaupikiawa rockshelter. The lava tube shelter was first remapped, using compass and tape for the interior portions of the cave, and plane table and telescopic alidade for the exterior and adjacent architectural features (Fig. 46). Pearson's excavation units had not been backfilled, and these were plotted along with other surface features. In order to resample the stratigraphy of the rockshelter, we then cleaned two faces on each of Pearson's two excavation units. This cleaning was done carefully using trowels, and all removed sediment was bagged and labeled (these bags were left in the units after completion of our work, although the research value of the sediment they contain is minimal, since it consists of disturbed materials). Once the faces of Pearson's units had been thoroughly cleaned and the intact deposits exposed, we photographed, drew, and recorded the stratigraphy (Fig. 47).

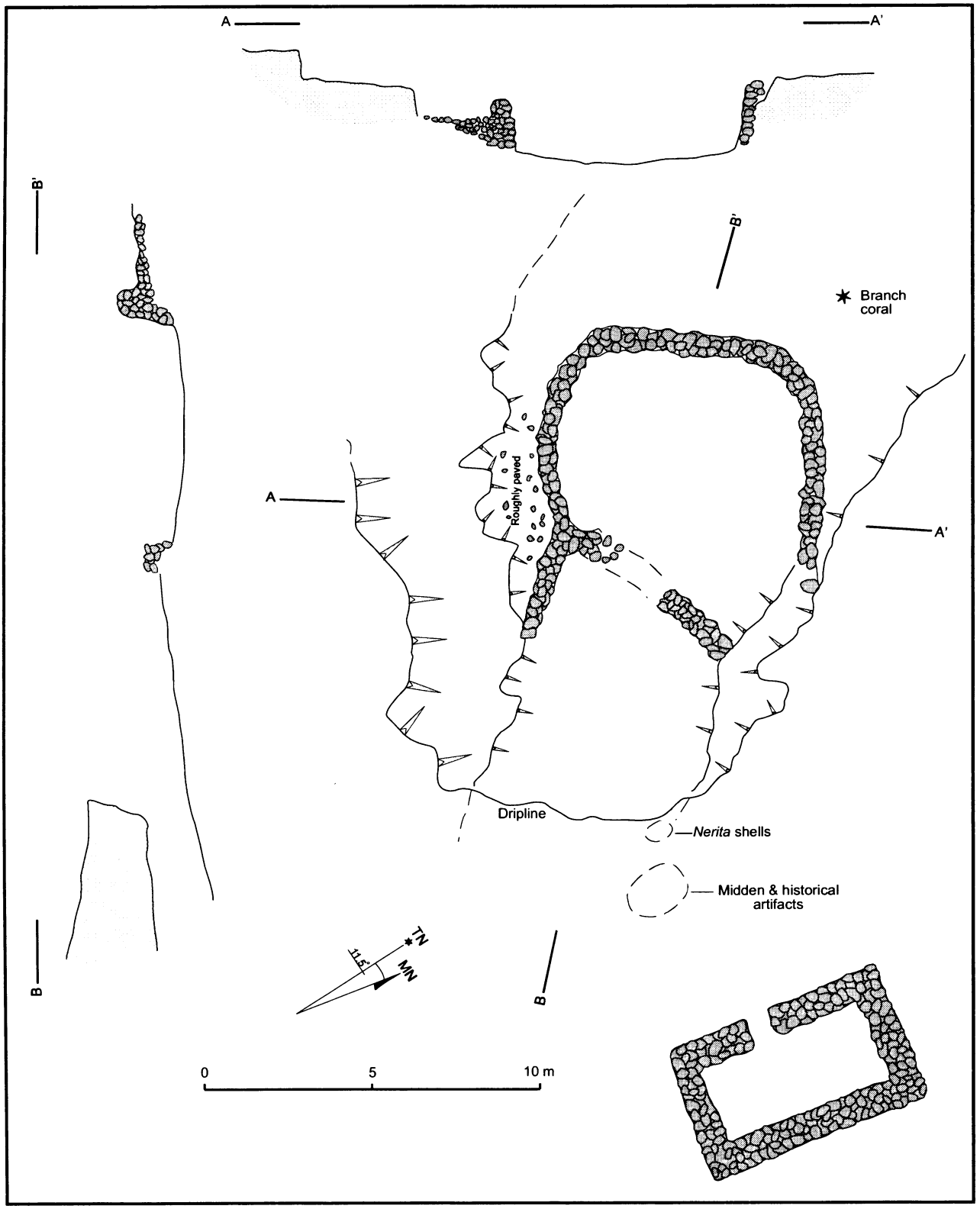
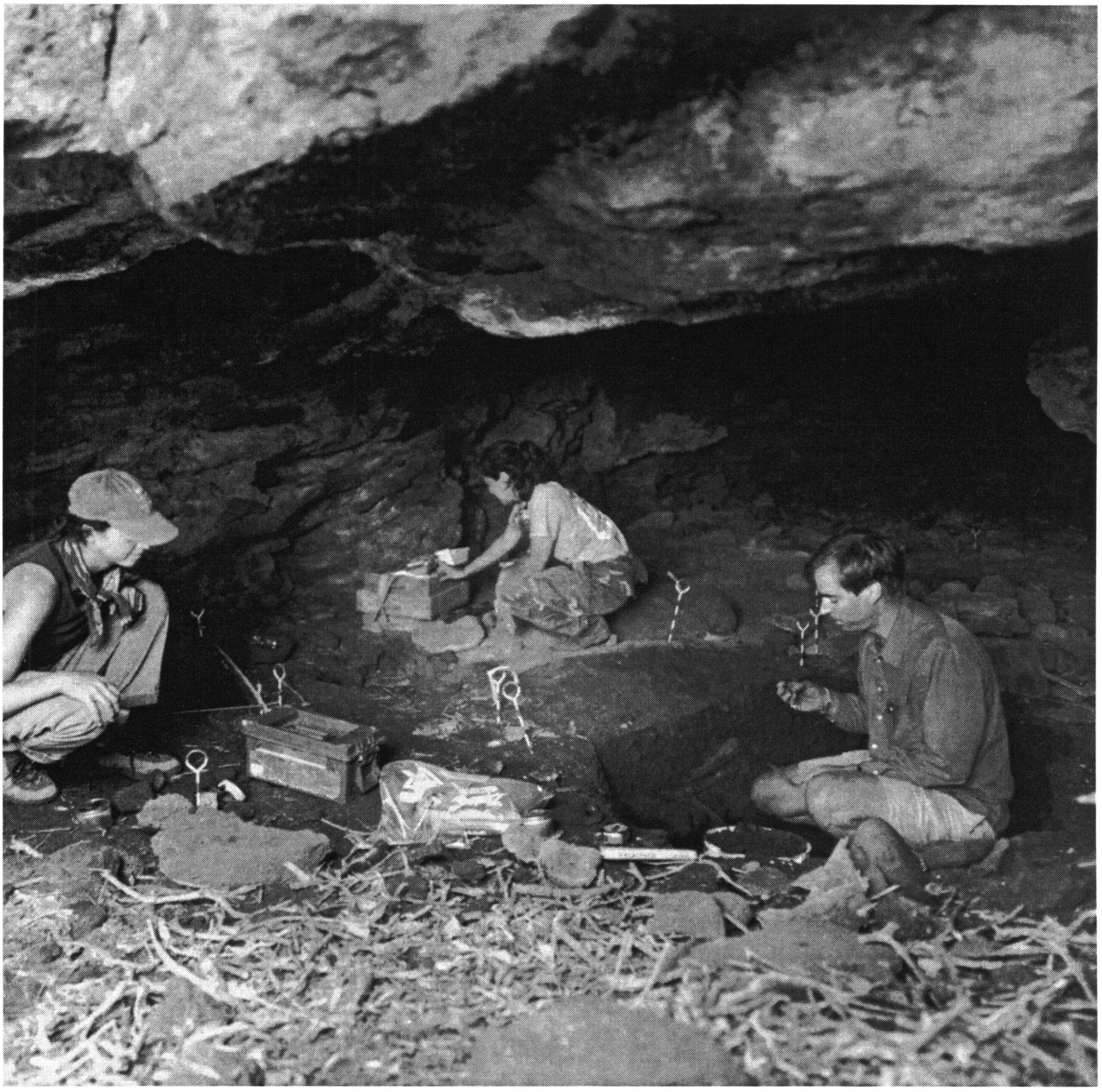


Figure 46 Plan map and sections of the exterior portions of the Kaupikiawa Rockshelter and adjacent Site KC-1.

After recording and interpreting the stratigraphy, we positioned two sampling columns against the exposed faces of each unit (total of four columns). Two 20 x 20 cm columns were then excavated from the surface down to sterile, with the contents bagged and transported back to our field quarters, where they were wet-screened through window screen (1/16") mesh. The screened residue was shipped to the Oceanic Archaeology Laboratory for detailed faunal, floral, and artifact analysis. A second set of 10 x10 cm columns was also excavated, and the removed sediment bagged in its entirety. These sediment samples were not screened in the field, but were retained for detailed geoarchaeological analysis of the shelter's stratigraphy (including granulometry, organic content, pH, and microconstituent analyses).

Following the completion of our column sam-

Figure 47. View of the interior of Kaupikiawa Rockshelter during cleaning of the stratigraphic profiles of Pearson's original excavations.



pling, Pearson's excavation units were draped in heavy polyethylene plastic sheeting, as a measure of protection against further erosion or disturbance by small animals. The double-bagged (and labeled) disturbed sediment which had been cleaned from the eroded faces was used to weight the plastic sheets against the excavation unit walls.

SURFACE FEATURES

The exterior portions of the site were mapped at 1:100 with plane table and alidade, with the resulting map shown here as Figure 46. The lava tube rockshelter is accessed from the eastern side of a collapsed portion of the tube; the collapse itself has been partially walled off on the south, west, and north with a stacked boulder wall. A piece of branch coral was noted in the collapsed area beyond the wall. To the east of the collapse, about 7 m from the dripline scarp, there is a well-constructed rectangular enclosure with a formal doorway on the west. The walls of this structure are made of carefully stacked pahoehoe slabs. The architecture strongly suggests a post-contact habitation, and this interpretation is reinforced by a small scatter of shell midden (*Cypraea, Drupa*, *Conus*, and *Cellana* shells) and a number of historic period artifacts, including shards of a cream-colored ceramic, polychrome painted ceramic (possibly from the popular "Lokelani" pattern), a hand-applied glass bottle lip, and a piece of copper. The presence of this presumably historic-period (probably mid-to-late 19th century) house in close proximity to the rockshelter is significant, as the house occupants would presumably have made use of the shelter as well.

The interior of the rockshelter was mapped with compass-and-tape at a scale of 1:100, as shown here in Figure 48. There is a slight slope down from the open collapse into the shelter itself, which has a ceiling height of between 1-2 m. The floor is relatively flat, with an ashy grey deposit covered in many areas by cobbles and boulders (much of it roof-fall). Some of these rocks have been arranged into an evident pavement about mid-way back from the dripline. Towards the rear of the shelter there is a stacked stone wall partly closing off access to a small, cramped second chamber.

Pearson had excavated two units in the shelter's floor in the portion of the cave just inside of the dripline; neither had been backfilled, but several decades of animal and probably human disturbance and erosion had obscured the original faces and exact shape of the excavations. Nonetheless it appeared that Unit A (our designation) had perhaps originally consisted of a 3 x 9 foot trench, while Unit B was probably a 3 x 3 foot square. The faces which we cleaned in order to record the stratigraphic sections and to take our column and micromorphology samples are indicated on the plan.

STRATIGRAPHY

A detailed description of the visual stratigraphy of both Units A and B, along with analysis of a micromorphology column and sedimentological analysis of bulk samples, will be given elsewhere (Kirch et al., in prep.). Here we briefly summarize the visual stratigraphy of Unit A (Figure 49), from which our three new radiocarbon dating samples were taken:

Layer I: Reddish black (2.5YR1) overburden.

