

**2003 FEIS HAWAII
KEKAHA KAI STATE PARK CONCEPTUAL PLAN
3 OF 3**

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Kekaha Kai State Park

North Kona, Island of Hawai'i

**Park Development Report
and
Final Environmental Impact Statement**

**APPENDIX
M**

Applicant:

Department of Land and Natural Resources
Division of State Parks
State of Hawai'i

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May 2003

Appendix M

Archaeological Inventory Survey
- Portions of Kekaha Kai State Park

**Archaeological Inventory Survey of
Portions of Kekaha Kai State Park**

Volume I

Report and Appendices

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Chapter 1

Executive Summary

At the request of Group 70 International, *T. S. Dye & Colleagues, Archaeologists, Inc.*, in cooperation with the Hawaii State Parks Division, has completed an archaeological inventory survey of portions of Kekaha Kai State Park in the North Kona district of Hawai'i Island. Fieldwork was carried out between March 6 and April 30, 2002 and June 19–21, 2002 by experienced four-person crews. The goal of the survey project was to collect baseline data needed by the State Parks Division to manage historic sites in the park. This was done primarily by drawing 1:100 and 1:50 scale plane table maps of habitation feature clusters, supplemented by descriptions and photographs of isolated features. Maps and descriptions were geo-referenced using global positioning system equipment and software. The goal of the State Parks Division is to preserve all of the identified archaeological features.

The project area of approximately 583 acres comprises the northern portion of Kekaha Kai State Park, north of the privately-held *ahupua'a* of Makalawena. It includes the whole of Awake'e *ahupua'a makai* of Queen Ka'ahumanu Highway, and an approximately 1,000 ft. wide strip of land that takes in the seaward ends of Manini'ōwali and Kūki'o 2nd *ahupua'a*. The survey areas are portions of the park that have been identified as desirable locations for public park facilities. They include planned improvement areas and road and trail corridors with a combined area of approximately 120 acres.

A total of ten sites comprising more than 1,000 features was recorded. Five of the sites are traditional Hawaiian settlements, which range in size from small villages to settlements of one or a few households. The largest and best-preserved site, 50-10-18-23355, is located at Kākapa Bay. A total of 359 features was recorded here. Settlement pattern analysis indicates that this site comprises seven household clusters preferentially located on 'a'ā lava flows near the cobble and white sand beach. Also present are a *heiau* reported to have been one of Kamehameha's as well as several large boulders and lava slabs that have been bashed with cobble hammerstones to expose an interior layer of red, often ropy, lava. These features, which lack an obvious function but which required considerable effort to complete, are tentatively interpreted as *kū'ula* fishing shrines; important features of a coastal settlement in which the bulk of economic activities were directed toward fishing. The *heiau*, which is the largest reli-

gious structure recorded during the survey, is one indication of the local importance of the Kākapa Bay community. Another is the network of transportation routes that serve the settlement. Four major trails terminate at the village: trail site 50-10-18-16059 originates inland and enters the village from Kūki'o 1st *ahupua'a* to the north; two branches of trail site 50-10-18-5337, which originates inland and south of the village, enter over the 'a'ā lava immediately *mauka*; and the coastal trail that serves the village from both the north and the south. The remnants of a canoe shed near the *heiau* indicate that the village was also a terminus for travel over water. A traditional Hawaiian cemetery, located outside the survey area, immediately *mauka* of the site's residential core, is marked on the USGS Makalawena quadrangle map. A small anchialine pond at the toe of an 'a'ā flow likely provided fresh water. Site 50-10-18-23355 is significant as a well-preserved example of a traditional Hawaiian coastal village and for the information on Hawaiian history and prehistory that it has yielded and is likely to yield in the future. It might also be significant for its association with the life of Kamehameha I, although this association needs to be substantiated through the discovery of additional information about Kamehameha's relationship to the *heiau* and the village. The entire site offers an outstanding opportunity for interpretation and display.

Site 50-10-18-23356 is the remains of a small village now badly disturbed by bulldozing, off-road excursions by four-wheel drive vehicles, and the activities of campers and others at the recently popular sand beach at Manini'ōwali, or Kua, Bay. A total of 348 features was recorded here. Settlement pattern analysis identified nine residential clusters located on the 'a'ā flow at the north end of the bay, along the sandy margin of the *pāhoehoe* flow at the central and southern ends of the bay, and on the *pāhoehoe* flow itself generally associated with relatively large lava tube caves. The habitation clusters here are more dispersed than at Kākapa Bay, but the focus of settlement seems to have been the north end of the bay where a canoe shed at the edge of an 'a'ā flow overlooks a relatively large, but now partially filled, anchialine pond, and a small, stratified cultural deposit that is preserved at the edge of a sand dune. Religious structures consist of several small shrines, the most prominent of which is located well inland, away from the coast. No large *heiau* is present today. Human burial seems to have been dispersed, as well. Bones were found in a lava tube cave, under a large 'a'ā boulder, and probably at several small above-ground structures, which were not dismantled to search for bones. The village was served by the coastal trail from the north and south, but no known *mauka-makai* trail terminates at Manini'ōwali Bay. The settlement pattern information suggests that site 50-10-18-23356 was less important traditionally than site 50-10-18-23355 at Kākapa Bay, and the site's integrity has been compromised by a range of modern activities. It is significant for the information on Hawaiian history and prehistory that it has yielded and is likely to yield. Portions of the site offer some potential for interpretation and display, although the level of previous disturbance and the fragility of the disturbed cultural remains at the north end of the bay and behind the south end, where looters have ransacked habitation caves, place limits on what might be done. The portions of the site with the greatest potential for interpretation and display are the *mauka* cluster, which includes a well-built enclosure that incorporates upright *pāhoehoe* slabs probably imported from some distance, and a shrine with several water-worn boulders, one of which vaguely resembles a stylized human face.

Site 50-10-18-23357 was assigned to eight small clusters of mostly small, probably temporary habitation features and some isolated features located along the coastal trail at Punaloa Point. A total of 75 features was recorded. The coastline here is rocky, making canoe access difficult; a canoe shed, however, is located on a small patch of sand on the point, indicating that the place was regularly accessed from the sea. In addition to the coastal trail, which enters the site from the north and south, several well-worn *mauka-makai* trails lead inland from individual clusters, beyond the survey area, and have not been followed out. The survey area here was limited to the area surrounding the coastal trail, but observations during fieldwork indicate that the *pāhoehoe* flows inland are heavily modified through the construction of numerous pits, which appear here to have supplied stone for building material. An inventory survey of these inland areas is needed to establish the cultural context for the recorded features along the coast. One cluster of features along the trail, now in poor condition, might have been a *heiau*, but the evidence in support of this interpretation is slim. This site is significant for the information on Hawaiian history and prehistory that it has yielded and is likely to yield. The coastal features offer some limited opportunities for interpretation and display; the canoe shed is readily visible and visitors hiking the coastal trail will appreciate the small patch of sand upon which it was built. Although the inland pit areas are outside the survey area, and were not recorded in detail, they appear to be good examples of *pāhoehoe* quarries and would likely yield good opportunities for interpretation and display.

Traditional Hawaiian habitation at site 50-10-18-23358 at Kaho'iawa Bay differs from the sites farther north. Habitation here centers on single, relatively large structures, rather than the clusters of smaller features recorded at Manini'ōwali and especially Kākapa Bays. Sixty-six features were recorded and grouped into a dozen clusters. The site is located on and adjacent to the cinderlands *makai* of Pu'u Kuili, a unique environment along this section of coast. Although the cinderlands offer some agricultural potential, especially in contrast to the barren lava flows that flank the *pu'u*, evidence for traditional Hawaiian agriculture is limited and equivocal. If agriculture were important here in traditional Hawaiian times, then it has left little or no trace in the cinderlands. Instead, the features here are oriented to the sea and its resources, exemplified most strongly by two features, one with a conch shell trumpet, interpreted as fishing lookouts. The site is served by the coastal trail and probably by trail site 50-10-18-5351, which originates inland and crosses an 'a'a flow to the north flank of Pu'u Kuili, where the trail is lost in the cinders before it reaches the *mauka* edge of the site. The integrity of features at this site has been compromised by modern activities, including the construction of new features by fishermen, campers, and marijuana cultivators. The site is significant for the information on Hawaiian history and prehistory that it has yielded and is likely to yield. The site offers little opportunity for interpretation and display.

Site 50-10-18-23359 at the south end of Awake'e Bay is located adjacent to a large set of anchialine ponds near the boundary with Makalawena *ahupua'a*. Features here are grouped into nine clusters at the south end of the bay, following a scheme used during a reconnaissance survey of the property in the 1980s. The features evidence a mix of traditional Hawaiian and modern habitation; a large complex of enclosures at the southern end of the bay, now being destroyed by four-wheel drive vehicle traffic to

Makalawena, includes a mortar-lined cistern that was built sometime prior to the first time it was recorded in the 1930s. Inland from the coast, on and extending from the edge of an 'a'ā flow, is a large habitation platform and associated graves and/or shrines, a well-built, nearly square enclosure, and a 75 m long, narrow structure described as a causeway, for lack of a better term. The function of this latter feature is enigmatic; the ground around it is not wet so it seems certain that it did not function as a causeway, and the traditional Hawaiian feature that it most resembles, the *hōlua* slide, is generally situated on more steeply sloping ground. This feature deserves further, in-depth study. Inland from the site, outside the survey area, is a habitation cluster built primarily on the edge of an 'a'ā flow adjacent to a very large, thoroughly looted habitation cave. The inland location of this habitation cluster, some 400 m from the shore, is unusual for the Kekaha coast, and was undoubtedly determined by the location of the cave. The site is served by the coastal trail and by a *mauka-makai* trail that enters Awake'e *ahupua'a* from the south, well inland of the site. The site is significant as a well-preserved example of a traditional Hawaiian settlement that was inhabited into the historic period, and for the information on Hawaiian history that it has yielded and is likely to yield. The site presents good opportunities for interpretation and display, although additional research into the function of specific features is needed to yield evidence for interpretation. An inventory-level survey of the many habitation features located inland of the site should also be completed before the area is opened further to the public.

The trail that connects the coastal habitation sites, short branches off the main trail to habitation clusters, and the many small features found on either side of the trail in between inhabited areas, were assigned to site 50-10-18-23360. The trail is not marked along much of its traverse of the project area. Short paved sections are present in several areas, but large sections appear to have been washed out by waves. The longest intact section cuts across the 'a'ā flow that formed Papiha Point between Kākapa and Manini'ōwali Bays, well inland from the coast. This section of trail is maintained and modified by pedestrians, many of whom are fond of marking the trail with white coral cobbles. This section of the trail through the 'a'ā flow is associated with many small features, primarily small overhang shelters that yield some shade for a portion of the day and small pits excavated into the 'a'ā clinkers. These features might represent temporary rest spots or storage features, used by travelers, but such functions seem odd given the short distances to presumably inhabited villages both north and south. Lack of cultural deposit at these small features makes them more difficult to interpret; they do, however, indicate that travel along the trail was often interrupted by short forays off the trail. The trail extends out both ends of the project area, connecting its settlements with other settlements both north and south. The site is significant because it has yielded and is likely to yield information on Hawaiian history and prehistory, and because of its important value to native Hawaiians owing to its association with the cultural practice of traveling along the Kekaha coast. The site is an important component of any program of interpretation and display at the park.

Four other site numbers were assigned to isolated features and groups of features. Site 50-10-18-23635 is an isolated probable burial platform located well outside the survey area. It was described, but no excavations were carried out to test the possibility that the platform contains human bones.

Site 50-10-18-23636 is a mound at the top of Pu'u Kuili that might represent a burial site indicated on historic maps. This mound has been modified repeatedly and extensively over the last two years and there is no solid evidence linking it to the historically recorded burial here, and it might represent the remains of an old survey point established at the top of the *pu'u*. No excavations were carried out to determine whether the mound contains human bone. Until further information on the location of the historic burial at Pu'u Kuili is obtained, this site should be treated as significant for its important value to native Hawaiians as a burial site of ancestral bones.

Site 50-10-18-23637 is a group of small features located along a proposed road corridor near Pu'u Kuili. One of the features is a burial site in which secondarily deposited human bones have been loosely covered with stones. The secondary burial feature does not appear to be ancient and it might be that the bones were moved here after they were uncovered elsewhere. Although the bones are located distant from modern settlements, the nature of their interment is not typical of traditional Hawaiian burials and it might be that they are the remains of an ethnic group other than native Hawaiian. The features in this cluster are significant for the information on Hawaiian prehistory and history that they have yielded and are likely to yield. The secondary burial feature might have important value to native Hawaiians or to another ethnic group of the state.

Site 50-10-18-23638 is another group of small features located along a proposed road corridor leading from Pu'u Kuili to Awake'e Bay. These features are significant for the information on Hawaiian history and prehistory that they have yielded and are likely to yield.

Information on the chronology of settlement and the nature of subsistence activities was collected at excavations carried out at three looted caves and at habitation features at Kākapa and Manini'ōwali Bays. ¹⁴C dates on short-lived materials support the idea established by previous archaeological work along the coast that settlement here occurred relatively late in traditional Hawaiian times, around A.D. 1400, or perhaps later. Subsistence activities were geared almost exclusively to fishing, and a diverse catch of mostly small inshore fishes comprised the bulk of the meat diet. Seabirds, primarily Bulwer's petrel, played a relatively minor role in subsistence, and the only remains of pig and dog were probably brought to the site as raw materials for fishhook manufacture. Large faunal collections from the looted caves yielded evidence interpreted as indicating operation of a long-standing *kapu* against the capture of *āholehole*, a fine food fish that is abundant in nearshore waters along the coast.



Chapter 2

Introduction

At the request of Group 70 International, *T. S. Dye & Colleagues, Archaeologists, Inc.* has completed an archaeological inventory survey of portions of Kekaha Kai State Park in the Kona district of Hawai'i Island. The survey project was carried out during planning for a proposed undertaking that will design and construct public park facilities in the northern portion of the park. Survey results will be incorporated into the planning process so the effect of the undertaking on historic properties can be evaluated and minimized. The conceptual plan for the park seeks to protect cultural resources (Group 70 International 1998:1-1).

project
undertaking

The primary goal of the survey project was to collect baseline data needed by the Division of State Parks to manage historic sites in the park. The survey project was carried out to meet the requirements set out in the State Historic Preservation Division draft *Rules Governing Standards for Archaeological Inventory Surveys and Reports* (§13-276).

This chapter identifies the project area and describes its physical environment. The survey areas within the project area are also identified. Subsequent sections describe the history of the project area from traditional Hawaiian times to the present, in the context of the three *ahupua'a* in which it is located. Consultations with individuals knowledgeable about the project areas' history are described. Specific settlement pattern predictions are made for each survey area based on the archaeological and historical background information. The chapter ends with a description of the report organization.

ahupua'a

The Project and Survey Areas

The project area of approximately 583 acres comprises the northern portion of Kekaha Kai State Park, north of the privately-held *ahupua'a* of Makalawena in the North Kona district of Hawai'i Island. It includes the whole of Awake'e *ahupua'a makai* of Queen Ka'ahumanu Highway, and an approximately 1,000 ft. wide strip of land that takes in the seaward ends of Manini'ōwali and Kūki'o 2nd *ahupua'a*. The survey areas are portions of the park that have been identified as desirable locations for public park

§13-276-5(a)(1.2)

facilities. They include planned improvement areas and road and trail corridors (fig. 1) with a combined area of approximately 120 acres. The project area is owned by the State of Hawai'i.

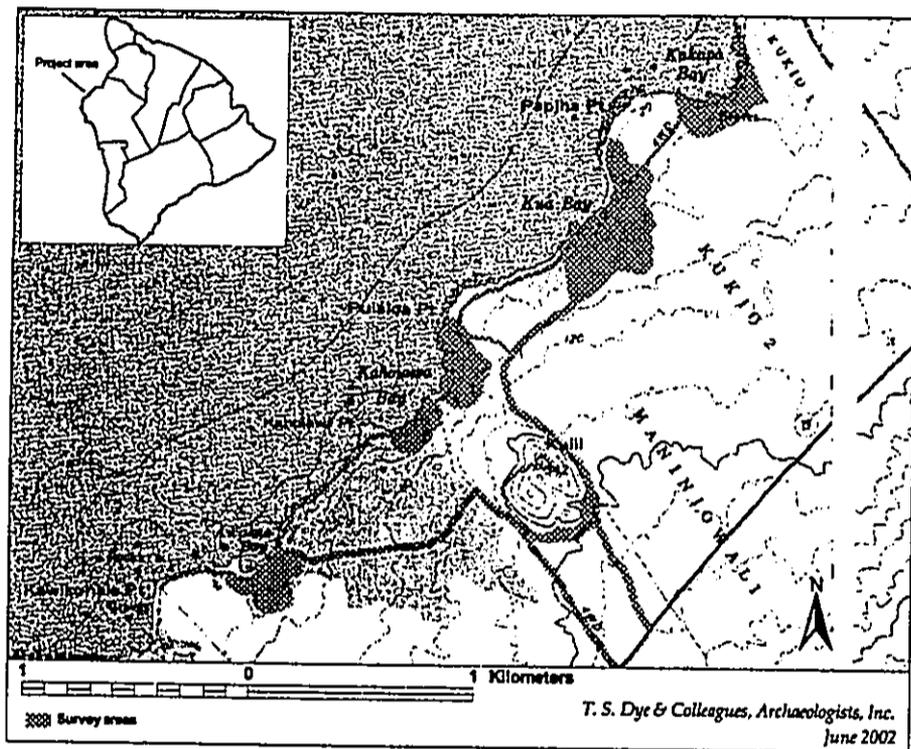


Figure 1. Archaeological inventory survey areas in Kekaha Kai State Park.

kalana

The project area is located in the *kalana* of Kekaha, the dry northern part of Kona (Maly 1998:4). Maly reports that native Hawaiian residents of the region affectionately referred to it as *Kekaha-wai-'ole o nā Kona*, waterless Kekaha of the Kona district (Maly 1998:4). It was also known, perhaps less affectionately, as *kaha 'ai 'ole*, a place without vegetable foods (Maly 1998:63).

The survey areas are portions of three large parcels of land identified by tax map keys 7-2-04:3, 17, and 19. Included within parcel 19 are parcels 8, 9, and 10, all 3-acre houselots, and parcel 12, a half acre parcel. They were subdivided during a failed attempt to develop private homes on the beach at Manini'ōwali Bay. Parcel 3, with an area of about 334 acres, according to modern tax maps, is located along the coast of Awake'e *ahupua'a*. Parcel 17, with an area of about 353 acres, includes a small section of the southern coast of Awake'e and the rest of the *ahupua'a* between parcel 3 and Ka'ahumanu highway. Parcel 19, with an area of about 196 acres, comprises a 1,000 ft. strip at the *makai* ends of Manini'ōwali and Kūki'o 2nd *ahupua'a*.

makai

Environment

§13-276-5(a)(3)

The project area is formed on predominantly alkalic and transitional basalt lavas from Hualālai volcano. Most of these were erupted 3,000–5,000 years ago. Older lavas are found at the southern edge of Awake'e *ahupua'a*, where there is a remnant of a 5,000–10,000 year old flow, and at Pu'u Kuili, where the cinder cone and the lavas immediately *makai* of it are more than 10,000 years old.

The project area represents a relatively old coastline for the region. South of the park, from Kaulana *ahupua'a* south to Kalaoa *ahupua'a*, the coast was formed by the A.D. 1800–1801 eruption of Hualālai. North of the park, at Ka'ūpūlehu *ahupua'a*, lavas from the A.D. 1800–1801 eruption covered flows 1,500–3,000 years old. Coast of an age similar to the park is found again at 'O'oma *ahupua'a*, 7.5 km south, and at Kīholo Bay, about 6 km north.

Most of the project area consists of 'a'ā and *pāhoehoe* lava flows that lack soil. On the lower slopes of Pu'u Kuili and stretching *makai* of the *pu'u* are cinderlands that exhibit some soil development. This type of land is unique along the Kekaha coast (Donham 1987:5).

The coastline of the project area is mostly rocky, with beaches present in the small bays. There are coral and basalt cobble beaches with variable amounts of sand at Awake'e, Kaho'jawa, and Kākapa Bays. A sand beach is found most of the year at Manini'ōwali Bay. Ruby McDonald, a *kama'āina* familiar with the area, remembers a sand beach at Kākapa prior to hurricanes Iniki and Iwa.

kama'āina

Brackish anchialine ponds are found behind three of the beaches. The largest of these is at the south end of Awake'e, where a cluster of about 35 ponds is found in an 'a'ā flow (fig. 2). At Manini'ōwali is a small, brackish pond, partially filled by a bulldozer several years ago. There is a small, wash-basin sized pond at the toe of the 'a'ā flow at Kākapa Bay.

The land behind the coast for 200–500 m is gently sloping through most of the project area with local variations caused by superimposition of lava flows of different age. Relatively steep slopes near the coast are found on the cinderlands around Pu'u Kuili. There is a relatively major escarpment at about the 80 ft. contour through most of the project area, best expressed on *pāhoehoe* flows. Lands *mauka* of the escarpment are more steeply sloped than the coast.

Kekaha is dry. The project area receives less than 20 in. of rain annually, with most of it falling in the winter months. There are no streams in the project area, but springs are found at places along the coast, most notably at Laekikaua, just north of the project area, where the water is potable (Springer 1992:195). The small ponds behind the beaches at Manini'ōwali and Kākapa and the cluster of ponds at the south end of Awake'e are brackish. Similar ponds at Makalawena were used for a variety of purposes and provided cooking and drinking water for the historic-era settlement there (Springer 1992:195).

Vegetation today is dominated by fountain grass and *kiawe*, both introduced in the historic period. Native plants identified in the project area, indicative of former vegetation patterns, include 'ilima, *milo*, *niu*, *nehe*, and *pua kala* (Springer 1987; Pantaleo et al. 1992). Dry forest taxa identified by Gail Murakami from wood charcoal collected at Manini'ōwali, immediately inland of the project area might have grown in the

'ilima
milo
niu
nehe
pua kala



Figure 2. Anchialine ponds at Awake'e Bay. Note *milo* trees at the coastal edge of the ponds.

project area during traditional Hawaiian times as part of a lowland dry shrubland or forest (Dye 2002). Modern vegetation communities that contain many of these plants include *wiliwili* forest (Gagné and Cuddihy 1990:74) and 'a'ali'i lowland shrubland (Gagné and Cuddihy 1990:71).

wiliwili

Background

The goals of this section are to predict the kinds and distributions of historic properties that might still be present in the survey areas and to provide a context for understanding and evaluating the significance of any historic properties that are found. The section begins with a review of previous archaeology in the region. Much of the project area had been surveyed previously at levels somewhat lower than inventory survey, so the focus here is on sites and their distribution in the project area, supplemented by information from survey and data recovery projects in lands *mauka* of the project area. The archaeological review is followed by a brief history of the project area.