Layer II: Black (5YR2.5/1) cultural deposit with considerable shellfish midden and charcoal.

Layer III: Dark reddish brown (5YR3/2) cultural deposit with shellfish midden and charcoal.

Layer IV: Very dark gray (7.5YR3/1) deposit of concentrated ash; probable combustion feature or rake-out from combustion feature.

Layer V: Very dark brown (10YR2/2) lens, ca. 2 cm thick.

Layer VI: Very dusky red (2.5YR2/2) deposit, appearing to be culturally sterile (i.e., lacking in shell midden), but with charcoal fragments visible.

FAUNAL ANALYSIS

Zooarchaeological analysis of bulk and column samples from both Units A and B was conducted by S. O'Day; full quantitative results will be presented elsewhere (Kirch et al., in prep.). In brief, the samples were dominated by invertebrate taxa (NISP = 7,671, total weight = 2,248.2 g), followed

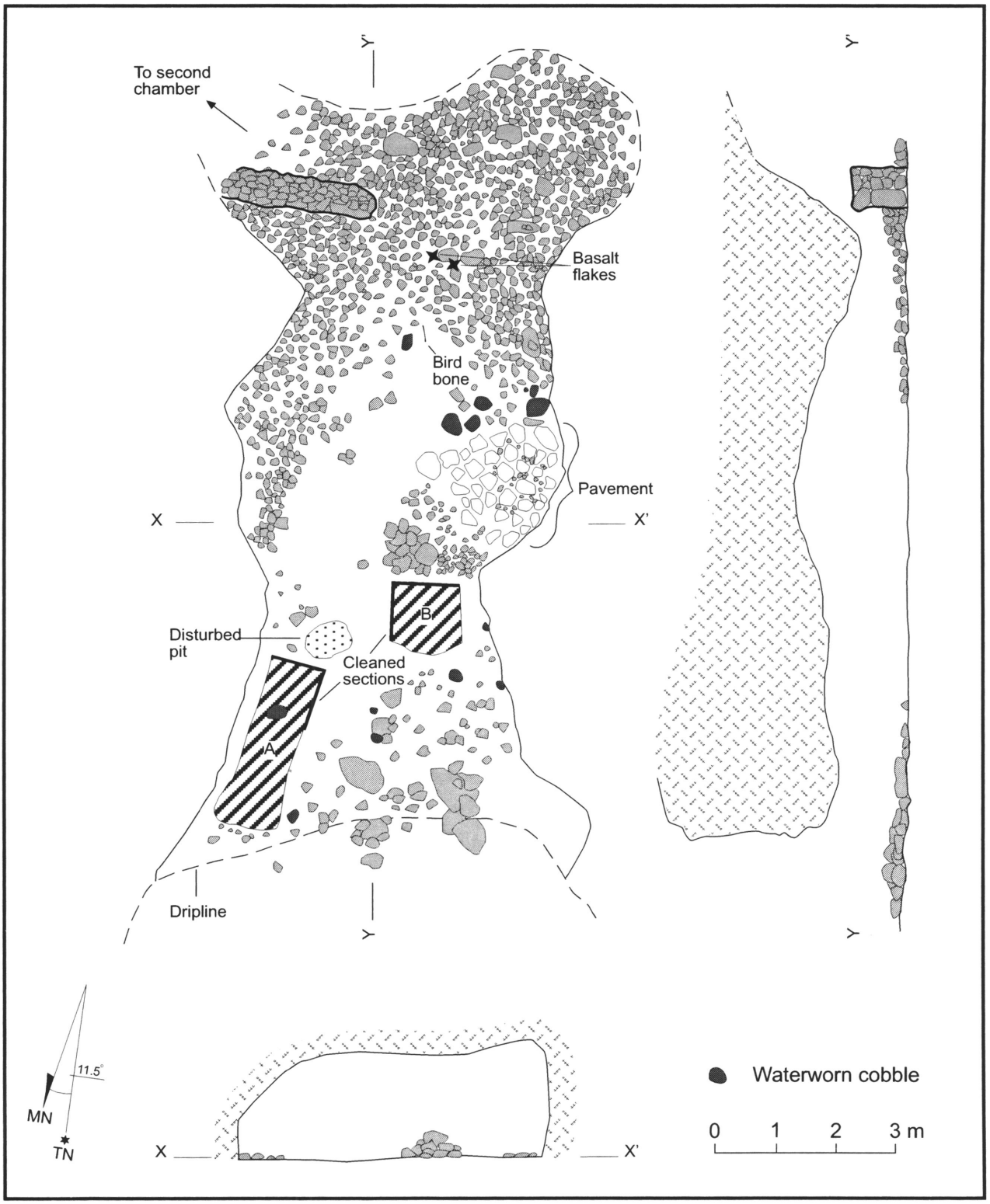


Figure 48 Plan and sections of the interior portion of Kaupikiawa Rockshelter. The areas marked A and B refer to the original units excavated by Richard Pearson.

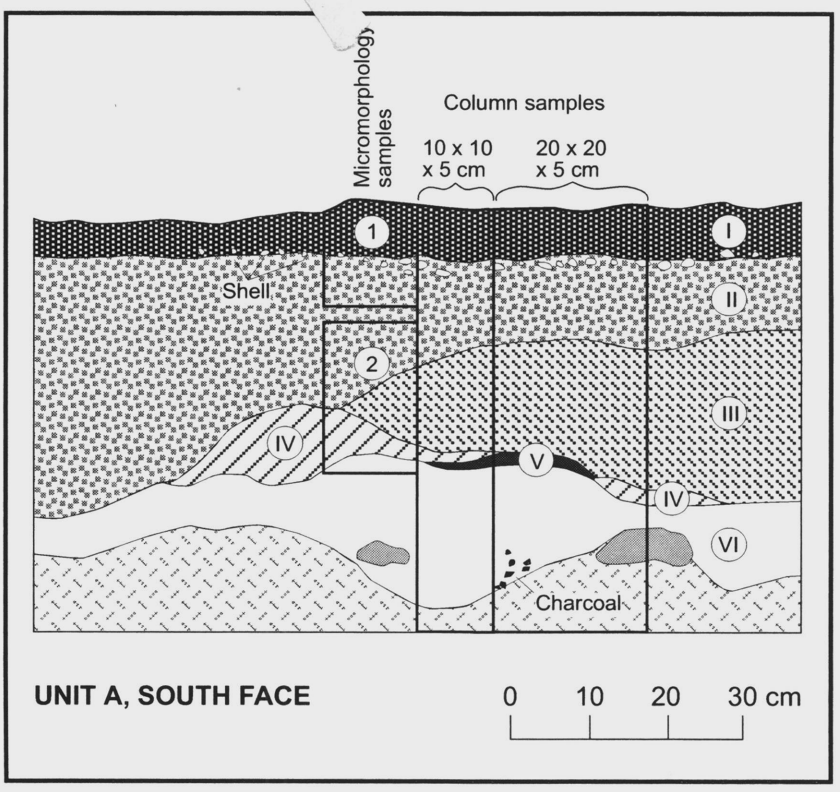
by vertebrates (NISP = 2,455, total weight = 103.02 g), primarily fish. Of the invertebrates, some 26 different species were identified, dominated by gastropods, but also including 5 bivalve taxa, 2 sea urchin species, and a small amount of Crustacea. Among the gastropods, the dominants were *Nerita picea*, *Littorina pintado*, *Cellana* sp., and *Cypraea caputserpentis*; this array is consistent with the rocky intertidal shoreline near the rockshelter. Vertebrate taxa included 21 kinds of fish, the native Hawaiian bat (*Lasiurus cinereus*), identifiable fragments of pig (*Sus scrofa*), and the Pacific rat (*Rattus exulans*). The identified fish were generally small-to-medium sized individuals, from taxa typically inhabiting near-shore and reef environments; most frequent were Labridae (*Bodianus* sp. and *Halichoeres* sp.) and Scaridae (*Scarus* sp. and *Calotomus* sp.). Important evidence for historic-period occupation of the upper layers of the rockshelter comes from the presence of bones of both the horse (*Equus caballus*) and the European house mouse (*Mus domesticus*), from Layers I and II of Unit B.

CHARCOAL ANALYSIS

After wet screening through $^1/_4$ and $^1/_8$" inch mesh, visible charcoal fragments of sufficient size to attempt identification were selected from the dried sediment samples from the 20x20 cm columns from Units A and B. Unit A yielded 8 charcoal samples and Unit B yielded 9 samples. Identifications were carried out by J. Coil, with methods adapted from Leney and Casteel (1975). Complete results will be presented elsewhere (Kirch et al., in prep.); here we merely summarize the sequence of change in charcoal types revealed by this analysis.

The 17 samples were arrayed in stratigraphic order, following field correlations between the two stratigraphic sections, and the identified taxa plotted by frequency (Fig. 50). The resulting "charcoal diagram" (similar in conception to a pollen diagram) was interpreted in terms of three analytical zones. Analytical Zone 3, at the base of the section (Unit A Layers VIa and VIb; Unit B Layers VII and VIII) was dominated by arboreal taxa, with all samples containing between 66-100% tree-derived

Figure 49 Stratigraphic section of Unit A, Kaupikiawa Rockshelter, showing the locations of sampling columns.



charcoal. Dominant taxa include *Antidesma* sp. and *Diospyros* sp.; also present are the native shrubs *Chenopodium* sp., *Osteomeles* sp., *Senna* sp., and *Wikstroemia* sp. Analytical Zone 2 is represented by 9 samples in the middle part of the section (Unit A Layers IIb, IIIa, IIIb, IV/V, Unit B Layers IIb, IIc, IId, IIe, Xa), a fairly homogenous shell midden deposit. The charcoal samples from this zone are a mix of arboreal and shrubby taxa, but with arboreal taxa representing 33% or less of the total identified fragments in all cases. Many of the taxa appearing here are typical of dryland region firewood assemblages in Hawai'i. Dominant taxa in Analytical Zone 2 include *Chamaesyce* sp. *Chenopodium* sp., *Osteomeles* sp., *Senna* sp., and *Wikstroemia* sp. Also appearing here are wood charcoal of the Polynesian-introduced economic trees *Aleurites moluccana* (candlenut) and *Artocarpus altilis* (breadfruit). At the top of the stratigraphic section, Analytical Zone 1 is represented by four samples (Unit A Layers Ia and IIa, Unit B Layers I and IIa). Charcoal in these samples is almost entirely from shrubs, with only one sample containing 25% tree charcoal. Dominants include *Chamaesyce* sp., *Chenopodium* sp., and *Senna* sp., with the addition (for the first time in the sequence) of *Sida* sp.

Tentatively, we would interpret this charcoal sequence as reflecting several periods of vegetation change in the vicinity of Kaupikiawa rockshelter. The earliest charcoal assemblages (Zone 1) are, in our opinion, not derived from firewood, but rather from anthropogenic burning events outside (but in close proximity) to the shelter. It is conceivable that charcoal from trees which grew directly outside of the cave mouth, and which were consumed by fire, washed directly onto the previously bare floor of the shelter. Analytical Zone 2, on the other hand, appears to us to be a typical firewood assemblage, representing wood burned in hearths and earth ovens within the cave during periods of human occupation. The preponderance of shrubby taxa probably reflects a firewood gathering preference, although it also possible that trees had become scarce in the vicinity of the shelter. In the uppermost zone, which probably corresponds to the post-contact period, there is a complete absence of arboreal taxa, which would correspond with the contemporary vegetation communities in the site's catchment area.

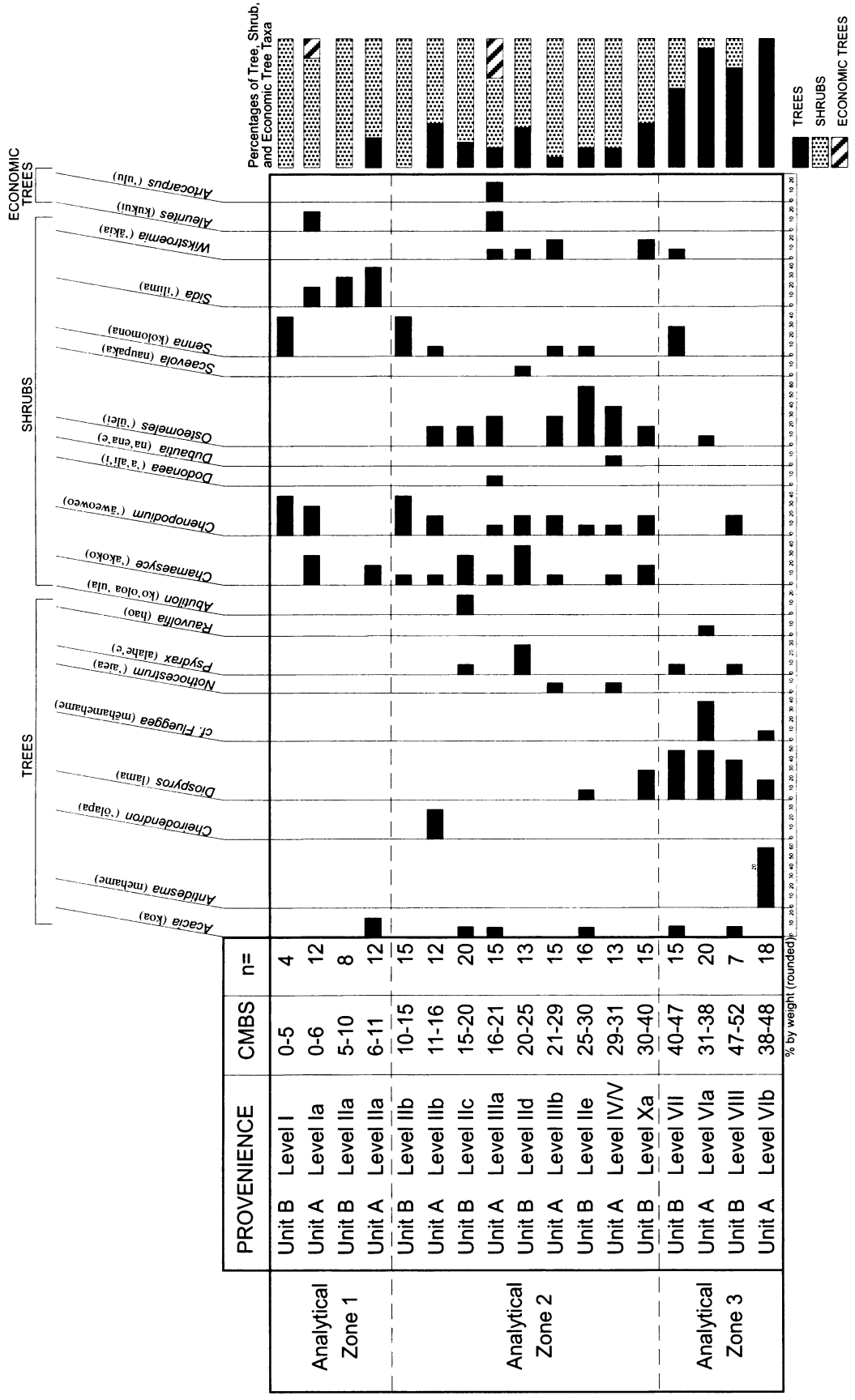
RADIOCARBON DATING

As itemized in Table 7, three samples from Kaupikiawa Rockshelter were selected for radiocarbon dating. All samples were obtained from Unit A, and each was identified to generic level prior to submission to Beta Analytic Inc. All samples were pretreated with an acid/alkali/acid sequence, and were dated by the AMS method.

REINTERPRETATION OF THE DEPOSITIONAL SEQUENCE

A definitive reinterpretation of the Kaupikiawa Rockshelter sequence must await the completion of all of our laboratory analyses; however, at this juncture several points are evident. First, the basal deposits (represented, for example, by Layer VI in Unit A) do not appear to represent actual human occupation of the site, although there is little doubt that the charcoal fragments included in these derived from anthropogenic burning in the site's vicinity. AMS dating of a secure sample of *Antidesma* sp. wood from the base of Unit A puts this initial phase of (probably) natural deposition at about 670-550 cal B.P., somewhat later than the date obtained by Weisler (1989) and used by Somers (1985) to argue for a thousand-year occupation of the peninsula. Actual human use of the shelter, and the deposition of shell and bone midden, begins with the Layer V and IV burn deposits in Unit A, followed by the accumulation of the thick Layers III and II midden deposits. Our new date from this part of the sequence, on short-lived *Chenopodium* wood, suggests that this phase is not older than about 300 years cal B.P., i.e., within the final Proto-Historic Period of the Hawaiian sequence as defined by Kirch (1985). The uppermost deposits (possibly the top of Layer II and certainly Layer I) date to the post-contact period, as indicated by the presence of foreign material culture and introduced faunal taxa.

In sum, while the Kaupikiawa Rockshelter does encapsulate a depositional sequence spanning ~500-600 years (i.e., beginning around the 14th-15th centuries A.D.), it should no longer be claimed as providing evidence for a millennium of human occupation at Kalaupapa Peninsula. Rather than providing evidence for a possible Developmental



	PROVENIENCE	CMBS	n=
Analytical Zone 1	Unit B Level I	0-5	4
	Unit A Level Ia	0-6	12
	Unit B Level IIa	5-10	8
	Unit A Level IIa	6-11	12
Analytical Zone 2	Unit B Level IIb	10-15	15
	Unit A Level IIb	11-16	12
	Unit B Level IIc	15-20	20
	Unit A Level IIIa	16-21	15
	Unit B Level IId	20-25	13
	Unit A Level IIIb	21-29	15
	Unit B Level IIe	25-30	16
	Unit A Level IV/V	29-31	13
	Unit B Level Xa	30-40	15
Analytical Zone 3	Unit B Level VII	40-47	15
	Unit A Level VIa	31-38	20
	Unit B Level VIII	47-52	7
	Unit A Level VIb	38-48	18

Figure 50 Charcoal diagram for the Kaupikiawa Rockshelter. See text for discussion.

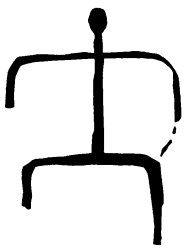
Table 7 Radiocarbon Age Determinations from Kaupikiawa Rockshelter

Laboratory No. (Beta-)	Provenience	Material	Measured ^{14}C Age B.P.	$^{13}C/^{12}C$ Ratio (‰)	Conventional ^{14}C Age B.P.	Calibrated Age (1σ) B.P.
-155364	Unit A, Layer IIA	*Sida* sp. charcoal	200 ± 40	-24.8	200 ± 40	290-270 200-150 20-0
-155365	Unit A, Layer IV/V	*Chenopodium* sp. charcoal	240 ± 40	-26.4	220 ± 40	300-280 180-150 10-0
-155366	Unit A, Layer VIB	*Antidesma* sp. charcoal	670 ± 40	-26.5	650 ± 40	670-550

Period settlement, as suggested by Weisler (1989), human activity in the vicinity of the rockshelter seems to have commenced during the Expansion Period, while actual occupation and deposition of shell midden dates to the Proto-Historic Period. In our view, this reinterpretation is more consistent with the environmental setting of the shelter, at the northerly, marginal extreme of the peninsula. Of course, our re-dating of this site in no way negates the possibility of a longer occupation sequence for the Kalaupapa Region. Indeed, our AMS date of 1200-1290 cal A.D. on the *loulu* palm charcoal from Waikolu Site 1 can be taken as an indication of human presence in this large valley by at least the 13th century, or the early part of the Expansion Period. In our view, the most likely localities for early human settlement and land use in the region would have been either in the large valleys such as Waikolu, and/or along the colluvial slopes with their richer agricultural soils.

CHAPTER 8

ETHNOBOTANICAL OBSERVATIONS IN THE SURVEY AREAS: RELEVANCE FOR CULTURAL LANDSCAPE INTERPRETATION[1]



During our archaeological fieldwork, J. Coil and P. Kirch made observations and notes regarding the distributions of native Hawaiian plants as well as naturalized plant cultigens originally introduced during the pre-contact and historic periods by Kalaupapa's residents. We were interested in part to determine whether such plant distributions might contribute to our interpretation of the surveyed archaeological remains, or provide independent clues for the nature of prior land-use practices. Moreover, we felt that recording the distribution of ethnobotanically significant plants was worthwhile in its own right, as these plants comprise a biotic and therefore fragile aspect of the cultural history and resources of KNHP.

Distributions of particular plants discussed below are summarized at each heading using the initials below for our various archaeological survey areas:[2]

P = Peninsula (mainly the east slope);
V = Valleys (Waikolu and Wai'ale'ia);
T = Talus and colluvial slopes (interface of peninsula and the cliffs);
C = Coastal (narrow interfaces of boulder beaches and base of sea cliff *pali* to east and west of peninsula); and
N = Nihoa land shelf.

NATIVE TAXA[3]

TREES

Destruction of the native arboreal vegetation, and its replacement by exotic, invasive plants (Staples and Cowie 2001; Stone et al. 1992) has been remarkably thorough in the surveyed areas. While the Kauhako Crater area (not part of our archaeological survey and thus not included here) has the best remaining examples of native plants, including members of the genera *Pleomele*, *Reynoldsia*, and *Senna* (Meideros et al. 1996), only a scant few of these seem to survive elsewhere. The few survivors seen during our reconnaissance include only a handful of *wiliwili* (*Erythrina sandwicensis*) trees along the base of the topside trail, a few scraggly *lama* (*Diospyros sandwicense*) trees along the west slopes of Wai'ale'ia valley, and a few *'alahe'e* (*Psydrax odaratum*) trees seaward from the crater on the peninsula's summit ridge.

SHRUBS

'Ākia (*Wikstroemia uva-ursi*) is common on the peninsula, where it grows in association with the historically-introduced lantana (*Lantana camara*), both in a low, wind-stunted habit. The growth pat-

tern of these shrubs demonstrates how the peninsula's single-course field walls may have worked to assist plant cultivation. Young plants can become established in the lee of stones, then grow continuously inland, with new growth sheltered in the lee of older growth. Lantana plants can be seen using *'ākia* plants as windbreaks to become established in this manner as well.

PRE-CONTACT HAWAIIAN CULTIVATED PLANTS

MILO (THESPESIA POPULNEA): (N, C)

Present also along the white sand beach to the west of the peninsula, *milo* finds its most extensive manifestation at Nihoa, where large expanses of the flat landshelf are densely shrouded with thick shrubby groves. *Milo* seems to be able to outcompete other post-contact invasive plants such as Christmas berry, lantana, and Java plum on Nihoa; all of these are well represented in the present Nihoa vegetation outside of *milo*-dominated areas. This suggests that the wide distribution of *milo* trees at Nihoa may reflect either past cultivation of this taxon there with intentional human assistance of its spread across the land shelf, or perhaps an earlier introduction and hence longer time span in which to attain this ecological dominance. A second line of evidence suggesting an anthropogenic influence in the spread of *milo* at Nihoa is the large quantity of stone tool remains found on the surfaces of Nihoa archaeological sites (including several adz sections). The "beautifully grained wood was made into calabashes for *poi*" (Neal 1965:564; Abbott 1992:87) and probably was carved into other kinds of wooden implements as well. This has helped to form our present hypothesis that the cultivation and carving of *milo* at Nihoa may have been a specialized craft activity.