§13-276-5(b)

Previous Archaeology

The archaeology of the project areas is relatively well known through walk-through surveys along the immediate coast and later reconnaissance surveys of the coastal portions of all three *ahupua'a* (fig. 3).

§13-276-5(b)(2)

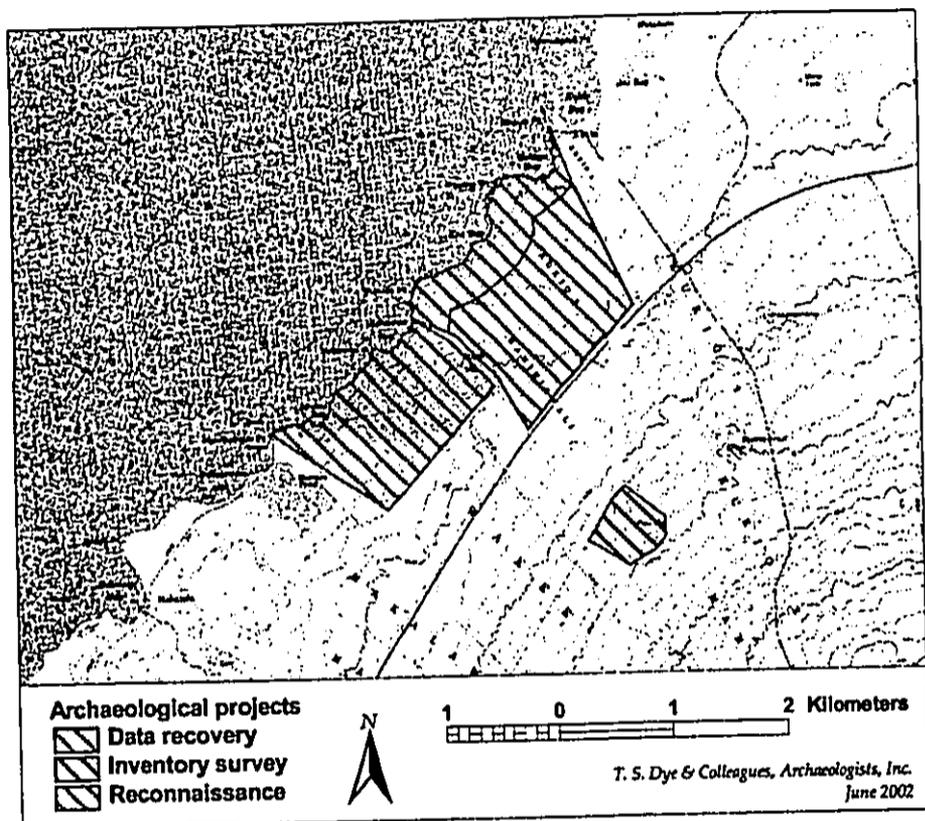


Figure 3. Previous archaeological project locations in Awake'e, Manini'owali, and Kūki'o 2nd ahupua'a. The map does not depict surveys of the coastline carried out prior to the 1980s.

Reinecke cursorily surveyed along the coast in the summer of 1930 finding "alternate hamlets on sandy beaches and waste stretches of lava flow and beach (usually coral)" (Reinecke 1930:1). He describes 15 sites (100-114) in the three ahupua'a, comprising platforms, shelters, house sites, huts, walls, pens, a cave, graves, wells, ahu, a cairn, and papamū. Many of the sites he describes were located on beach sand, others were on pāhoehoe, and a few were on 'a'ā. At Kākapa Bay, where most of the beach is backed by 'a'ā flows, he noted that "close examination of this whole area would disclose many sites and traces of sites of all kinds, especially little caves for shelter and storage" (Reinecke 1930:21).

Cordy identified 12 sites comprising 22 features on the coast of Manini'owali ahupua'a and ten sites comprising 21 features on the coast of Kūki'o 2nd ahupua'a in 1975 as part of "a wide-scale settlement pattern analysis designed to identify and study only permanent housing in a large region" (Cordy 1981:145). His work showed

pāhoehoe

that permanent housing was typically located at the shore and extended no more than 400 m inland (Cordy 1981:148). Feature types described include platforms, enclosures, C-shaped walls, caves, a walled pit, and pavings. Features were interpreted as sleeping houses, canoe houses, men's houses, and special purpose structures, based on a model of form, size, and shape developed out of historical accounts and archaeological data (Cordy 1981:82). All the features investigated by Cordy were built in a single stage.

Eighteen of the sites were classified as commoner households; four single-feature sites were classified as *mua*. Complete surface collections were made at 29 features in 15 sites to gather artifacts for relative dating. All features but one were dated to the prehistoric period based on the presence of traditional Hawaiian artifacts and the absence of historic artifacts. One feature, a high-walled sleeping house enclosure at Kūki'o 2nd *ahupua'a* (Cordy 1981:155), was believed to be occupied into the historic period, based at least partially on the presence of high walls (Cordy 1981:98).

The four small parcels at Manini'ōwali Bay were surveyed by Lloyd Soehren, who, apparently unaware of Cordy's work, found no evidence of permanent habitation but described "a number of features typical of casual, temporary occupation" (Soehren 1982b). He describes several looted caves, three platforms, a terrace, two *ahu*, three trails, a terrace and a wall, and a canoe shed. Soehren (1982a) reports finding "an old Hawaiian foot trail leading to Kua [Manini'ōwali] Bay from *mauka*, probably Huehue" 100 yards *makai* of Queen Ka'ahumanu Highway. The trail wasn't mapped and its path to Manini'ōwali Bay wasn't described. Subsequent survey has followed this trail to Kākapa Bay. No complete trail to Manini'ōwali Bay from *mauka* has been recorded. Soehren's work was followed up by Cordy (1986), who correlated the sites described by Soehren with previous descriptions and assigned state site numbers to them.

The extent of settlement behind the coast in the project area was revealed by Donham (1987), who identified 84 sites comprising 239 features in parcel 3 at Awake'e in 1986. The most common feature types were terraces, platforms, a variety of open-ended enclosures, walled shelters and depressions, modified outcrops, and cleared and levelled areas. Most of the sites were found in the immediate coastal zone; nine of them were interpreted as permanent habitations. A tenth permanent habitation site, tentatively interpreted as either a chiefly residence or ceremonial center, was located 365–400 m inland, on the margin of the 'a'ā flow at the south end of the *ahupua'a*. The presence of a substantial permanent habitation site this far inland was not expected; nor was a chiefly residence or ceremonial center. This site constitutes a deviation from the typical North Kona settlement pattern. Its inland location might be explained by its proximity to a trail that enters Awake'e *ahupua'a* from Makalawena *ahupua'a mauka* of the site, apparently the primary *mauka-makai* trail leading to Awake'e Bay. A second deviation from the expected settlement pattern noted by Donham was the small size of several features interpreted as permanent habitations (Donham 1987:120).

Other trails recorded by Donham include the coastal trail, remnants of which were found at several places, and short segments connecting habitation locations.

Temporary habitation sites in caves and lava blisters, under lava overhangs, and in small shelters and cleared areas were found throughout the project area. Also scattered throughout the project area are several types of features, including soil-filled terraces, modified outcrops, walled depressions, and *pāhoehoe* clearings, tentatively interpreted as agricultural features. The cinderlands of Pu'u Kuili, perhaps the lands along the

coast best able to support agricultural pursuits, were apparently not modified for agriculture.

Shrines were tentatively identified at five sites around Awake'e Bay, the most prominent of which occurs at site T-104 (fig. 4), located at the edge of an 'a'ā flow.



Figure 4. Habitation and shrine site T-104 at Awake'e, panorama looking west. The coral-paved platform is interpreted as a shrine or burial. The scale is marked in 10 cm increments.

Human burials were tentatively identified at six sites.

A reconnaissance survey of the portions of Manini'ōwali and Kūki'o 2nd *ahupua'a makai* of Queen Ka'ahumanu Highway was carried out in 1989 (Ladefoged 1989). It recorded 2,703 features, primarily 'a'ā pits, overhang shelters, and *pāhoehoe* pits, but also including pavements, rock mounds and alignments, enclosures, cairns, trails, a variety of open-ended enclosures, platforms, terraces, cupboards, lava tubes, hearths, midden scatters, an upright stone, and an eroding cultural deposit. Most of the features were assigned to 131 sites, whose boundaries are located on a map showing the coast, *ahupua'a* boundaries, major geologic features, and roads. Sites are primarily located along the coast; site density declines with distance from the coast. This reconnaissance survey was followed up by Sinoto and Pantaleo (1990), who relocated and assessed the significance of the sites recorded by Ladefoged (1989). Site boundaries were refined and new temporary numbers were assigned to the sites. Several sites were redefined and grouped together into large complexes at Kākapa Bay, Manini'ōwali Bay, and Punaloa Point.

Archaeological sites between the project area and Queen Ka'ahumanu Highway in Manini'ōwali and Kūki'o 2nd *ahupua'a* were then inventoried by Pantaleo et al. (1992), who recorded 25 sites comprising 1,305 features. Most of the recorded features, 1,196 or 92% of the total, are *pāhoehoe* pits. These are small-scale excavations in the surface of *pāhoehoe* flows whose functions have long intrigued and baffled archaeologists.

Typical of the dry lands behind the coast in Kekaha, *mauka-makai* trails were the dominant traditional Hawaiian sites recorded in the area. Two trails enter the area from *mauka*. One, site 50-10-18-5337, enters near the middle of the area, swings north toward Pu'u Pāpapa and heads *makai* over the 'a'ā to the traditional Hawaiian settlement at Kākapa Bay. Over most of its length this trail follows smooth *pāhoehoe* flows, where it is mostly visible as a series of shallow, worn areas in the *pāhoehoe* whose dark gray color contrasts with the brown surface of the adjacent lava. The trail crosses short stretches of 'a'ā lava in several places; it is paved with steppingstones

makai

in these places. One short branch of this trail heads toward Manini'ōwali Bay, but is lost as it drops from one *pāhoehoe* flow to an older *pāhoehoe* flow. The inventory survey did not record a *mauka-makai* trail leading to Manini'ōwali Bay, where there is evidence for a substantial traditional Hawaiian settlement.

A second *mauka-makai* trail, site 50-10-18-5351, runs in a nearly straight line down the center of the 'a'ā flow at the southern edge of Manini'ōwali *ahupua'a*. The trail is visible as a relatively level path cleared of boulders and large cobbles. In several areas the trail is built up to keep it level across swales in the 'a'ā. It drops off the 'a'ā flow at Pu'u Kuili, where it is lost in the cinders of the *pu'u*. It is likely that this trail led to the traditional Hawaiian settlement at Kaho'iawa Bay.

pu'u

Fifty-one features showed evidence of temporary habitation in traditional Hawaiian times (Pantaleo et al. 1992:118 ff.). Most of the temporary habitation sites are located in natural features that were modified only slightly for use; 19 in lava tubes, nine in lava overhangs, and two in lava sinks. Twenty-one of the temporary habitation features were composed of surface architecture, which was generally small-scale and rudimentary. These include eight C-shape enclosures, seven outcrops modified to provide level surfaces and some degree of shelter, five enclosures, and one platform. Evidence for habitation was generally scant, limited in most cases to a scatter of marine shells, with occasional pieces of coral or artifacts. Deep or stratified habitation deposits typical of permanently inhabited sites are absent in the area. Three features with relatively rich cultural deposits were interpreted as having seen recurrent use (Pantaleo et al. 1992:127).

Also recorded were a shrine overlooking Manini'ōwali Bay and four burial sites.

No sites were found on the cinder cone, Pu'u Pāpapa, whose sediments appear not to have been used for agriculture.

Data recovery investigations were carried out in 2001 (Dye 2002). The primary substantive objectives of the data recovery project were to date construction and use of selected sites and to investigate the idea that *pāhoehoe* pits were constructed as seabird nests. These objectives were accomplished with excavations at two lava tube shelters and an enclosure used as temporary habitations by traditional Hawaiians while away from their homes in the uplands to fish in the nearshore waters along the coast and catch seabirds.

Fishermen's shelters in the area were first used sometime after A.D. 1331 and before A.D. 1679. Given the dating evidence, it is reasonable to say that they were in use by about A.D. 1550 and were used for about 250 years until they were abandoned in the early 1800s. Fishermen caught, cooked, and ate mostly small reef fish, very many of them between just 5–10 cm long. They collected and ate *pipipi*, *leho*, and sea urchins. They also captured and ate small seabirds, most prominently the Bulwer's petrel, which nests in pits. Pigs and dogs appear to have been absent in the project area. The fishermen carried out some small-scale production of fishhooks and other fishing gear. They also stored water-worn cobble hammerstones in their shelters, but apparently did not use them there. A primary function of the hammerstones appears to have been creation of the *pāhoehoe* pits that are so numerous in the area.

Some of the *pāhoehoe* pits in the area were used as seabird nests. Evidence for this is found in small pieces of pumice that were picked up by the birds at sea and deposited in the pits after chemicals in the digestive tracts of the birds deposited a distinctive

coating of hydrous phosphate on several of them. Use of the pits for seabird nests appears to have been only one of several functions performed by the pits, and there is no evidence that it was a primary function. The fishermen who camped in shelters nearby did not eat more seabirds than their contemporaries in areas without *pāhoehoe* pit nests. The *pāhoehoe* pits were also used on a small scale as quarries for construction materials used most prominently to face a *heiau* at Kākapa Bay. Perhaps they were used as water catchments or sweet potato planters, but there is no direct evidence for either of these functions and only a few of the many *pāhoehoe* pits located near the abundant cinder deposits at Pu'u Pāpapa contain sediment that certainly would have provided a good planting medium. It is also possible that *pāhoehoe* pits fulfilled some religious function, though no direct evidence for this was found.

heiau

Two archaeological inventory surveys *mauka* of Queen Ka'ahumanu Highway have been carried out. Hammatt and Chiogioji (1995) surveyed 53 acres around Pu'u O'o at the site of the present West Hawai'i Veterans' Cemetery. They recorded a trail leading over the *pu'u* north to a scoria abrader quarry and petroglyph. Scoria occurs as a thin crust on a *pāhoehoe* flow. Abraders were shaped in an abrading area at the northwest end of the quarry. Borthwick and Hammatt (1995) surveyed a road corridor and recorded the presence of a trail segment 800–1,000 ft. *mauka* of Queen Ka'ahumanu Highway, and a short wall and "evidence of surface bashing" at a small island of *pāhoehoe* lava surrounded by 'a'ā. The bashing was apparently not related to scoria quarrying; its function wasn't determined.

scoria

History

This section summarizes the history of the project area. It is based on the work of several historians who have searched archival and historical documents and conducted oral history interviews in the region for more than 30 years. They have reviewed:

§13-276-5(b)(1)(B)

- Hawaiian language newspapers;
- Hawaiian Land Commission Award records from the *māhele* of 1848;
- Maps of the region dating to the 1880s and later;
- Boundary Commission testimonies;
- Records in the primary repositories, including:
 - Hawaii State Archives;
 - Survey, Land Management, and Parks Divisions of the Department of Land and Natural Resources;
 - Bureau of Conveyances;
 - Bishop Museum; and
 - Mo'okini Library at University of Hawaii-Hilo; and
- Native Hawaiian accounts authored by J. Ka'elemakule, J. W. H. I. Kihe, and J. Wise.

māhele

They have for many years conducted interviews with dozens of individuals knowledgeable about the lands.

Before the *Māhele*

§13-276-5(b)(1)(A)(i)

kāne
wahine

kahuna

Place names of Manini'ōwali and adjacent lands are personified in a legend of Kekaha (Maguire 1999). The legend is interpreted by Springer as a story about the formation of the land by volcanic action (Springer 1992:205). In the legend a *kāne*, Uluweuweu was betrothed to the *wahine* Manini'ōwali, who was born on the same day. As *kāne* sometimes do, Uluweuweu fell in love with another *wahine*, Kahawaliwali, and no longer wished to marry Manini'ōwali. Both Uluweuweu and Manini'ōwali became ill. A *kahuna*, Kīkōaua, identified the love triangle as the cause of illness and prescribed to Manini'ōwali's parents that they do away with them all. Kīkōaua then invoked his gods, including Pele, to do the deed. Today, the rock formation and bay of Manini'ōwali are separated from the rock formation and bay of Uluweuweu by the rock formation of Kahawaliwali and the lava flow that formed Kīkōaua Point.

Pu'u Kuili is a regional landmark that Hawaiians at sea likened to a bird in flight:

Ina oe i ka moana a huli mai oe e nana ia Kuili, e ike mai ana oe, i ke lele aku me he manu ala ... If you are at sea and turn to look at Kuili, you will see [Kuili] looking as a flying bird ... (Springer 1992:217).

The name Kuili is translated as "memorized temple prayer" (Pukui et al. 1974:120).

Several of the project area place names shown on the U.S.G.S. Makalawena quadrangle are in error, or use modern names in place of their traditional Hawaiian names. Manini'ōwali Bay is labelled Kua Bay; Kaiwikoholā Point is labelled Kawikohale Point (Springer 1987:178); and Kapo'ikai ponds at Awake'e are labelled 'Opae'ula ponds (Springer 1987:175).

An informant told Marion Kelly that Kūki'o was owned by his great-grandfather, Kinolau, at a time Kelly reckons as the late 1790s, before written records were kept. Kinolau and his wife, Ha'ilauwahine, lived and were buried at Kūki'o (Kelly 1971:10).

The *Māhele*

§13-276-5(b)(1)(A)(ii)

Māhele records offer no information on traditional settlement patterns in Awake'e, Manini'ōwali, or Kūki'o 2nd *ahupua'a*. The *ahupua'a* of Awake'e was awarded to Nueku Nāmau'u, a young relative of Mataio Kekūanao'a, who died in 1848 (Maly 1998:14, note 4). The land was Award 10474. The *ahupua'a* became government land in 1850, when Mataio Kekūanao'a surrendered it in lieu of commutation (Donham 1987:161). Manini'ōwali and Kūki'o 2nd both became government lands in the *māhele*. No native tenant claims for *kuleana* in any of the three *ahupua'a* have been located (Maly 1998:14).

After the *Māhele*

§13-276-5(b)(1)(A)(iii)

The seaward portion of Awake'e *ahupua'a* was purchased from the government by Kahaialii in 1856 at 25 cents an acre (Donham 1987:162). Awarded as Grant 2023, this land today constitutes parcel TMK:7-2-04:3.

In 1886, King Kalākaua leased the government land of Kūki'o 2nd and Manini'ōwali *ahupua'a* at an annual rent of \$5.00 a piece (Maly 1998:41).

The lands of the project area appear to have been undeveloped until recently, although nearshore areas of the coast were undoubtedly visited by fishermen over the years. Development in Kekaha was centered outside the project area. Most of the development was well inland of the project area, *mauka* of the government road, where homestead lots were laid out and Hu'ehu'e Ranch was established on about 40,000 acres of land (Maly 1998:31). A village with a school and church was established at Makalawena, south of the project area (Maly 1998:23), and in 1882, a new *lau hala* house belonging to Paapu was recorded at Uluweuweu Bay in Kūki'o 1st *ahupua'a*, north of the project area (Maly 1998:34).

In the early 1980s, a road was graded from Queen Ka'ahumanu Highway to four houselots situated behind Manini'owali Bay (Soehren 1982a, b; Cordy 1986). Portions of the houselots were graded, too, destroying several cave features, portions of a trail, and filling most of the anchialine pond there (Cordy 1986:4). Houses were never built on the lots, but the road opened the bay for public use and today it is regularly used for camping, ocean recreation, and rave parties by a wide segment of the local and tourist communities.

Consultation Process

§13-276-5(g)

Unlike many development projects, consultation with knowledgeable individuals has been a central theme in planning Kekaha Kai State Park. Community involvement in park planning began in 1994. In 1995, a task force of community members representing various organizations and interests convened to guide the first phase of park development (Group 70 International 1998:ES-1). The task force is still active and a non-profit organization is being formed to guide development and use of the park. A further effort to consult with knowledgeable individuals was undertaken by Maly (1998), who interviewed 15 people with first-hand knowledge of park lands between 1985 and 1998. These interviews expand upon, and complement, interviews conducted earlier by Marion Kelly that touched upon the history of Kūki'o (Kelly 1971).

In addition, Kekaha is blessed with a *kama'āina* who grew up listening to the legends of the region and has written about its history (Springer 1992, 1987, 1986).

kama'āina

Settlement Pattern Predictions

§13-276-5(b)(2)(c)

A regional settlement chronology for the Kona district was developed by Cordy et al. (1991). In this chronology, the first permanent settlements were established about A.D. 900 at favorable spots along the coast near ponds and bays. Prior to this, open-air and shelter cave habitation sites were used on a temporary basis by fishermen. The first permanent settlements would have been small and their inhabitants would have traveled regularly up the flanks of Hualālai to farm the well-watered uplands. By A.D. 1200, settlements would have grown to the point that they were each ruled by a local chief (Cordy et al. 1991:575), and by A.D. 1400, permanent settlements had begun

to spread out along the Kekaha coastline, away from the favorable spots initially settled. Cordy believes that small *heiau luakini*, shrines of the ruling chiefs where human sacrifices were offered, were first constructed in Kona during the fifteenth and sixteenth centuries, a political development that culminated with the reign of Līloa ca. A.D. 1580–1600, who unified the island under his rule. According to Cordy, the seventeenth and eighteenth centuries, up until the time of European contact, were a time of rising population and expanding demands on resource production.

The traditional Hawaiian settlement pattern at Kekaha Kai, as at other dry lands along the leeward Hawai'i Island coast, can be divided into three zones:

- (1) the narrow coastal habitation zone associated with the exploitation of marine resources; (2) an open, sloping intermediate zone, with shallow soil and grassy vegetation, and little evidence of human occupation other than the foot trails which linked the coast with the uplands; and (3) extensive, gently-sloping upland zone with substantial surface stone remains of habitation structures and rectangular agricultural field units (Rosendahl 1994:20).