HALA (PANDANUS SP.) (N, T, V, C)

Pandanus trees are found in most of the surveyed zones, and it is notable that they seem to correlate strongly with the location of archaeological sites, especially terraces or enclosures with probable residential functions. *Pandanus* trees provided a major source of leaves (*lau hala*) for plaiting mats, canoe sails, and baskets, and thus were purposefully cultivated around residential site areas in precontact times (Meilleur et al. 1997). The groves that we find in KNHP in association with stone structures are thus taken to be survivals from indigenous plantings. However, *hala* trees are also found in locations removed from archaeological settlement, such as on steeper ridge faces in Wai'ale'ia valley; these more extensive stands are probably remnants of the Coastal *Pandanus* Forest vegetation community described by Gagné and Cuddilhy (1990). At Nihoa Site NI-6, dried *Pandanus* fruits ("keys") formed a thick layer on the ground below *hala* trees.

KUKUI (ALEURITES MOLUCCANA) (V, N, T)

As elsewhere in Hawaii, *kukui* trees have naturalized in KNHP and spread upwards into Waikolu, Wai'ale'ia, and Waihānau valleys, where their distinctive light-green foliage can be discerned in virtually all of the higher ravines. In Waikolu and Wai'ale'ia valleys, *kukui* trees can be seen growing atop steep, high ridges on the upper valley walls, and this brings into question the nature of the dispersal mechanism which would transport the large, heavy seeds ('*kukui* nuts') into such remote locations. Distribution to high ridge areas by either pigs or people are the most likely explanation; if the latter, this suggests a very conscious effort at plant dispersal. This is not surprising, given the varied uses of the plant, ranging from providing light, to providing pigment for tattooing and *kapa*, to the ingredients for a relish and for medicine (Abbott 1992). Athens (1997:268) reports that there is no archaeobotanical evidence for *Aleurites* in the islands prior to about A.D. 1100 (either as pollen grains, or the hard endocarps). Further archaeobotanical research within KNHP could help to test this hypothesis.

KĪ (CORDYLINE SP.) (V, T).

Kī plants are found throughout the higher-rainfall areas of the park such as Waikolu and Wai'ale'ia valleys, and on the colluvial-talus slopes. The *kī* plant had several uses, including providing the leaf wrappers for food bundles, and its root produces a high sugar content after baking in the earth oven.

The plant was certainly extensively cultivated in pre-contact times, but it also readily spreads and even thrives without human attention. Its presence throughout our more inland survey areas probably reflects cultivation of the plant in these areas in pre-contact and/or post-contact times.[12]

KALO (COLOCASIA ESCULENTA) (V).

Kalo, the most important staple crop in ancient Hawai'i (Handy and Handy 1972), was as we know from the Mahele documents raised extensively in irrigated pondfield systems in the valleys, and in dryland terraces or plots on the colluvial slopes. Taro, however, does not naturalize well and is typically out-competed by weeds and other exotic vegetation if not regularly tended. Nonetheless, we saw some feral taro in Waikolu Valley, naturalized along the stream banks and at the stream mouth. As reported above, there are remains of a large irrigated pondfield system (Waikolu Site WK-1) nearby.

KAMANI (CALOPHYLLUM INOPHYLLUM) (T, N).

Two *kamani* groves were located during our survey in the park. One grove is in the "Lang-lang" colluvial slope area (Kalawao, Sampling Area A). This grove consists of ~12 mid-aged trees (dbh=~50-60 cm), some already fallen, but with others successfully reproducing. It is likely that these trees are descendants of *kamani* trees planted in the vicinity during pre-contact times. It may be significant that the grove is located in close association with the large *heiau* Site 289. [5]

A second *kamani* grove, this one consisting of one very large diameter tree (~ 2 m dbh) and about a dozen younger, narrow-trunk trees (~20-30 cm dbh), is found on the Nihoa landshelf, at the inland end of the dryland field system recorded as Nihoa Sites NI-4 and -7. Above the field system area, the terrain becomes steep rocky talus and the *kamani* trees are located at this juncture. We searched in vain for the remains of a *heiau* associated with this grove.

Kamani trees, although prized for their excellent timber and used to carve calabashes, were nonetheless relatively rare in the islands, making the presence of two groves within the KNHP of some importance. Hillebrand (1888:40) observed that "only a few old trees remained in 1870" when he carried out his botanical work in the islands. Neal (1965:586) confirms that "in many parts of Polynesia the *kamani* was a sacred tree . . . and it was much planted around temples." Thus the association between *kamani* trees and Site 289 probably dates back to the period of use of this *heiau*.[6]

HAU (HIBISCUS TILIACEUS) (T, V, N).

Large shrubby stands of *hau* were observed near the mouth of Wai'ale'ia Valley and on the colluvial slopes in the "Lang-lang" area. Interestingly, although *hau* was seen at Nihoa, *milo* dominates low-lying soil areas where *hau* expansion might have otherwise have been anticipated. There has been some debate over whether this plant, used for a variety of purposes by the Hawaiians, was present in the archipelago prior to Polynesian arrival, or whether it was purposefully introduced; Athens (1997:268) argues for the former, although with caution.

'AWAPUHI (ZINGIBER SPP.) (V).

Patches of several kinds of *'awapuhi* ginger were found in more interior reaches of Waikolu Valley. These include at least some *'awapuhi-kuahiwi* (*Zingiber zerumbet*), which was almost certainly a Polynesian introduction.

NONI (MORINDA CITRIFOLIA) (V, T, C, N).

Noni is a shrub or small tree commonly naturalized in coastal and lowland areas in Hawaii, mostly in areas where it was formerly cultivated. The acidic fruit were used medicinally, while the root yielded a yellowish dye used on *kapa* (Abbott 1992:57). We observed *noni* plants in all of our survey areas, except on the peninsula where conditions are too dry and open. Near Nihoa Site NI-10, unusually large, arborescent *noni* trees were observed in association with low field walls, suggesting that these trees are remnants of previously cultivated areas on the Nihoa landshelf.

POST-CONTACT NATURALIZED PLANTS (CULTIVARS AND/OR INVASIVES)

DATE PALM (PHOENIX SP.) (V, P).

Date palms were apparently once planted in the Kalawao area, and have now become naturalized and are spreading into the valleys. It is likely that the Kalaupapa area is the only place in Hawaii where this has happened, since this taxon was not included as a naturalized plant in the Wagner et al. (1990) flora. The mouth of Wai'ale'ia valley, for example, contains many date palms. These have probably been spread by pigs, since they grow on the sides of sheer cliffs along the coast and valley walls. Fruits on these trees are edible but small. The old Federal leprosy research station area in Kalawao has what appears to be a landscaped grove, and may represent the original source of the spreading palms.

TOBACCO (NICOTIANA GLABRA).

Tobacco plants are found naturalized along the sea cliff faces where these intersect with boulder beaches. These plants are most likely feral descendants of tobacco originally cultivated by historic period residents of the Kalaupapa area.

COFFEE (CAFE ARABICA).

A grove of coffee trees, ~150 x 50 m in dimensions, was found atop a colluvial bench in the east slope of Wai'ale'ia Valley (above Wai'ale'ia Site 8). These are probably semi-naturalized remnants from historic period coffee cultivation in this location.

FALSE KAMANI (TERMINALIA CATAPA) (C, T).

This large tree is found along coastal areas and naturalized within Java plum/strawberry guava canopy forests along the colluvial slopes. It seems likely that this taxon is spreading inland from original plantings (?) or colonization events along the coastal strip and in the Kalawao area. In one case in Kalawao Sample Area A, a stacked stone wall which forms part of a large enclosure bends to avoid a large *Terminalia* tree, which strongly suggests a historic-period construction age for this wall, as well as perhaps demonstrating the long-lived nature of individuals of this taxon.

INVASIVE FLORA

Many of the usual suspects occupy large territories in the surveyed area, the most common and prolific include: strawberry guava (V, T), Christmas berry (P, T, N) , lantana (P, N, V), and Java plum (V, T, C). Large *Terminalia* (*kamani haole*) trees are also spreading into areas containing an otherwise Java plum and guava canopy. JC noted a pattern where areas dominated by guava tend to be more colluvial/mass wasting sediments, while Java plum dominated areas tend to be more boulder-covered rock-slide areas. Thus each of these taxa seems to possess a slight advantage in these respective terrains and can therefore more successfully establish invasive dominance. Another specific relation involving guava was seen on the talus slopes just west of Wai'ale'ia Valley, where *Guajava cattleinum* trees grow unusually tall. This is the same area where pre-contact-looking field system remnants were found, suggesting that in addition to offering favorable growing conditions for guava, the soils in this area may have been recognized by pre-contact Hawaiian cultivators as especially favorable as well.

INTERPRETATIONS/SUMMARY

Making concurrent ethnobotanical observations on plant distributions during the course of archaeological survey not only added another layer of cultural data, but in several cases provided clues as to the function, chronology, and or distributions of sites such as *heiau*, garden areas, and possibly a specialized craft center. Of particular note were the unexpected mono-stands of *milo* on Nihoa; the association of *kamani* trees with the Site 289 *heiau*; and, the presence of *hala* trees on a significant number of putative habitation sites. Also, on a more general level, because some plants can survive as individuals or persist as a semi-naturalized population in localized areas, they can help us reconstruct the prehistoric and historic landscape. Other plants, however, show no such tendency to stay in one place, and the spread of invasive plants such

as Christmas berry, guava, Java plum, and lantana is surely the most remarkable aspect of Kalaupapa's 20th century vegetation history. It is also clear that the processes of vegetation change in Kalaupapa are increasingly dynamic, and further invasions from new exotic plants are likely to continue to occur in the future, as well as changes brought by efforts to control feral ungulates in the peninsula area.

CHAPTER 8 ENDNOTES

[1] A first draft of this section was authored by JC, and was expanded and amended by PVK.

[2] Our archaeological survey areas did not include the Ka'uhako Crater area or developed areas such as Kalaupapa town, so information on plant distributions in these areas are not included. However, see Meideros et al. (1996) for a report on native and naturalized plants in the crater area.

[3] This category includes both endemic and indigenous plants native to pre-human Hawaii. Coil's ability to recognize native grasses and some native herbaceous plants in the field is relatively limited, so this section comments mainly on tree and shrub taxa.

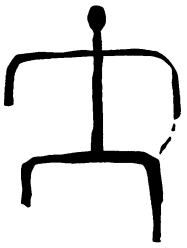
[4] In historic times, the juice of the sugar-rich *kī* root was fermented and then distilled to make *'ōkolehao*, a whisky much consumed by the Native Hawaiians despite strong disapproval of the missionaries. According to Greene, the consumption of *kī* whisky was rampant among the Kalawao lepers at the time of Father Damien's arrival; "this practice was illegal but difficult to stop because certain members of the police force were themselves involved in the distilling operations" (1985:91).

[5] S. Millerstrom (pers. com. 2000) has noted that in the Marquesas Islands, trees of the same species (called *tamanu*) are often planted in association with ritual and religious structures.

[6] We would point out that there are cultural management implications here, in that the *kamani* grove should be considered an integral part of the site itself. Currently the trees are being choked by aggressive introduced species, especially Java plum.

CHAPTER 9

DISCUSSION AND INTERPRETATIONS



In the preceding pages we have summarized the results of our reconnaissance survey of archaeological sites within a sample of the varied microenvironments encompassed within KNHP, as well as reviewing what is known from the efforts of earlier investigators. In addition, we have tried to extract from a range of historical and ethnohistorical records (especially the archival documents deriving from the Mahele) information pertaining to traditional Hawaiian land rights and use on the peninsula and in the adjacent valleys. Clearly, despite our efforts, we have only begun to scratch the surface with respect to the tremendous archaeological and culture-historical resources contained within the KNHP. The following paragraphs are an attempt—albeit tentative and incomplete—to synthesize this diversity of evidence. We have couched the discussion largely in terms of a set of *research problems* requiring further investigation, rather than as conclusions, to emphasize that the archaeological study of the Kalaupapa Region is still very much in its infancy. We hope, nonetheless, that the research problems outlined below will aid successive investigators in developing a long-term program for Kalaupapa archaeology and culture-history studies.