The project area includes the narrow coastal habitation zone and the *makai* portion of the intermediate zones. The survey areas, designed to concentrate on the areas with remains of traditional Hawaiian settlement, fall mostly within the narrow coastal habitation zone, with the exception of the proposed entrance road, which extends into the intermediate zone.

Reconnaissance surveys throughout the northern portion of Kekaha Kai State Park indicate clearly the nature of the traditional Hawaiian settlement pattern. Consistent with the marine orientation of subsistence activities here, traditional Hawaiian sites are clustered around small bays where access to the sea is most convenient. Remains of small villages are found at Awake'e Bay, Kaho'iawa Bay, Manini'ōwali Bay, and Kākapa Bay. Cordy found six *kauhale* at Kākapa Bay, and eight at Manini'ōwali Bay (Cordy 1981:166). Donham (1987) identified nine sites with permanent habitation in Awake'e *ahupua'a*, although she used a different method of identifying permanent habitation sites than Cordy, one that included clusters of structures, none of which was large enough to be classified as permanent habitation in Cordy's scheme. In the north, on the sloping cinderlands of Pu'u Kuili at Kaho'iawa Bay, just south of the boundary with Manini'ōwali *ahupua'a*, is a cluster of three permanent habitation sites. Two other sites are situated behind the beach at the south end of the bay. Three more permanent habitation sites are found from the coast to well inland along the edge of the 'a'ā flow at the south end of Awake'e Bay.

The villages were connected to one another with an *ala kahakai*, or coastal trail, and with inland gardens by a series of trails that lead *mauka* from the coast out of the project area. Trails enter the village at Kākapa Bay at five places: along the coast from north and south; behind the *heiau* and the cluster of *kauhale* north of the *heiau*; and at the pāhoehoe flow that extends toward the bay from Kūki'o 1st *ahupua'a*. There are three recorded entrances to the village at Manini'ōwali Bay, two along the coast from the north and one from the south. The two trails from the north both originate at Kākapa Bay, south of the *heiau*. The lack of a known trail to the bay from inland is conspicuous. There are three possibilities, none of which can be traced on the ground today. The first

heiau luakini

*ala
kahakai*

is that the trail was located where the graded road to Manini'ōwali Bay is located today; a trail at the *makai* end of this alignment is present (Soehren 1982b:2), although survey of the proposed road corridor did not record a trail, but instead recommended that the "old Hawaiian foot trail to Kua Bay from *mauka* should be located and recorded ...". Two possible trails branch off from trail site 50-10-18-5337. One branches off just north of the graded road near Queen Ka'ahumanu Highway, is lost as it presumably cuts through site 50-10-18-5349, and picks up again *makai* of a prominent burial site, 50-10-18-5348. This trail is lost in the broken *pāhoehoe* lava *makai* of the burial site, well before it reaches the bay. A second possibility was pointed out independently by Hannah Kihalani Springer and by Robert Punihaole, *kama'āina* of Kekaha. This trail branches off site 50-10-18-5337 just before it crosses a lava channel that divides the two halves of Pu'u Pāpapa. It is lost in the broken *pāhoehoe* lava *makai* of the *pu'u*, but would likely have followed a path near the edge of the 'a'ā lava flow that forms Papiha Point at the north end of Manini'ōwali Bay. Although there are features in this area typical of those found along trail site 50-10-18-5337, there is no trace of a trail on the *pāhoehoe*. There are three entrances to Kaho'iawa Bay, two along the coast and one across the Pu'u Kuili cinderlands from trail site 50-10-18-5351 on the 'a'ā lava flow at the south edge of Manini'ōwali *ahupua'a*. There are three entrances to Awake'e Bay, two coastal and one along the trail, site T-182 (Donham 1987:106), that enters the *ahupua'a* from Makalawena, about 800 m from the shore.

All of the *mauka-makai* trails are incompletely mapped *mauka* of Queen Ka'ahumanu Highway.

In between the villages, along stretches of rocky coastline where access to the ocean is relatively difficult, are a variety of small-scale traditional Hawaiian features scattered widely over the landscape (Ladefoged 1989; Sinoto and Pantaleo 1990; Donham 1987; Cordy 1981).

These sources provided the information used by Group 70 International to prepare a map of the historic and cultural resources areas within Kekaha Kai State Park, which served as the basis for selecting the survey areas within the project area (fig. 5). This map shows significant areas at the south end of Kākapa Bay, encircling Manini'ōwali Bay, and at the south end of Awake'e Bay. Most of the coast between these areas is designated as moderately sensitive, with scattered sites at the north ends of Awake'e and Kaho'iawa Bays, midway between Punaloa Point and Manini'ōwali Bay, and on the 'a'ā flow at Papiha Point.

Organization of the Report

Report organization reflects as closely as possible the outline contained in the SHPD draft *Rules Governing Standards for Archaeological Inventory Surveys and Reports* (§13-276).

Chapter 3 discusses the methods used to identify, record, locate and define historic sites. It also sets out methods used in the laboratory to draft the 1:50 and 1:100 scale plane table and other maps drawn in the field, to prepare and ¹⁴C date samples of organic matter, to calibrate the ¹⁴C dating results, to classify and describe artifacts, and

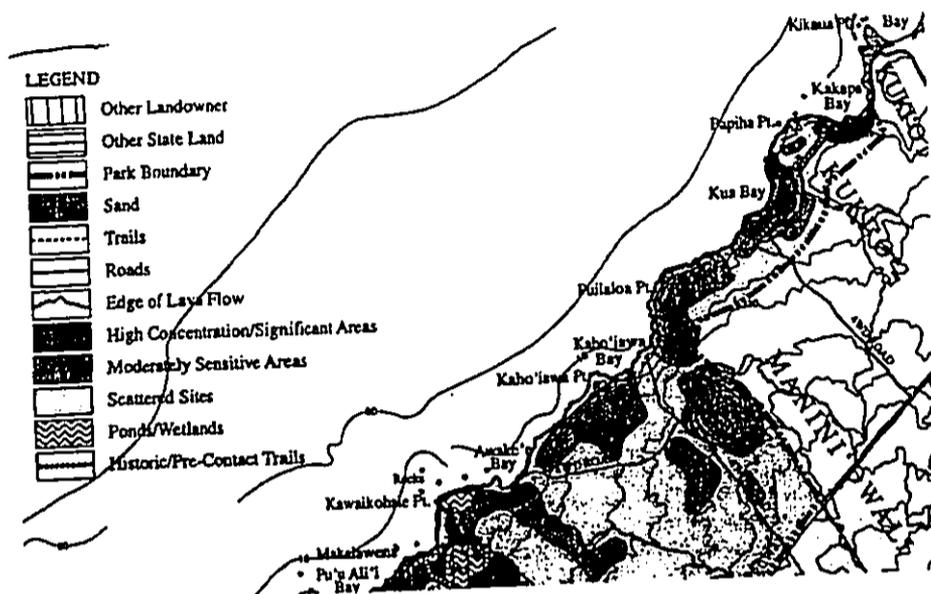


Figure 5. Sensitivity areas for historic and cultural resources. Source: Group 70 International (1998), figure 3-11.

to identify vertebrate and marine invertebrate faunal remains and wood charcoal.¹

The results of the field survey are reported in chapter 4, where the ten sites designated during the survey project are individually described.

Chapter 5 presents the results of ¹⁴C dating and calibration, artifact classification and description, identification of vertebrate and marine invertebrate faunal remains and of wood charcoal. The chapter is supported by several appendices, including a field catalog in appendix B, a list of artifacts in appendix C, a description of categories used in the vertebrate faunal analysis in appendix D, minimal faunal data tables for vertebrate remains in appendices E, a report of wood charcoal identification in appendix F, and graphical displays of individually calibrated ¹⁴C dates in appendix G.

Chapter 6 presents the results of a Bayesian analysis of the duration of occupation and use of four site features, and a statistical comparison of vertebrate faunal remains with collections made at other sites in the *ahupua'a* of the project area and elsewhere on Hawai'i Island.

Chapter 7 summarizes the survey project findings. It re-evaluates ideas on the history of land use in the northern portion of Kekaha Kai State Park and puts these in regional context.

¹There is no requirement in the draft SHPD rule (§13-276) to discuss laboratory methods. The discussion is provided here as a generally accepted scientific practice in the presentation of laboratory results.

The report includes a glossary and a bibliography of works cited in the text.² Glossary entries are indicated in the margins where they first appear in the text.

As an aid to technical review, references to the SHPD draft rules are also called out in marginal notes. They indicate the adjacent text is written to satisfy the designated section of the draft rules.

²The bibliography is a SHPD requirement for data recovery reports (§13-278-4(a)(9)), but not for inventory survey reports. It is included here as part of the standard scholarly apparatus of an archaeological report.

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Chapter 3

Methods

Fieldwork was carried out in two sessions. The first began March 6th, 2002 and ran for eight weeks, ending April 30, 2002. Approximately 145 person-days of effort were expended by a four-person crew consisting of Alan Carpenter, Thomas Dye, MaryAnne Maigret, and Maurice Major. They were joined at various times by volunteers Jeff Putzi, Cindi Hanohano Punihaole, Bobby Camara, Paulette Chang, Aldona Dye, and Veronica Dye. Camara's extensive knowledge of the cultural features around Manini'ōwali Bay was very helpful. The second session lasted three days, June 19–21. Eleven person-days of effort were expended by the four-person crew consisting of Carpenter, T. Dye, Toni Palermo, and Martha Yent. Both crews, although perhaps a bit old to work so long in the hot Kona sun, tried to make up for their advanced ages with persistence and whatever knowledge might come from many years of experience in the field. Carpenter and Palermo lack graduate degrees, but the rest of the crew are all qualified to serve as principal investigator for any archaeological project.

§13-281-3

Back in the office, the work was carried out primarily by the report authors. Major wrote the site descriptions for habitation feature clusters at Kākapa, Manini'ōwali, and Kaho'iawa Bays and at Punaloa Point. These are contained in chapter 4. He also developed and applied criteria for estimating occupational stability (see pg. 32) and put together a database of recorded features that eventually became appendix A. Desilets sorted, cataloged, described, and photographed artifacts. In the course of this work he developed a digital photographic technique for presenting front, back, and cross-section views of an artifact, similar to traditional pen and ink drawings, on a single plate. Maigret drafted final maps from the plane table and tape and compass maps drawn in the field. She also contributed to the design of volume 2. The rest of the work of report writing and production was carried out by T. Dye.

Identify, Locate, and Record Historic Sites

Survey conditions during both fieldwork sessions were ideal. Survey areas at Kākapa and Manini'ōwali Bays and at Punaloa Point were marked in the field by registered surveyor Gregg Scheid and his crew, using survey-grade global positioning system

equipment. They set lath stakes at the boundaries of the large survey areas and marked the centerline of the proposed entrance road corridor with white PVC pipes at approximately 100 ft. intervals. The coastal trail was not marked by the surveyors, but it was followed in the field with relative ease. Its northern section, from Kākapa Bay to Manini'ōwali Bay, is clearly marked across an 'a'ā lava flow. Several intact sections of the trail exist south of Manini'ōwali Bay. Between these sections, the archaeological crew followed a route at about the same elevation and distance from the sea. The survey area boundary at Awake'e Bay, as shown on planning maps, was estimated on the ground by the archaeologists, guided in most areas by the map of archaeological sites prepared by Donham (1987).