VARIABILITY IN THE KALAUPAPA ARCHAEOLOGICAL RECORD

Perhaps the most striking aspect of Kalaupapa regional archaeology is its tremendous variability, an observation that should not surprise given the corresponding variation in landscape and environment. Indeed, the range of variation in archaeological sites found within the KNHP could be said to correspond with the broader range normally found on an island-wide scale. Since at least the late 1960s, archaeologists have recognized that a major axis of variation in the Hawaiian archaeological record corresponds to the windward-leeward gradient (in indigenous Hawaiian terminology, the *ko'olau-kona* axis) which divides all of the major islands into relatively "wet windward" and "dry leeward" regions (Newman 1970; Kirch 1985). Paradoxically, although the Kalaupapa Region at first glance appears to lie exclusively within a typically windward zone, the low elevation and low annual rainfall over much of the peninsula make this zone essentially "leeward" in most environmental characteristics. The deep valleys, on the other hand, are quintessentially representative of windward environmental zones. Thus, within a relatively compact region—one that was certainly

spanned by a single sociopolitical community—both dry, "leeward" and wet, windward landscapes influenced the range of land use and resource exploitation strategies.

Both the ethnohistorical record (especially the Mahele documents) and the surface archaeological record reveal how critical this environmental axis—ranging from the relatively arid conditions on the mid-to-northern portions of the peninsula, to the extremes of high rainfall in the valleys—was to the formation of cultural landscapes. The peninsula exhibits one of the most formalized examples of a dryland agricultural field system known anywhere in the archipelago. Indeed, the closest parallels are to be found on the leeward side of Hawai'i Island, with the Kohala and Kona field systems (Newman 1970; Ladefoged and Graves 2000; Ladefoged, Graves, and Jennings 1996; Schilt 1984; Kirch 1984:181-94). The peninsular system was developed for the intensive cropping of sweet potato, a cultigen which responds well to low winter rainfall. In Waikolu Valley, in contrast, one finds extensive remains of the other major kind of intensive Hawaiian agriculture, permanently irrigated terraced pondfields for the cultivation of taro, the other culturally dominant Hawaiian crop. Thus, the Kalaupapa Region encapsulates the key contrast between "the wet and the dry", which has long been identified by ethnobotanists and anthropologists as being of signal importance in the development of Oceanic subsistence economies (Barrau 1965; Kirch 1994). The Mahele records of land use, providing a "time-capsule" at mid-19th century, reveal how both wet and dry systems were critically important to the structuring of household economies, and thus ideally at least, each household unit attempted to control and utilize resources in both wet and dry zones.

In between these two major kinds of agricultural zones with their corresponding physical infrastructures of field boundaries or pondfield terraces, lies another intermediate or transitional zone, that of the extensive colluvial slopes running east-west at the southern margin of the peninsula, below the towering cliffs. This zone, which is neither strictly "wet" or "dry" but is characterized by moderate annual rainfall and a particular edaphic medium highly conducive to horticulture, displays an archaeological landscape marked by extensive dryland terracing and other agricultural features. Equally significant, it is within this zone that many of the large ceremonial structures or *heiau* are found, suggesting that agricultural production within the colluvial slope zone may have been especially important to the regional economy. The Mahele documents are again instructive, for they suggest that many of the narrow *'ili* land units, within which smaller *mo'o* horticultural plots were claimed, were situated on these colluvial slopes.

Variability in the archaeological record of KNHP is not limited to these broad patterns of agricultural systems and land use, but may be found as well in patterns of household architecture. Residential sites distributed over the peninsula—which, it must be remarked, appear to be intimately integrated into the extensive dryland field system—include a diversity of C-shaped, L-shaped, and linear windbreak walled structures, as well as rectangular and square enclosures. These types are thus similar, though not necessarily identical in all architectural details, with habitation features found in other leeward localities, such as Kawela, Moloka'i (Weisler and Kirch 1985) or Kahikinui, Maui (Kirch, ed., 1997). We strongly suspect that there is some temporal patterning in this diversity, with the fully enclosed, high-walled sites (particularly those with formal entryways) representing post-contact developments, and the windbreak structures representing pre-contact or early historic forms. This hypothesis will need to be tested through a program of excavations and dating. In contrast, residential sites found in the valleys and on the Nihoa landshelf typically consist of terraces, platforms, or pavements, similar in all respects to the range of habitation features known from other windward localities such as Halawa Valley (Kirch and Kelly 1975).

The known ritual structures of the Kalaupapa Region (*heiau* and *ko'a*) are likewise notable in their range of architectural variation.[1] They include massive terraced stone platforms constructed on the important colluvial slopes, exemplified by Site 289, as well as walled enclosures such as the partially-destroyed *heiau* at Kalawao. Several of the sites recorded and mapped by our team appear to display orientations which may have cardinal geographic or astronomical significance, an aspect of *heiau* orientation recently noted for the Kahikinui district of Maui. If such preferred orientations are

confirmed for *heiau* within the Kalaupapa Region, this might suggest a degree of cultural connection between the late pre-contact polities of Maui and Moloka'i.

Although plants are not usually considered as an aspect of the archaeological record per se, the vegetation communities associated with archaeological sites do constitute an aspect of the larger legacy or record of human land use and of the cumulative, historical enculturation of landscapes. In our surveys, we therefore paid some attention to the range of plants associated with archaeological sites, and have provided information on our ethnobotanical observations throughout this volume. Here too, we find aspects of variation with potential significance for understanding the diversity of cultural practices within the Kalaupapa Region. While the main crop plants themselves, such as taro or sweet potato, have rarely survived since the abandonment of the dryland and irrigated agricultural complexes (with the exception of some feral *Colocasia* in Wailau Valley), other plants of economic importance continue to persist in parts of KNHP. For example, a close correspondence was observed in Wai'ale'ia and Wailau valleys, as well as on the Nihoa landshelf, between stands of *Pandanus* or *hala* and habitation terraces. As Meilleur et al. (1997) have pointed out, such isolated stands are likely to preserve a range of genetic variation which may have disappeared elsewhere in the archipelago. They are thus a part of the larger cultural resource base which deserves to be protected and preserved every bit as much as inanimate archaeological features.

An ethnobotanical phenomenon of much interest to our team was the discovery of an extensive grove of *milo* (*Thespesia populnea*) trees in the central part of the Nihoa landshelf. Virtually monospecific in composition, this stand suggests to us the possibility that the occupants of Nihoa may have developed, as at least part of their local economic strategy, a form of specialized silviculture possibly linked with production of *milo* wood objects. The ubiquitous presence of basalt lithics, including several adz sections, provides collaborative evidence for specialized woodworking. In this instance, a combination of archaeological and ethnobotanical observations leads to a hypothesis that might not have been evident otherwise.

To sum up, the Kalaupapa Region, as encompassed within the boundaries of KNHP, displays a remarkable range of variation in archaeological sites, in plant communities with ethnobotanical associations, and indeed in the diversity of cultural landscapes as these can be inferred from historical and archaeological evidence. In the senior author's experience of nearly 40 years field research throughout the Hawaiian Islands, it would be difficult to find another region of similar size displaying as great a range of variability and diversity as Kalaupapa. Clearly, this presents both a challenge and an opportunity—as well as a responsibility. The challenge lies in seeking to fully discover, record, and understand this unparalleled mosaic of cultural landscapes, while the opportunity is that provided to researchers who have the advantage of exploring virtually the entire scope of traditional Hawaiian land use practices within the confines of a single administrative unit (the KNHP). The responsibility, need we point out, is that of assuring that the archaeological, ethnobotanical, and cultural resources of the Kalaupapa Region will be protected and preserved so that these may continue to yield new insights into Hawaiian culture-history, continuing to offer inspiration and enlightenment for generations to follow.

SOME MAJOR RESEARCH ISSUES

We turn now to a set of specific research issues and questions arising from our reconnaissance work in the Kalaupapa Region. We do not imply that these are the only important questions, but they seem to us to be among the core research problems calling out for continued and more intensive investigations. Their resolution will require not only more extensive surface survey of archaeological sites in different part of the KNHP, but also targeted excavations and innovative kinds of laboratory analysis.

1. CHRONOLOGY OF HUMAN OCCUPATION AND LAND USE

An enduring problem that has engaged several generations of Hawaiian archaeologists is that of the timing of initial Polynesian discovery and settlement of the archipelago. The pendulum of schol-

arly opinion has swung back and forth several times since Kenneth Emory obtained the first set of radiocarbon dates from such sites as Kuli'ou'ou Rockshelter on O'ahu and the Pu'u Ali'i sand dune site at South Point, Hawai'i (Emory, Bonk, and Sinoto 1959), the latter at first thought to evidence colonization as early as the first century A.D. Later work suggested that initial Polynesian arrival in the archipelago might not have occurred until perhaps A.D. 750, and recent paleoenvironmental evidence from O'ahu (Athens 1997; Athens et al., 2002) suggests that a date of ca. A.D. 800 is perhaps the best estimate, at least for that island. However, problems with the dating of several early sites, including Pu'u Ali'i and the Bellows Dune Site (O18) on O'ahu remain unsatisfactorily resolved (Dye 1992; Tuggle and Spriggs 2000). Moreover, the question of initial Hawaiian settlement is encapsulated within a larger debate concerning the colonization of Eastern Polynesia as a whole, in which proponents of both a "long" and a "short" chronology have taken what at times appear to be polarized positions (Irwin 1981; Kirch 1986, 2000; Spriggs and Anderson 1993). Those advocating a longer chronology find the Hawaiian evidence for settlement by at least A.D. 800 (if not slightly earlier) to be significant, as this strongly contradicts the extreme short chronologists' view that the whole of Eastern Polynesia was not explored or settlement prior to about A.D. 1200.

Within this larger debate (which shows no signs of resolution in the immediate future) the island of Moloka'i has figured significantly. The Hālawa Dune Site, at the mouth of Hālawa Valley and yielding adzes, fishhooks, and other forms of material culture distinctively different from later protohistoric Hawaiian styles, was dated by Kirch (in Kirch and Kelly, eds., 1975) to about A.D. 600, and placed within his Developmental Period for the Hawaiian cultural sequence (Kirch 1985).[2] Synthesizing a suite of 48 radiocarbon dates then available for Moloka'i sites, Weisler (1989:126, 137) drew attention to one sample (Beta-9276) from the Kaupikiawa Rockshelter in Kalawao *ahupua'a*, a sample which had been excavated by Pearson in 1966 and subsequently submitted for analysis by Gary Somers in 1984. Weisler commented that this sample, with a conventional age of 880 ± 70 B.P., was the "2nd oldest date for Moloka'i," and "suggests use of Kalaupapa Peninsula during the late Developmental (A.D. 600-1100) to early Expansion period (A.D. 1100-1650) for exploitation of marine resources" (1989:137). The date has more than once been cited in literature pertaining to Kalaupapa, for example by Somers (1985:117), as evidence that the Kalaupapa Peninsula has been continuously occupied for as long as 1,000 years.

Our resampling and redating of the Kaupikiawa Rockshelter, described above in this volume, strongly suggest that the 1966 Pearson sample yielded an age too old by two to three centuries, and that initial human activity at the rockshelter actually dates to the mid-14th century.[3] Moreover, this early charcoal deposition may reflect only intermittent and low-intensity human activity in the site vicinity, with permanent utilization of the shelter commencing even later in time, during the last one or two centuries prior to European contact (e.g., the Proto Historic Period of Kirch [1985]). Our revision of the depositional sequence and chronology for the Kaupikiawa Rockshelter is more consistent with the widespread pattern of population expansion into ecologically marginal zones during the later Expansion and even Proto Historic Periods. Situated near the northern end of the peninsula, in an area dominated by bare pahoehoe lava outcrops with limited soil, and where rainfall is the lowest, the Kaupikiawa Rockshelter seemed an unlikely choice for early settlement. Thus, revising the date of its use to the late Expansion and Proto Historic Periods implies that the northern, marginal fringe of the peninsula as a whole more likely dates to this later time frame.

Revising the Weisler-Somer early chronology for Kaupikiawa Rockshelter, however, by no means negates the assertion that the larger Kalaupapa Region has a lengthy settlement history, one that could well date back into the Developmental Period, or possibly even earlier. Here our new radiocarbon date of 780 ± 40 B.P. from the lower pondfield cultivation horizon in the Waikolu irrigation complex, calibrated to A.D. 1200-1290, is most relevant. This sample—which, we stress, needs to be confirmed with additional excavation and dates—derives from an intensive agricultural facility which bespeaks permanent and well-established settlement. Situated on prime arable land at the mouth of Waikolu Valley, this is precisely the

kind of landscape for which a generalized wet/dry ecological model of Polynesian landscapes would predict early settlement (Kirch 1984). The setting is, in fact, quite comparable to that for the early Hālawa Dune Site, with the proviso that Hālawa Valley has better and year-round canoe landing access than Waikolu (the latter having an exposed boulder beach that can be impossible to land on during winter storms).

Aside from the question of when the Kalaupapa Region was first settled by colonizing Polynesians, and in what specific ecological zones settlement was first established, there is the larger matter of establishing a chronological sequence for the region. At present, with six radiocarbon dates in evidence, the Kaupikiawa Rockshelter is the only site within KNHP which can be said to be relatively secured dated. The single date from Waikolu hints at a long sequence of agricultural intensification, but needs to be confirmed and followed up by more work. For the vast dryland field system that covers much of the peninsula, we have only a single radiocarbon date of 510 ± 80 B.P., obtained by Ladefoged (1990:176) from a test pit on the periphery of the system, which might be taken to suggest that at least some portions of the system began to be constructed by the 14th to 15th-centuries A.D., within the mid-to-later Expansion Period. Working out the chronology for the development of the field system will be a complex task, one requiring extensive excavations and a larger number of high-precision radiocarbon dates on specifically identified materials (see below).

A long-established tenet of modern archaeology holds that a robust chronology is the framework upon which culture-history and interpretation (whether of so-called processual or post-processual schools) must be based. For the Kalaupapa Region, the work of establishing such a temporal framework has only just begun, yet all subsequent interpretation will depend upon it. In our view, then, a program of carefully targeted excavations in a diversity of site types, including habitation, economic, and ritual structures, coupled with a program of radiocarbon dating of these sites, must be one of the highest priorities for archaeological research within KNHP. Moreover, such dating needs to be executed using the most sophisticated techniques available, which at a minimum should include specific-level identification of all samples (to avoid the problem of "old wood" and similar sources of in-built error), selection whenever possible of short-lived taxa to assure that the dated event corresponds to the target event (Dean 1978), and use of the AMS dating method to assure maximum precision.

2. ORIGINS AND DEVELOPMENT OF THE KALAUPAPA FIELD SYSTEM

One of the large-scale processes that was intimately associated with the rise, in the Hawaiian archipelago, of the largest and most socio-politically complex of all Polynesian cultures, was the intensification of agricultural production systems (Kirch 2000:317-21). The issue as to whether such intensification is ultimately to be understood as a response to an underlying demographic causality, or was itself a prime causal factor in allowing later Hawaiian populations to expand at near-exponential rates of increase, depends on one's theoretical position vis-à-vis the Malthus-Boserup debate on the linkages between population and technology (Kirch 1994:15-20; Morrison 1994). Our own view lies somewhere in the middle, with the suggestion that causality is neither simple nor linear. Such theoretical debates to the side, however, there can be no doubt that beginning in the Expansion Period—around the 12th to 13th centuries A.D.—and continuing in some localities even after European contact (e.g., the Anahulu Valley [Kirch and Sahlins 1992]), Hawaiian landscapes were remarkably transformed through high levels of human labor. Wherever flowing water was available, valley bottoms and alluvial plains were converted to extensive systems of irrigated pondfield terraces, as for example in Waikolu Valley. In dryland zones where surface water was scarce, or seasonally limited, other forms of agricultural intensification were developed, these largely emphasizing the cultivation of sweet potato, but also dryland taro, *Dioscorea* yams, and other secondary crops (Handy 1940). The physical remains of such dryland cultivation systems are more varied than those of wetland, irrigated systems, and include several kinds of formal "field systems" with permanent field divisions (field walls) that variously run either along or perpendicular to the slope contours (such as the Kohala

and Kona field systems of Hawai'i Island), as well as a host of minor features such as mounds, enclosures, modified outcrops, low terraces and so forth. The archaeological vestiges of such dryland agricultural systems have been the subject of considerable research, beginning with Newman's pioneering work in the late 1960s and continuing to the present (e.g., Newman 1970; Rosendahl 1994; Schilt 1984; Clark and Kirch, eds., 1983; Ladefoged and Graves 2000; Allen, ed., 2001; McCoy 1999).

Extending over much of the Kalaupapa Peninsula is one of the most remarkable examples of such a dryland field system, and the only formal system of this type known outside of Hawai'i Island.[4] By "formal system," we mean one in which the individual cultivation plots or fields are defined by boundary walls or divisions. In the Kalaupapa case, these formal field walls or alignments have a preferred north-south orientation, hence placing them perpendicular to the dominant trade winds and suggesting that one major function of the walls was to provide a parallel series of windbreaks. The close spacing of many of the walls, however, is quite unlike the situation in either the well-documented Kohala or Kona systems, with distances between parallel stone rows often no more than 2-4 meters. Thus, stone clearance as well as wind protection may have been involved in the agronomic functioning of the alignments. Then too, it is evident that these stone alignments, once created, served to permanently define and demarcate plot boundaries, conferring a kind of sociological grid over the area of intensively cultivated land. We have shown, for example, that in the Mahele land records there is a tendency for *kula* or dryland claims to be very narrow and long in their dimensions.

The Kalaupapa field system has yet to be mapped in its entirety over the peninsula, or its range of variation defined. Preliminary air photo interpretation by the National Park Service (R. Hommon, pers. comm., 2000) shows that the grid of field walls is unevenly distributed, with sectors of greater density of walls. Air photo interpretation, moreover, is reliable only for parts of the terrain where vegetation cover is relatively low.[5] In our reconnaissance project, we focused on one sample transect across the field system, the Kaupikiawa Transect, using intensive ground survey (including plane table mapping of field walls) to record not only the field system stone alignments, but other kinds of stone structures dispersed within the system. Aside from Ladefoged's limited work on a peripheral part of the field system near the Kalaupapa airport (1990), our transect survey represents the first attempt to study a portion of the field system at close range.

One of the most important findings emerging from our Kaupikiawa Transect survey is that a diversity of stone structures are indeed integrated within the field system, and that these include numerous features that are residential in function. Some of these features, such as the KT-1 to -6 sites forming a cluster near the eastern coast, are certainly of post-contact age (based on the presence of European type artifacts). Others, however, especially those situated on higher ground in the western part of our transect, seemed to us to be of pre-contact age, based on architectural form, absence of European artifacts, and presence of traditional Hawaiian artifacts such as basalt lithics. These features also seem to form small clusters (such as the KT-18 to -22 cluster) which may represent traditional *kau hale* or household groups. The apparent integration of pre-contact residential structures within the field system is significant, since this suggests that the system itself is likely to have pre-contact origins.

Historical records (e.g., Morgan 1948) make it clear that Kalaupapa was a major source of sweet potato and Irish potato exports to California during the Gold Rush, and on this evidence Ladefoged (1993) argued that the Kalaupapa dryland field system may have seen a significant although short-term phase of intensification in response to the Pacific economy of the mid-19th century. However, based on his work in the vicinity of the Kalaupapa airport, where a 19th century sweet potato farmstead was identified and later excavated (Goodwin 1994), Ladefoged has gone farther in pushing his view that the Kalaupapa field system may be largely of *historic period* age: "The archaeological and ethnohistorical evidence from Kalaupapa suggests that the intensive field system found throughout the peninsula *was not primarily a prehistoric phenomenon* but was extensively elaborated during the historic period" (1993:128, emphasis added).

Based on our own Kaupikiawa Transect sur-

vey, we are skeptical of Ladefoged's rather sweeping claim, that the Kalaupapa field system is largely of historic age. While concurring absolutely that there was an important phase of *reintensification* associated with the Gold Rush and the large mid-19th century Pacific economy, we would pose an alternative hypothesis: that the peninsular field system developed more gradually and incrementally, over a period of perhaps several centuries, beginning during the mid-to-late Expansion Period and extending on into the Proto Historic Period.[6] The history of its development, we suggest, was more likely to have been parallel to those of the Kona and Kohala systems, and linked (whether as cause or effect, or some combination of both) to the high rates of population growth and density which have now been so well documented for the later phases of Hawaiian prehistory. Most likely, given the sickening demographic collapse throughout the islands after European contact and introduction of foreign diseases (Bushnell 1993), the Kalaupapa field system underwent a phase of *disintensification* in the early part of the 19th century, as did many indigenous Pacific agricultural systems (Brookfield 1972). However, the infrastructure of the system, and the agronomic knowledge of how to produce high sweet potato yields within its boundaries, were still intact in 1849, when the influx of "49-ers" to California suddenly sent a wave of demand for foodstuffs out across the Pacific. That the Kalaupapa system was able to respond to this immediate demand so rapidly—within a single year increasing production dramatically—is evidence in itself that the system was fundamentally in place, and not something created *de novo*.

To be sure, our alternative hypothesis now needs to be tested in the field, and this can only be accomplished through an intensive program of detailed study, including excavations and dating of both agricultural features and the associated residential sites. Working out the history of the Kalaupapa field system, we believe, will in fact be key to understanding much that was central to the development of traditional life on the peninsula.

In drawing attention to the Kalaupapa field system, we do not intend to underemphasize the importance of the other agricultural systems whose archaeological remains dominate the landscape of the Kalaupapa Region. These include the zone of colluvial slopes between the peninsula and the high cliffs, which as we have already mentioned seem to have been an equally important economic zone, marked by extensive sets of dryland terraces and also by a number of large *heiau* sites. Waikolu Valley, for its part, was a major zone of wet taro production, and we have partially recorded and dated one irrigated pondfield system at the valley mouth. Our brief reconnaissance forays into the interior of Waikolu indicate the presence of extensive sets of pondfields, some of which may have been modified and intensified in the 19th or early 20th centuries under the economic incentives of taro production for the leprosy settlement. Certainly, these colluvial slope and valley agricultural systems also deserve intensive archaeological study, and will contribute to the overall historical understanding of the Kalaupapa Region.

3. RISE OF THE KO'OLAU POLITY

Viewed within a broad, comparative Polynesian context, the prehistory of the Hawaiian Islands stands out for the degree to which this branch of the Polynesian "cultural phylogeny" elaborated and intensified its sociopolitical organization and structure. By the Proto-Historic Period, the final century and a half prior to Cook's arrival, Hawaiian society had undergone radical transformations from its Ancestral Polynesian form. Within the range of structural diversity exhibited by Polynesian sociopolitical systems, Hawaii may arguably be taken to represent a historical working out to its developmental endpoint, of the inherent possibilities of the Polynesian chiefdom "type" of social formation. In *Stone Age Economics*, Sahlins wrote that

> . . . a few of the Polynesian societies, *Hawaii particularly*, take the primitive contradiction between the domestic and public economies to an *ultimate crisis*—revelatory it seems not only of this disconformity but of the economic and political limits of kinship society (1972:141, emphasis added).