Most of the project area contains little or no vegetation and ground surface visibility was generally excellent. Some *kiawe* trees were cleared from the features around Manini'ōwali Bay, and several sites along the coastal trail and in Awake'e were heavily overgrown with *kiawe* and had to be cleared. Survey proceeded without clearing most of the time and survey crews were confident that all features could be seen and were found.

Complete survey coverage was accomplished by a combination of methods, the choice of which was made on the basis of feature density, and the presence or absence of large or complex structures. No attempt was made in the field to work out precise measures of feature density or structure size and complexity; decisions about which method to use were made by applying these terms in a relative fashion, with reference to the then current understanding of the range of feature types present and their distribution over the landscape. In areas with a high density of features or where large or complex structures were present, 1:100 or 1:50 scale plane table maps were drawn. An initial walk-through by one or more archaeologists established how the plane table map(s) would be laid out. Architectural and important natural features were identified and numbered pin flags were set at points, such as feature corners and the ends of walls, that could serve as controls for map drawing. A map was prepared with north arrow and scale bar and the flagged points were placed on it with the aid of a telescopic alidade and stadia rod. The map sheet was then transferred from the plane table to a drawing board that the archaeologist could handle easily in the field. Architectural and natural features were drawn by establishing baselines between flagged pins with a metric tape or stadia rod and taking measurements off the baseline. Large or conspicuous rocks were drawn individually; other rocks were drawn at the appropriate size and general shape. Pavings and other features made up of small rocks were indicated by standard symbols indicating feature and material type. Plane table maps were georeferenced by taking two or more GPS locations at known points and marking these on the map with the GPS file name.

In areas with a low density of relatively small, simple features, a different, less labor-intensive method was used. Survey areas of manageable size were identified using boundary markers, roads, and natural features. A single archaeologist walked sweeps through the area, placing pin flags at identified features. Once the archaeologist was satisfied that all features had been found and marked, their locations were recorded with GPS. Features were measured and described using standard terms for architectural components, such as terrace, platform, wall, alignment, and pit, and modifying these with additional details as needed. Tape and compass maps were made of the larger,

more complex features. Photographs were taken of most features with a digital camera.

Architectural features were described in formal terms, using a limited set of component descriptors, in an approach similar to one worked out at Kawela and Makakupaia Iki *ahupua'a*, Moloka'i in the 1980s (Weisler and Kirch 1985). Given the level of technological development in traditional Hawai'i and the constraints imposed by the limited choice of raw materials available in the environment, the number and variety of architectural components is fairly limited. Lacking mortar or other means save gravity for holding together structures constructed of terrigenous and marine-derived clay, silt, sand, gravel, pebbles, cobbles, and boulders, traditional Hawaiian builders were limited to piling materials in various forms, or removing materials to create the architectural features that archaeologists record today.

Natural features of the environment often attracted development and structures were built in such a way as to augment or otherwise incorporate them. Natural features are simply described, using appropriate natural scientific terms.

Non-architectural features, such as midden scatters, game boards, and the like are generally described as attributes of the architectural features with which they are associated. Sometimes, however, they occur as isolates unassociated with an architectural feature. In these cases they have simply been assigned labels commonly used in the archaeological literature and no attempt has been made to shoehorn them into the classification of architectural features.

The component descriptors of architectural features are classified with a paradigm that includes two dimensions:

- A distinction between additive components, built by piling materials together, and subtractive components, built by removing materials. In practice, construction of a component involves taking materials from one place and putting them somewhere else, and so involves both subtraction and addition. In almost all cases, one or the other activity is clearly primary and the other secondary, but it is useful to recognize that there is scope for some judgment on the part of the archaeologist using the classification and to be alive to the possibility that an archaeologist might mis-attribute primacy.
- The ideal geometric form that, on a human scale, the feature most closely represents: point, line, horizontal plane, vertical plane, cylinder, or polyhedron. The use of zero-, one-, and two-dimensional ideal forms for three-dimensional objects is intended to emphasize the primary dimensions of components and to indicate that the other dimensions are best considered secondary attributes of the components. Points refer to structures important primarily for their locations, and generally too small to have been used as a space by an adult. Lines refer to structures whose length far exceeds the other two dimensions, important for connecting distant points. Horizontal planes refer to structures that form surfaces, generally large enough to have been used by an adult, but whose thickness is only secondarily important. Similarly, vertical planes refer to structures whose length and height are more important than their width. Cylinders refer to structures used to connect distant points, like lines, but whose other two dimensions, roughly equal to one another, are important to their function. Polyhedrons refer to structures large enough to accommodate an adult. Here, it might be noted that

the use of geometric forms is an analytic device that aims to provide some clear points of formal reference in an archaeological landscape in which ideal forms are rarely, if ever, realized and in fact appear not to have been a goal of builders.

The paradigm includes twelve states, none of which appear to be logical impossibilities. These states are labeled with terms in common use among archaeologists in Hawai'i (table 1), although no claim is made that the classification encompasses their range of application in the literature. The terms themselves are trivial; it is the classification that brings structure and utility to the descriptions.

Table 1. Architectural component descriptors

	Additive	Subtractive
Point	mound	pit
Line	stone alignment	path
Horizontal plane	pavement	clearing
Vertical plane	wall	trench
Cylinder	berm	ditch
Polyhedron	foundation	open hole

The components occur either singly or with other components as archaeological features, which have fairly standard definitions in Hawaiian archaeology. Single component features are often subdivided into various types based on particular attributes. Certain combinations of components, and of components with natural features, are very common in the archaeological landscape and these have been given their own labels. The feature types identified during the inventory survey include:

'a'ā pit A pit, generally less than 2 m in diameter and 1 m deep, excavated into 'a'ā clinkers. Most of these pits could have been constructed without the use of tools; cobble and small boulder clinkers in most places could have been removed by hand;

alignment A stone alignment. One course of rocks, laid generally end-to-end to form a line. A variant, the circular alignment, describes fire rings and similar features often found near modern campsites;

berm An elongated mound of rocks, generally low, wide, and lacking any trace of a facing;

boulder A natural feature, modified in some way. In the project area these are most common on 'a'ā flows where they have been worked with cobble and sometimes pebble hammerstones, usually to expose a reddish, subsurface layer of rock. A variant is the boulder *ahu*, where cobbles have been placed on top of a large, usually prominent, boulder;

C-shape enclosure A wall that forms an open-ended enclosure that resembles the letter C in plan;

- cave** A natural feature. In the project area, usually a lava tube that yields evidence of having been used, typically for habitation and/or burial;
- clearing** An area from which cobbles and boulders have been cleared. In the project area, most usually created by removing boulders and cobbles from an area of 'a'ā lava flow to create a level, relatively smooth surface. Some clearings might also have been worked with a cobble hammerstone to reduce the size of larger clasts and make them smoother;
- clearing enclosure** A clearing in an area of large stones where stones peripheral to the clearing rise to a height typical of stone walls;
- depression** This term is used in two senses. It describes natural features of the topography that either appear to have been used in some way, or to have been deliberately incorporated into the distribution of architectural features. It also refers to shallow basins created by bashing the surface of *pāhoehoe* lava. The sense in which it is used should be clear from the context;
- enclosed shelter** A multi-component feature generally consisting of a natural shelter such as a lava overhang fronted by a flat area much larger than the shelter and at least partially enclosed by a wall;
- enclosure** A wall or series of walls laid out in such a way as to distinguish inside from outside. Generally, enclosures have a roughly rectangular plan and are either open-ended or completely closed;
- mound** A mound. In the project area, these are usually simple, stacked mounds, whose diameter is roughly equal to height. Similar features are often described by the terms *ahu* or *cairn*;
- open hole** The single example in the survey area is excavated into 'a'ā lava and is as large as a typical habitation feature;
- overhang shelter** A multi-component feature generally consisting of a natural shelter, such as a lava overhang or boulder, under which a small clearing or open hole has been made, the outer edge of which might or might not be marked by an alignment or low wall. On 'a'ā lava flows the alignment or low wall, if present, was usually formed with material removed from the clearing;
- pāhoehoe pit** A pit formed by breaking through a crust of *pāhoehoe* lava to expose a generally shallow cavity;
- path** These are expressed differently through the project area depending upon substrate. On *pāhoehoe*, paths are worn areas generally indicated by a darker color and very slight indentation. On 'a'ā, they are generally indicated by consistently smaller stones than the immediately surrounding landscape;
- pavement** Pavements take on a wide variety of forms in the project area depending upon substrate, local topography, and the material(s) used for paving;

platform A foundation raised on all sides above the ground, usually with a flat, horizontal surface;

platform enclosure A platform that supports a walled enclosure;

terrace A foundation flush with or below the natural land surface on one or two adjacent sides;

terrace enclosure A terrace that supports a walled enclosure;

trail A single- or multi-component feature consisting of one or more alignment or path, with or without platforms that act as causeways; and

wall A wall that, by its plan, doesn't unambiguously distinguish inside from outside.

Attributes of features include the usual metrical data, the materials with which they were constructed specified by type and form, and the various portable items that were discarded around them, such as midden and lithic scatters and *'alā* cobbles. These portable items are sometimes found by themselves, isolated from features, and in these cases, they have been treated as features and appear on the maps of feature distributions.

Many of the features that were mapped or otherwise described are small and informally constructed. Examples within a given formal type generally exhibit a fairly wide range of variability. This has led some investigators to propose typologies that subdivide the range of formal variability. An example of this type of exercise is a typology of *'a'ā* pits recorded at Kanikū, South Kohala (Hammatt et al. 2001:31 ff.). *'A'ā* pits are one of the most numerous feature types in the Kanikū project area. Five types are defined based on cross-section and treatment of the pit walls and base. The simplest, type I, consists of an excavation into loose boulders and cobbles with no treatment of the pit walls and base. Type II is a simple excavation in which *'a'ā* cobbles were stacked to form walls within or around the pit. Type III pits were modified to include a partial ceiling or overhang, constructed by anchoring an *'a'ā* slab to partially cover the pit opening. Type IV pits were placed under natural *'a'ā* overhangs. Type V pits have ceilings that completely cover the pit. Application of the typology to the pits at Kanikū failed to yield any interpretable results, however, as the authors note "no clear association of form with size, depth, or contents" (Hammatt et al. 2001:133). Spatial analysis of the pit types at Kanikū was also fruitless. In the absence of demonstrated utility, typologies of the small, informally constructed features were avoided in favor of brief notes on attributes of the features where these were warranted in the opinion of the experienced, qualified field archaeologist.

The typology of feature types and their components is a means to study the spatial qualities of the traditional Hawaiian cultural landscape. There are two main advantages of the component approach. Identification of a component based on an ideal geometric form is a statement by the recording archaeologist about the relative importance of an archaeological feature's attributes. For example, features identified as linear components, such as trails, are primarily important as connectors of distant points. Their role in settlement pattern analyses will be based primarily on this characteristic, whether the analytic approach centers on notions of centrality and connectedness drawn from

graph theory (Hage and Harary 1983), on networks (Haggett et al. 1977), or on communication and the constraints it places on the growth of settlements (Fletcher 1995). Secondary attributes might be important in particular analyses. In the example of trails, the type of the trail might be important to establish its age (Apple 1965), or its width might be important as an index to capacity, a variable in several types of network problems.

The second advantage of the component approach is that it encourages analytic descriptions of multi-component features that specify the relations among components. During the Empirical Survey Period of Hawaiian archaeology, 1920–1950, relations among architectural components was a primary research topic, the goal of which was to provide chronology for the origins, migrations, and external contacts of traditional Hawaiians (Dye 1989:8). With the advent of ^{14}C dating in the 1950s, and its development in subsequent decades as the primary means of establishing chronologies, interest in the relations among architectural components has waned and today is demonstrated primarily in the investigation of large structures such as *heiau* (e.g. Ladd 1973; Kolb 1991). In fact, despite much variation, modern plan maps of smaller sites attempt to represent the site as it looks, with little or no analysis or interpretation. This approach, often seen as “scientific” in distinction to the interpretive map styles produced by earlier archaeologists, can go too far, however, by focusing exclusively on literal detail and ignoring analytic detail. This issue was not particularly important for the present project because most architectural features are relatively simple and because literal detail in the maps was important for site preservation and management. However, future advances in site description and mapping will incorporate analytic detail and work up a standard set of symbols for graphical display.

Defining Historic Sites

Definition of feature types and their components makes possible investigation of how features aggregate into larger spatial units that might have played a functional role in traditional Hawaiian society. This is an aspect of archaeological practice in Hawai‘i, especially in work carried out for historic preservation review, that is relatively underdeveloped and neglected. One indication of this neglect is that the term “site” is not defined in the SHPD draft rule, nor is it routinely defined by archaeologists in the state who apply the term in a variety of ways. Although some have advocated abandoning use of the term (Weisler and Kirch 1985), we believe that this would accomplish little. Instead, we have chosen, where possible given the limits imposed by survey area boundaries, to define sites explicitly at a scale intended to represent entities likely to have had salience in traditional Hawai‘i: villages, such as might have been called *kaiāulu* by their inhabitants, and the trails that linked villages, which were recorded with the features that were invariably found beside them. Owing to the constraints of survey area boundaries, especially along the proposed road corridors, some features were recorded as isolates, unassociated with features outside the corridors. In these cases we have assigned site numbers to arbitrarily clustered groups of features that might have lacked functional relationships in the past.

Within villages, we have attempted to define *kauhale*, each of which likely housed

site

kaiāulu

kauhale

an extended family group whose size and composition fluctuated with the seasonality of crop growth in the uplands and other factors. We recognize that the term *kauhale* referred to a wide variety of living arrangements in old Hawai'i and that these would have resulted in a similarly wide variety of archaeological feature clusters. Accordingly, *kauhale* were identified by searching along the coast for spatially bounded, recurring groups of feature types, at scales lower than that of the site, exhibiting evidence of a habitation deposit. *Kauhale* were separated from one another by at least a 10 m buffer where few, if any, features are found, and each *kauhale* has unobstructed access to the beach or coast. We believe this approach, based primarily on the distribution of features, is essential if variability in the size and composition of functional feature types among *kauhale* in different parts of Hawai'i is to be investigated productively.

Although our focus has not been on the identification of permanent housing versus temporary habitations and short-term camps, we have drawn on the model developed and refined by Cordy, which was based partially on architectural remains in the project area (Cordy 1981; Cordy et al. 1991), in our consideration of occupational stability evidenced by sites and features. The Cordy model distinguishes between the two types of site based primarily on level of construction effort, stratigraphic indications of periods of abandonment and reuse, variability in feature types, and geographic context.¹ Permanent housing exhibits relatively great construction effort on relatively large and substantial structures, which lack evidence for periods of abandonment and reuse, and which are associated with smaller structures along the coast. Temporary habitations and short-term camps exhibit relatively little construction effort on relatively small and insubstantial structures that yield evidence for periods of abandonment and reuse and which are found isolated or in clusters with similar features along trails and in widespread locations from the coast to the uplands. This portion of the model, formulated almost entirely in relative terms, provides a useful means of distinguishing between sites used intensively and those whose use was more expedient and brief. Our *kauhale* are all examples of permanent housing, using these criteria.

The portion of the model that we have not found useful is the specification of size ranges for the two types of sites, with permanent housing larger than about 16–19 m² and temporary habitations and short-term camps smaller than 16 m². This is probably the most controversial part of the model, and it is the only part that is not set out in relative terms. It was criticized by Green, who noted that

functionally equivalent structures vary in size from one community to another. There is no magic figure uniformly applicable throughout a given Polynesian society (Green 1980:42).

Cordy accepts this regional variability (Cordy et al. 1991:530) and has reanalyzed structure area data from Kaloko with this in mind (Cordy et al. 1991:535). We believe that the problems with the size distinction run fairly deep, however, and that new methods are needed to investigate the size distribution of archaeological features.

¹Cordy includes site form as a distinguishing characteristic, but all of the listed forms of permanent housing are also present in temporary habitations and short-term camps. The formal types cited as restricted to temporary habitations and short-term camps—C-shape and L-shape enclosures and caves—all have examples that are reasonably, or arguably, interpreted as permanent habitations (Cordy et al. 1991:530 ff.). Thus, site form is not a diagnostic attribute.

We develop these below, following the basic plan set out by Cordy (1981), so the approaches can be plainly distinguished.

The evidential basis for the size distinction was established initially from descriptions of traditional Hawaiian life carefully chosen to eliminate the pervasive effects of Western contact on Hawaiian culture. The primary basis for the distinction is a quote from David Samwell, surgeon on Cook's voyage and a keen observer of Hawaiian culture. Describing the villages at Kealakekua, Hawai'i Island, Samwell wrote that

[t]heir Houses in general are but small, being not above 6 or 7 yards long and ab^t 4 broad, some few are 12 or 15 in length and 7 or 8 in breadth and they may be about as high as they are long (Samwell 1967:1176).

Cordy makes this quote serve a double purpose. Samwell's measure of the small houses is used to establish a lower limit of 19 m² for the size of permanent housing (Cordy 1981:59), this being the metric equivalent of a house 6 yards long and about 4 yards broad. This use of the measure is problematic because Samwell does not indicate that he was reporting a lower limit on house size. Instead, his use of the phrase "being not above" clearly indicates that the measure was intended as an upper limit on the size of small houses. Cordy then uses Samwell's measures of small and large houses, along with similar dimensions that Cook reports, to distinguish sleeping houses from "men's houses, canoe houses, or possibly house temples" (Cordy 1981:77). Sleeping houses are described by Cordy as 20–24 m². This range appears to be drawn from the range of values Samwell reported for the upper limit of house sizes of about six or seven yards long; a house seven yards long and 4 yards broad would have an area of about 24 m². However, Samwell is clearly not specifying a size range for a class of houses here, but is instead indicating what he believed to be the uncertainty of his estimate.

It is worth noting that the lower limit to house size is not mentioned by Samwell. Both he and Cook appear to have believed that Hawaiians lived in a range of small dwellings. While on Kaua'i, Cook referred to the smallest houses as "little huts" (Beaglehole 1967:283), without giving their dimensions. At Kealakekua, Samwell observed that

[t]he ground round the Bay on which these Towns are built is all covered with Lava, or rather is entirely composed of rocks of solid Lava, it in most places very uneven, lying in large fragments confusedly thrown together having the Appearance of the Ruins of an old Castle; here & there it is thrown together so as to form small Dens² under ground which some of the Indians use for Houses (Samwell 1967:1176).

We can find nothing here that indicates to us that permanent habitations in villages were generally larger than 19 m². Indeed, the fact that villages included houses that might be described as little huts or as small underground dens, suggests to us that even in coastal villages, where the bulk of permanent habitation was found, permanent habitations took on a wide variety of sizes and forms and were not restricted to structures greater than 19 m².

²One meaning of the word "Den" at the time Samwell wrote was "a place hollowed out of the ground, a cavern" (Murray et al. 1971).

The categories established in this way were then modified using a variety of archaeological data taken primarily from the leeward coast of Hawai'i Island. Cordy plots the floor areas of structures as bar plots with bin widths of one meter and asserts that they yield a bimodal distribution, which fits the model of small sleeping houses and larger men's houses, canoe houses, and house temples. We cannot discern bi-modality in Cordy's plots, however, and believe that the bi-modality he found is likely an artifact of the method he used to plot the floor area data. Statisticians have for some time been aware that bar plots of frequency data change their shape when either bin size or bin boundaries are changed. Bin sizes that are too small yield an uneven plot whose main trends are difficult to discern. *Bin sizes that are too large can obscure potentially important features of the distribution.* To overcome these potential problems, statisticians have developed a variety of density estimators which strike a balance, isolating the main trend of the distribution without sacrificing too much internal detail. When the floor area data presented by Cordy are plotted using a kernel density estimator (fig. 6), it is clear that the distributions are not bimodal in the way described by Cordy. Each of the four floor area samples yields a density distribution heavily weighted toward small floors, with a long straggling tail of larger floors. The bulk of the structures in all of the samples have floor areas less than 40 m²; the distributions at larger floor sizes all flatten out beyond this point. There are some fairly pronounced differences in the shapes of the distributions, however. At 'Anaho'omalū, the floors tend to be very small, less than 10 m², and at Lapakahi and Kaloko, most structures are smaller than 35 m². At Hālawā, structures with floor areas less than 19 m² are absent.

The density distributions, especially for Kaloko, Lapakahi, and Hālawā, portray graphically the situation described by Samwell at Kealakekua. He described houses as being not above about 24 m². This is somewhat smaller than the breaks observed in the density distributions at 35–40 m², a disjunction that might be explained by the fact that many traditional Hawaiian houses were somewhat smaller than the foundations upon which, or the enclosures within which, they were built. This shows clearly in a number of drawings made by William W. Ellis, artist on Cook's voyage (e.g. fig. 7). Thus, the archaeological remains of a house about 24 m², might be expected to be somewhat larger. If, for instance, the foundation extended beyond the walls of the house only 50 cm, then the foundation would measure 35 m², a figure that fits neatly with the density distributions (fig. 6).

It is interesting that the relatively substantial leeward settlements at Kaloko and Lapakahi provide the best fits for Samwell's description of traditional Hawaiian houses. Samwell's observations of traditional Hawai'i were confined primarily to the lee sides of the islands, where Cook found protected anchorage. The distributions from Hālawā, a windward valley, and 'Anaho'omalū, a settlement in the ecologically marginal zone near the boundary of Kona and Kohala districts, depart from this model in ways that might be predicted by the productivity of their environments. They indicate the potential utility of the method in investigating regional differences in traditional Hawaiian settlement patterns.