What is especially interesting—and of the greatest possible import for understanding how a "chiefdom" might be transformed into an "archaic state", is the apparent sundering of the classic Polynesian structure of land-holding descent (or "ascent") groups.[7] To again quote Sahlins:

> Hawaii is missing the segmentary polity of descent groups known to cognate Polynesian peoples:

> organization of the land as a pyramid of embedded lineages, with a corresponding hierarchy of ancestral cults, property rights, and chiefly titles, all based on genealogical priority within the group of common descent (1985:20).

Tracing the evolution of Hawaiian sociopolitical organization has been a concern of archaeologists for several decades (e.g., Hommon 1986; Cordy 1974, 2000; Kirch 1984, 1985; Kolb 1994), both from the perspectives of empirically documenting various material changes in the archaeological record reflective of sociopolitical transformations, and of understanding the causal factors contributing to these changes. Recent efforts have attempted to integrate archaeological evidence with the indigenous record of oral traditions pertaining to chiefly genealogies, marriages, wars of conquest, and other political affairs, such as Cordy's (2000) reconstruction of Hawai'i Island ancient history and Abad's (2000) study of Hawaiian sociopolitical complexity based on the traditional histories of the four major islands. These new studies have the advantage of combining materialist archaeological evidence for sociopolitical change (e.g., changes in settlement pattern, or sequences of *heiau* construction and elaboration) with an indigenous cultural perspective that provides an emic or "insider's" view of how the political process operated.

In these recent studies, Moloka'i remains largely neglected, in part because the ethnohistoric record of oral traditions pertaining to Moloka'i chiefs is incomplete and less well documented than for the larger islands of Hawai'i, Maui, O'ahu, and Kaua'i.[8] Summers (1971:4-20) syntheses the available genealogical and traditional accounts, which indicate that Moloka'i was originally an independent chiefdom polity, with Kamauaua as its first recorded *ali'i nui* or paramount chief (dated by genealogical reckoning to the 13th century A.D.). During the late Expansion and Proto Historic Periods, the island became entangled at various times in wars and invasions featuring prominent *ali'i* from the larger islands, such as the war between the Kona and Ko'olau factions of the island in which Kuali'i of O'ahu came to the aid of the Kona chiefs. On the cusp of European contact, Moloka'i was subjugated by the O'ahu paramount Peleioholani, only then to be taken control of by the Maui king Kahekili in 1785 when he invaded and conquered O'ahu. Between 1790 and 1795, control of Moloka'i shifted to the Hawai'i paramount Kamehameha, then back to Kahekili, and finally and decisively to Kamehameha. In short, what we can glean from the oral traditions is a history in which Moloka'i was originally an independent polity, albeit with long-standing tensions between two internal factions, the chiefs of the respective Kona (dry, leeward) and Ko'olau (wet, windward) sides of the island. Wars between the Kona and Ko'olau factions more than once attracted chiefs of the larger islands to join in support of one side or the other, which may have heightened interest in bringing the island under their sway. In the final decades of the Proto Historic Period, Moloka'i had become a prize claimed and fought over by the larger and predatory Maui and O'ahu polities lying to the east and west respectively.

As sketchy as it is, this political history suggests that an island-wide degree of political integration may have first been achieved around the 13th century A.D., or the early part of the Expansion Period, a phase of key cultural changes throughout the archipelago, including rapid population growth and settlement expansion. However, the traditions also suggest that internal tensions between the leeward and windward parts of the island were long-standing. In this history, the Kalaupapa Region figures as part of the Ko'olau or windward polity, which evidently incorporated the peninsula with the four great windward valleys of Hālawa, Wailau, Pelekunu, and Waikolu. That these locales should have been joined by a common identity is not surprising, given that they all featured an economic infrastructure based on taro irrigation, and were presumably linked by regular canoe traffic between their bays. Indeed, with the high productivity conferred by their extensive irrigation systems, along with the dryland field system of Kalaupapa, the Ko'olau polity would have had significant economic resources at its command. Disadvantages lay in the paucity or absence of coral reefs and inshore fisheries (in contrast, the Kona chiefdom boasted the most extensive array of fishponds in the archipelago), and in the difficulties of inter-valley communication during the stormy winter months.

Working out the history of the sociopolitical

development of the Ko'olau polity over the several centuries spanning the Expansion and Proto Historic Periods is a challenge that will have to be addressed largely by field archaeology, as it seems unlikely that new or expanded sources of traditional history will be forthcoming. In such an endeavor, the Kalaupapa Region will play an important role. Among the key sources of material evidence are the many *heiau* and *ko'a*, ritual structures, that were constructed by and for the ruling elite, and where the varied and elaborate ceremonies legitimating the politico-religious system of domination over land, labor, and resources were held during the annual ritual cycles. As this system itself changed and evolved in relation to the transformation of social organization and the chiefship, the temples themselves were changed and elaborated, so that in their constructional histories they encapsulate a key record of cultural change. Accessing this record will require a great deal of careful field research, beginning with detailed mapping and architectural recording, and interpretation of temple sites within their larger archaeological landscapes. Ultimately, however, it will also be necessary to develop temporal sequences for these sites, requiring excavation and dating, as has been done for a few temple sites on other islands (e.g., Kāne'ākī Heiau on O'ahu, or several sites studied by Kolb [1994] on Maui). The excavation of *heiau* is, of course, a sensitive matter which will require careful consultation with the Native Hawaiian community. Ideally, such excavations could be undertaken in consort with a program of stabilization and restoration of *heiau* structures, as many of these sites have suffered through partial collapse and weakening of foundations by overgrowth of exotic vegetation. In any event, unraveling the longer term sociopolitical history of the Ko'olau chiefdom, and Kalaupapa's role in this history, will only be possible when the material record contained within the suite of *heiau* is itself revealed.

4. HISTORIC PERIOD TRANSFORMATIONS

As noted in the Introduction, our 2000 reconnaissance survey explicitly excluded consideration of known 19th and 20th century archaeological sites, although some of the structures we recorded do clearly date to the post-contact era. While our own emphasis was on the variability to be found in the range of pre-contact sites, there is without doubt tremendous scope for "historic archaeology" within the KNHP. Indeed, the complexity and richness of the historic-period archaeological record of the Kalaupapa Region rivals its prehistoric-period variability, reinforcing the overall significance of KNHP for understanding and interpreting Hawaiian history, both before and following European contact.

One major set of historic period transformations occurred between the phase of initial contact with Europeans and ends prior to the conversion of the peninsula to an isolated colony for sufferers of Hansen's disease. From the final decades of the 18th century until the advent of the major changes in land tenure—known collectively as the Great Mahele—Hawaiian economy, society, and politico-religious systems underwent a rapid series of changes, in part as responses to the rapidly-expanding Pacific sector of the so-called "World System" (Wallerstein 1974). But, as Kirch and Sahlins (1992) have shown in their integrated ethnohistorical-archaeology study of the Anahulu Valley, O'ahu, the nature of these changes was strongly mediated by distinctively Hawaiian cultural patterns, and thus not merely the local manifestation of an expanding, generalized world capitalism. For the Anahulu case, Kirch and Sahlins outline a three-phase historical sequence: beginning with the period of inter-island wars and conquests (A.D. 1778-1812), culminating in Kamehameha's hegemony over all of the archipelago excepting Kaua'i Island; continuing with a phase of early mercantile developments marked by the sandalwood trade, and also encompassing the arrival of the first Protestant missionaries (A.D. 1812-1830); and, culminating in the "Whaling Period" (A.D. 1830-1860) when the expanding whale-ship provisioning trade led to major economic restructurings, and at mid-century, the Great Mahele division of lands which forever and irreversibly ended the relations of production upon which traditional Hawaiian society had been founded.

These same periods provide a guide for the kinds of historical transformations that undoubtedly changed the Kalaupapa Region and its inhabitants' lifeways. Moloka'i was itself subject to the inter-island rivalries of Kahekili and Kamehameha, at the same time that its population was suffering

from the ravages of introduced diseases, leading to a large-scale population decline. How such changes are reflected in the archaeological record of the region is a problem awaiting investigation, but one likely consequence was a phase of disintensification of the dryland field system on the peninsula, and perhaps also of portions of the valley irrigation systems. Religious conversion, of course, had as one consequence the abandonment of the temples, now becoming fossilized witnesses of the final stage of the traditional ritual system. The effects of the ever-expanding World System were locally expressed in a most dramatic fashion by the demand for potato exports occasioned by the California Gold Rush in 1849, with Kalaupapa becoming a major supplier, probably expressed archaeologically by a reintensification of the field system.

From 1846-52, the inhabitants of Kalaupapa and the adjacent valleys participated in the various phases of the Great Mahele, beginning with the allocation of the principal *ahupua'a* to the *ali'i*, and followed by the submission of claims on the part of the *maka'āinana* or common people for their customary agricultural lands and house lots, these being only in part awarded by the Land Commission. It is probable that certain archaeological features in the region reflect the consequences of this land reallocation, such as enclosing walls associated with particular claims, and quite possibly even the construction of the large boundary wall separating Kalawao and Makanalua *ahupua'a*.

Those *maka'āinana* who did receive their claims, however, had only a few years in which to enjoy the fruits of their new status as landholders, for in 1865-66 the Kingdom acquired title of the *ahupua'a* of Kalawao, Makanalua, and Kalaupapa in order to create an isolation colony for the rapidly increasing population of persons who had been diagnosed with *ma'i Pākē*, leprosy, or Hansen's disease as it is called today. This conversion of the Kalaupapa Region into a leprosy settlement resulted in enormous changes to the local settlement patterns, and to a significant restructuring of the archaeological record. Much of Kalawao *ahupua'a* was converted into a formal settlement with houses, churches, schools, a water system (which in turn caused major land transformations in both Wai'ale'ia and Waikolu Valleys), roads, and by the early 19th century, a large U. S. Federal Leprosy Investigation Station.[9] In the early 20th century, the settlement was moved to Kalaupapa, on the western side of the peninsula, where it remains today. With the exception of the two churches, the Kalawao settlement was abandoned and thus its ruins today encapsulate a sort of "time capsule" of the leprosy settlement between its founding in 1865-66 and the movement to the new Kalaupapa settlement after 1900. The potentials for historical archaeology here are, needless to say, outstanding.

CHAPTER 9 ENDNOTES

[1] McCoy (MS) reports the discovery, or rediscovery, or several additional *heiau* during his summer 2002 field season. These include a "large *heiau*" on the colluvial slopes in Kalawao, and another terraced stone platform which may correspond to Stokes' *hana aloha heiau* (Summers' site 302).

[2] Weisler (1989:124) mistakenly referred to the Hālawa Dune Site as dating to Kirch's Colonization Period, but Kirch (1985:302) was quite explicit in assigning it to the succeeding Developmental Period.

[3] We suspect that the age of the 1966 Pearson sample correctly dates a large bulk sample of mature, dryland forest wood, but does not correctly date initial human use of the rockshelter; i.e., the dated event does not correspond to the "target date" for human occupation, in the sense of Dean (1978). It is therefore most likely an instance of the "old wood" factor so pervasive in radiocarbon dating.

[4] Other extensive dryland agricultural zones have been identified, such as the dryland colluvial slopes of Mākaha Valley, O'ahu, portions of which were carefully mapped and studied by Hommon (1969, 1970), but these lack the formality of walls separating individual garden plots.

[5] Vegetation cover is much heavier on the western slope of Kauhakō crater, where the trade winds are less severe and such exotic plants as Christmas Berry and Java Plum form

a closed canopy cover. Recent survey by Mark McCoy (MS) has shown that dryland agricultural features are to found under this canopy, yet are not visible in the aerial photos.

[6] Ladefoged's single radiocarbon date from a buried feature, of 510 ± 80 B.P., provides some minimal evidence in support of this hypothesis.

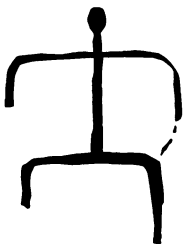
[7] On the nature of Ancestral Polynesian social organization, including land-holding ascent groups, see Kirch and Green (2001).

[8] As Abad (2000:36-45) points out, this reflects the geographic origins of the main 19th-century scholars who collected and synthesized the extant body of Hawaiian oral traditions: David Malo was of Hawai'i Island origins and later lived and worked on Maui, while Samuel Kamakau traced his descent to families of O'ahu and Kaua'i. Abraham Fornander was a *haole* who married a chiefess, Alanakapu Kīna'u, of Moloka'i origins, and not surprisingly much of the little we know of Moloka'i traditions derives from Fornander's writings (Summers 1971:7).

[9] The ruins of this federal station, consisting of rows of concrete pilings and other features, cover a significant part of Kalawao.

CHAPTER 10

A LONG RANGE PROGRAM FOR KALAUPAPA ARCHAEOLOGY



The main contribution of our 2000 reconnaissance survey of portions of the Kalaupapa Region has been to add to our understanding of the tremendous range of archaeological (and ethnobotanical) landscapes within the Kalaupapa Region. Building upon the pioneering work of Stokes and Summers, and of the more limited studies by Somers, Ladefoged, Goodwin, and others, we have been able to examine a greater range of microenvironments contained within the boundaries of KNHP, from the deep amphitheater valley of Waikolu, to the colluvial slopes of Kalawao, the field system of the peninsula proper, and to the remote landshelf of Nihoa. As this report was in the final stages of production, a second University of California, Berkeley, field team carried out a second field season at KNHP, extending survey into new areas of the colluvial slope zone, the Kaupikiawa Transect (extending our 2000 transect farther to the west, across the Kalawao-Makanalua boundary wall), and beginning a new transect on the western slopes of Kauhakō Crater (Mark McCoy [MS], and pers. comm., 2002). Their preliminary results confirm that the full range of variability in the archaeological landscapes of the Kalaupapa Region has yet to be exhausted.

Without doubt, the Kalaupapa Region and the KNHP hold an archaeological and historical legacy rivaling any other part of the archipelago, collectively a suite of "cultural resources" with great potential to add to and enhance our understanding and appreciation of the long sweep of Hawaiian history, from the arrival of early Polynesian voyagers, through the development of hierarchical chiefdoms and their intensive economic bases, to the dramatic transformations of the post-contact era. The 2000 and 2002 University of California, Berkeley, surveys have documented this archaeological potential; what is now required is a long-term program of research to extend our knowledge base beyond a reconnaissance level, and to begin to address the major research topics and issues just outlined.

Kalaupapa is now in a major phase of transition. Still in part a Hansen's disease settlement, the number of remaining patients is finite and decreasing. Within a few years, the State of Hawai'i Health Department is expected to relinquish administrative control of the region, and the National Park Service—which has already taken on significant aspects of environmental and cultural resource management—will become the primary if not exclusive agency responsible for the area encompassed by Kalawao County (the present area of KNHP).

In creating the Kalaupapa National Historical

Park, the U. S. Congress declared its intent that one aim of the Park would be "to research, preserve, and maintain important historic structures, traditional Hawaiian sites, cultural values, and natural features" (Public Law 96-565, Section 102; 1980). Given the extent to which the saga of the leprosy settlement and of Father Damien have overshadowed the history of Kalaupapa, however, there is a tendency in the minds of the public at large as well as of those charged with administration and management of the Park, to emphasize those aspects of Kalaupapa associated with its post-1865 history. We can only reiterate and underscore the words of NPS archaeologist Gary F. Somers, who conducted the first intensive-level survey of a portion of Kalaupapa, and who titled his report "Kalaupapa, More than a Leprosy Settlement" (Somers 1985). Indeed, our own research has convinced us that Somers was not exaggerating when he claimed that "the sheer number and types of archaeological resources that exist today, the possibility that there has been 900 to 1,000 years of occupation and use within the park, and the excellent state of preservation of the resources combine to make Kalaupapa National Historical Park one of the richest and most valuable archaeological preserves in Hawaii" (1985:117).

Somers concluded his 1985 report with a set of six specific recommendations, all still relevant today. In particular, he urged that "archaeologists from other institutions . . . be encouraged to cooperate with the National Park Service and to conduct archaeological research at Kalaupapa to assist the National Park Service in its attempts to understand and interpret the prehistory and early history of the park" (p. 119). It was with this recommendation in mind that we undertook the 2000 survey, which was collaboratively financed and supported by the University of California, Berkeley, and the NPS. Our fieldwork was continued in 2002, and plans are being laid for continued collaboration in the future. Given the extent and variability of archaeological resources within KNHP, however, and the diversity of research problems to be addressed, there is surely scope for more than one university or institution to become involved with the NPS in this long-term collaborative endeavor.

To conclude this report—on merely the first phase of what we anticipate and hope will be a long-term endeavor—we express our appreciation to the National Park Service for inviting us to explore the archaeological landscapes of the Kalaupapa Region. Our team has had the unique prerogative and intellectual excitement of discovering new sites hidden within thickets of exotic Christmas Berry and lantana, of seeing first-hand the diversity of archaeological remains that make this such a remarkable region. We trust that our initial results have added in some measure to our collective knowledge of the archaeological resources and culture history of the KNHP, and will help to set the course of a continuing research endeavor. From the majestic valley of Waikolu, across the broad sweep of the peninsula under the towering cliffs of Keōlewa, to the sea of Papaloa, and the fragrant *hala* groves of Nihoa beyond, the Kalaupapa Region truly deserves not only to be studied, researched, and investigated, but preserved, protected, and treasured.

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Appendix

List of Sites Recorded

SITE NUMBER	SITE TYPE	GPS EASTING	GPS NORTHING
WAIKOLU			
WK-1	Pondfield terraces		
WK-2	Terraces	715120	2342021
WK-3	Pondfield terraces	715139	2341846
WK-4	Pondfield terraces	715150	2341775
WK-5	Pondfield terraces	415141	2341683
WK-6	Pondfield terraces	715071	2341604
WK-7	Pondfield terraces	715044	2341542
WK-8	Pondfield terraces	715014	2341370
WK-9	Terraced enclosure	715214	2341003
WK-10	Pondfield terraces		
WK-11	Pondfield terraces		
WAI'ALE'IA			
WL-1	Walled shelter against boulder	713158	2342633
WL-2	Rectangular enclosure	713125	2342548
WL-3	Walled shelter	713125	2342548
WL-4	Filled terrace (probable burial)		
WL-5	Earth-filled platform		
WL-6	Stone-faced terrace		
WL-7	Habitation terraces, stone-faced		
WL-8	Stone-faced terrace	713050	2341771
WL-9	Free-standing wall	712895	2341560
KALAWAO			
Site 289 *Heiau*	Stone-faced terrace complex	712543	2343308
KA-1	Petroglyph and walls	712503	2343403
KA-2	Rectangular enclosure	712590	2343242
KA-3	Terrace and enclosure	712580	2343210
KA-4	Terraces	712580	2343210
KA-5	Terraces	712532	2343264
Site 288 *Ko'a*		713327	2342380
KB-6	Rectangular enclosure and terrace	713312	2342370
KB-7	Stone-faced terrace		
KB-8A	Stone cairn (probable burial)	713307	2342334
KB-8B	Stone-faced terrace	713307	2342334
KB-9A	Rectangular enclosure with terraces	713228	2342255
KB-9B	Stone-outlined clearings		
KB-10	Parallel stone alignments		
KB-11	Stone-faced terrace		
KB-12	Stone-faced terrace	713264	2342234
KAUPIKIAWA TRANSECT			
KT-1	Enclosure with attached platform	712010	2345661
KT-2	L-shaped shelter	711998	2345632
KT-3	Linear shelter and enclosure	712017	2345622
KT-4	L-shaped shelter	711996	2345582
KT-5	L-shaped shelter	712015	2345565
KT-6	Small shelter	711993	2345556
KT-7	Small enclosure	712015	2345754
KT-8	Circular enclosure	712005	2345787
KT-9	*Ahu* (cairn)	712113	2345611
KT-10	C-shaped shelter	711985	2345523

KT-11	L-shaped shelter	711853	2345429
KT-12	Linear shelter	711795	2345444
KT-13	L-shaped shelter	711743	2345420
KT-14	U-shaped shelter	711812	2345519
KT-15	Small circular enclosure	711821	2345521
KT-16	Rectangular enclosure	711933	2345593
KT-17	C-shaped shelter	711911	2345598
KT-18	L-shaped shelter and enclosing walls	711704	2345563
KT-19	L-shaped shelter	711748	2345511
KT-20	C-shaped shelter	711753	2345517
KT-21	Stone mound	711955	2345506
KT-22	C-shaped shelter	711703	2345443
KT-23	C-shaped shelter	711684	2345543
KT-24	Linear shelter	711660	2345525
KT-25	Linear shelter and wall	711609	2345391
KT-26	Rectangular enclosure	711579	2345425
KT-27	L-shaped shelter with cupboard	711538	2345392
KT-28	L-shaped shelter	711588	2345446
KT-29	C-shaped shelter	711510	2345388
KT-30	L-shaped shelter		
KT-31	Irregular-shaped shelter	711504	2345389
KT-32	C-shaped shelter	711590	2345438
KT-33	L-shaped shelter	711602	2345451
KT-34	Linear shelter	711597	2345443
KT-35	Linear shelter		
KT-36	Core-filled wall	711677	2345479
KT-37	Stone-walled depression	711510	2345443
KT-38	Lava tube shelter	711509	2345453
KAUPIKIAWA POINT			
KC-1	Rectangular enclosure with doorway	711759	2345984
KC-2	Circular enclosure	711782	2346038
KC-3	Stone walled shelter	711803	2346047
KC-4	Rough enclosure	711751	2346029
KC-5	Parallel field walls in depression	711756	2346039
KC-6	Rectangular enclosure	711819	2346042
KC-7	Free-standing walls	711738	2346025
KC-8	Parallel field walls within irregular stone enclosure	711784	2345959
KC-9	Stone-walled shelter (habitation)	711702	2345960
KC-10	C-shaped shelter	711712	2346024
KC-11	C-shaped shelter	711679	2346034
KC-12	Circular enclosure	711662	2346050
KC-13	Irregular enclosure	711742	2345919
KC-14	Stone mound (burial ?)	711824	2345997
KC-15	Rectangular enclosure	711795	2346077
KC-16	Complex walled structure		
NIHOA			
NI-1	Habitation terraces (stone-faced)	706076	2343803
NI-2A	Rectangular enclosure		
NI-2B	Free-standing wall		
NI-2C	C-shaped shelter		
NI-2D	Semi-circular enclosure		
NI-3	Burial (rectangular pavement)		
NI-4	Field system complex		
NI-5	Burial (rectangular pavement)		
NI-6	Habitation complex (terraces)	706115	2343714
NI-7	Agricultural field complex		
NI-8	Rectangular enclosure	7016214	2343650
NI-9	Rectangular enclosure		
NI-10	Habitation terraces	705869	2343754

Note: Detailed survey forms including sketch plans, dimensions, and descriptions of the sites listed here are on file in the archives of the Kalaupapa National Historical Park, and in the archives of the Oceanic Archaeology Laboratory, Berkeley. All GPS positions are given with reference to the NAD83 datum.