The approach we have developed employs instead a variety of occupational stability attributes, which, when found, indicate relatively permanent habitation. It is our belief that the archaeological problem of assigning particular functions to individual features requires excavation, often large-scale, and comparative analysis of the

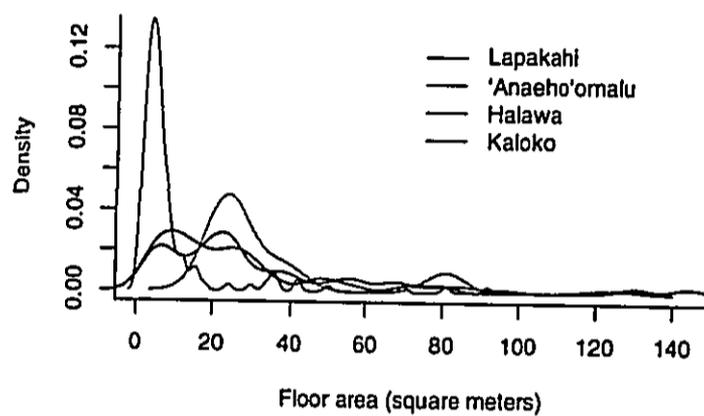


Figure 6. Density plot of floor areas in four Hawaiian settlements. Data from Cordy (1981). The plots were made with a kernel density estimator, using a bandwidth, b , determined with an unbiased cross-validation estimate (Venables and Ripley 1994:139) based on the data themselves. The values of b used for the figure are: Lapakahi, 16.2; 'Anaeho'omalu, 4.0; Kaloko, 15.7; and Hālawā, 20.6.

excavated cultural materials, an approach attempted but not completed for Kawela, Moloka'i (Weisler and Kirch 1985). In the absence of large-scale excavations, the occupational stability indicators use information from surface features to infer relative permanence of a settlement and so are suited for use in the context of an inventory survey, where excavations are generally limited in extent. The following list of attributes was used to infer occupational stability at Kekaha Kai.

storage features The presence of cupboards within features, or of small overhang features or partially-covered pits peripheral to habitation features indicate prolonged use. These types of features are not expected at structures constructed for short-term use;

disposal features Features for the disposal of food remains and other occupational debris counter-indicate temporary use structures, whose short-term use does not require regularization in the disposal of wastes;

burials Burials, in a sense the ultimate permanent habitation features, are found most commonly near residential structures, in a pattern widespread in Hawai'i and elsewhere in Polynesia;

public features Cleared courtyards, *lānai*, and large, special-purpose structures are features of settlements at which the full range of social activity has been planned



Figure 7. "A view of Karaka-cooah Bay, in the Island of O'whyee," by William Ellis. Note the platform extending beyond the walls of the house in the left foreground.

for and developed. In contrast, temporary habitation sites are built to accommodate a limited range of social activity generally associated with a specific task, such as gardening or fishing;

physical barriers Permanent settlements have many features that serve to limit the potential for interaction among inhabitants (Fletcher 1995). Chief among these are the walls of houses, which separate private family from public spaces, but also present are a variety of landscape features that separate activity areas from one another. Limitations on interaction serve to relieve stresses that build in communities where people live close to one another;

numerous component features Permanent habitations generally contain a variety of different-sized structures, whereas temporary habitations contain either isolated, small structures, or a cluster of similar features;

trail network Permanent settlements contain demarcated paths that regulate the flow of people from one place to another. Temporary habitations might often be located next to trails, especially major trails that run either along the coast or *mauka-makai*, but they lack demarcated paths connecting features with one another;

surfaces worn from use Evidence of surfaces worn with the bare feet or leaf sandals typical of traditional Hawai'i are a strong indicator of use over a long duration. In the project area, these take on different forms depending on the substrate. Worn *pāhoehoe* surfaces generally show as dark areas on the brown lava, while worn

'a'ā surfaces are distinguished by the relative uniformity of gravel and pebble-sized rocks in a near-level area that lacks cobbles and boulders;

rectilinearity or redundancy Rectilinear structures are suited for permanent habitations because they lend themselves to additions, which can readily make use of an existing straight wall to form one side of a new rectilinear structure. They can also be divided into rooms by the addition of straight interior walls, creating redundant spaces within the same structure. These qualities offset the higher construction costs for rectilinear structures, which require relatively long exterior walls for the area they enclose. *These benefits are absent in temporary habitations, where more expedient construction generally results in rounded structural plans; and*

rebuilding or additions Evidence of multiple phases of construction, either through modification of an existing structure or the addition of architectural elements, is *prima facie* evidence for at least recurrent habitation.

Excavations

Excavations were carried out at eight features, using a variety of methods, each suited to a particular circumstance.

At two surface architectural features with evidence for a cultural deposit, a regular unit was excavated with trowel and whisk broom, following standard archaeological practice. Excavation was by natural layers in both cases; cultural layers were relatively thin and could not be divided into temporally discrete arbitrary levels. All excavated material was passed through 0.125 in. mesh screen to facilitate collection of cultural materials, which were placed in ziploc bags labeled with a field catalog number and other provenience information as necessary. Stratigraphic profiles of both units were drawn in the field using a level line for datum.

Small, informal pits were excavated into the corners of two stone-lined hearths with a trowel. Material removed from the hearths was bagged in the field as a total unit. The object of these excavations was to collect charcoal for identification and dating. The species composition of charcoal from fire-pits is often a good indicator of the age of the material; traditional Hawaiian features yield charcoal from native and Polynesian-introduced taxa that are not present in the modern environment. Charcoal recovered in this way provides a date for the use of the feature. Both of these small excavations yielded homogeneous materials and no stratigraphic profiles were drawn.

An erosion scarp in a dune deposit at Manini'ōwali Bay was faced with a trowel to expose buried cultural layers. The scarp provided one of only a few opportunities to expose stratigraphy, given the generally thin deposits in the project area. The exposed stratigraphic section was photographed and a profile drawing was made by tracing the photograph. Wood charcoal for identification and dating was collected by digging a small amount of material out of the exposed face and collecting it as a total unit in a ziploc bag labeled with a field catalog number and other pertinent provenience information.

total unit

scarp

Looters' back-dirt piles at three cave sites were excavated opportunistically. Cave sites contain by far the greatest concentrations of cultural material in the project area. Without exception, caves with cultural materials have been extensively looted; the material in most caves has been completely excavated. Looters were interested primarily in the larger, well-preserved artifacts and routinely discarded small or broken artifacts, and floral and faunal remains. These are found in piles within and outside the caves. The piles were investigated preliminarily to identify those with the best preserved materials. These were then partially excavated and the excavated material was put through 0.125 in. mesh screen to facilitate the collection of cultural material. Artifacts, floral remains, and vertebrate faunal remains were collected; marine invertebrate faunal remains were not collected. Observation of the marine invertebrates in the field indicated that the species represented in the cave and their relative proportions are similar to other sites along this coast, including sites in the project area. Because there are no outstanding research issues concerning marine invertebrate faunal remains, effort was directed instead to the vertebrate remains. Large collections of vertebrate faunal remains were made in this way in a relatively short time.

The material collected can only be provenienced to the cave feature, and nothing can be said about the spatial or stratigraphic distribution of the materials. This is probably less important than it first seems. Most of the cave sites along this coast have a simple stratigraphy with a single cultural layer that is not practically divisible into units of varying ages. The chronologic information yielded by the collections is thus probably not much inferior to what might have been collected if the caves were not looted. Although some larger caves along this section of the Kona coast do yield evidence for activity areas, including one from the project area Hammatt and Folk (1980); Barr et al. (1993); Donham (1987), smaller caves generally do not. Thus, the primary negative effect of the looters' efforts might have been loss of larger, well-preserved artifacts. Other sources of information were probably much less affected. Floral and faunal data from caves along the Kona coast are rarely, if ever, analyzed at a level of detail finer than the cave itself and thus should be directly comparable to the collections made from the looted caves in the project area.

A primary goal of the excavations was to recover materials with which to date construction and use of the features. This is a common goal of archaeological excavation, but a review of dating results from archaeological investigations in and near the project area Goodfellow and Head (1995); Goodfellow et al. (1992); Sullivan et al. (1996); Walker and Rosendahl (1988); Head et al. (1995, 1996); Pantaleo et al. (1992); Cordy (1981) indicates that this goal is rarely, if ever, achieved. The reasons for this failure are several and varied:

- poor control over sample provenience, in particular dating amalgams of charred material originally dispersed throughout a stratigraphic layer or collected from the sieve;
- failure to specify the archaeological event being dated and to distinguish it from the dated event (Dean 1978; Taylor 1987);
- use of the now-discredited volcanic glass dating technique (Olson 1983);

- inadequate characterization of ^{14}C dated material and failure to control for the “old wood” problem (Dye 2000), whose effects are documented for Hawai'i (Dye and Carson 2001); and
- calibration without benefit of prior chronological information, which can be incorporated within a Bayesian statistical framework (Buck et al. 1996).

The problems of dating feature construction and use are conceptually distinct and require different approaches. For example, a reasonable strategy for dating construction of an archaeological feature is to establish a *terminus post quem* by dating material stratigraphically inferior to the feature's base. Materials at and stratigraphically below the feature's base can be confidently identified as older than the construction date of the feature; it can be stated with relative certainty that these materials were not deposited after the feature was constructed. Dating feature use is simpler, though care must be taken to date materials that derive from a context that can be reliably associated with an event that took place at the feature, or are themselves reliably associated with such an event.

A second goal of the excavations was to collect faunal remains in sufficient numbers to compare with collections made immediately *mauka* of the project area (Dye 2002). Analysis of these collections using multivariate statistical methods indicated that most faunal collections from archaeological sites along the Kona coast are too small for detailed comparison at the taxon level. Instead, the data were aggregated into the taxonomic classes Osteichthyes (fish), Aves (birds), Mammalia (pigs and dogs) and Polynesian rats to achieve archaeologically interpretable statistical results. It was anticipated that analysis of large collections from the project area would shed light on the relationship between sample size and diversity (Grayson 1984) for Kona coast faunal collections, and that comparison of the identified faunal specimens with an inventory of nearshore fishes (Brock and Brock 1974) would yield information on the influences of natural and cultural factors affecting the composition of vertebrate faunal collections from archaeological sites along the Kona coast.

Laboratory Methods

Archaeological materials collected from the 0.125-inch screen were sorted in the field to segregate artifacts, vertebrate faunal remains, marine invertebrate faunal remains, and macrobotanical remains. Vertebrate faunal remains from six proveniences, including bone artifacts, were sent to Alan C. Ziegler, Zoological Consultant for identification. A small number of fish remains from TU-1 at site 50-10-18-23356, feature 104 were not sent to Ziegler, but were identified instead by T. Dye. Artifacts were described, photographed, measured, and weighed in the *T. S. Dye & Colleagues, Archaeologists, Inc.* laboratory by Michael E. Desilets and Dye. Marine invertebrate faunal remains were sorted, identified, and weighed by Toni Palermo and Alan Carpenter at the Division of State Parks.

Six lots of vertebrate faunal remains were identified to the lowest taxonomic level possible by Ziegler. Ziegler identified and separated the material into various faunal categories (appendix D), and placed the remains of each category in an individual

stapled plastic bag along with a yellow paper slip giving the name of the particular category represented and, often, a pertinent comment on the material. The specimens in each of the bags were counted and weighed to the nearest 0.1 g by Toni Palermo and Alan Carpenter at the Division of State Parks, and this information was entered into a relational database for analysis and presentation.

Five charcoal samples were examined for taxa identification by Gail Murakami of the Wood Identification Laboratory at International Archaeological Research Institute, Inc. The freshly fractured transverse and tangential facets of each charcoal piece were viewed under magnification with a dissecting microscope. Taxa identifications were made by comparing the anatomical characteristics seen during examination against those of known woods in the Pacific Islands Wood Collection at the Department of Botany, University of Hawai'i, and published descriptions.

Thirteen samples of carbonized, short-lived materials were submitted to Beta Analytic Inc. of Miami, Florida for ^{14}C dating using an accelerator mass spectrometer (AMS). Four of the dated samples of short-lived materials were identified by Gail Murakami as native shrubs. Nine samples were identified by T. Dye as *kukui* nutshells.

Sediments were described in the *T. S. Dye & Colleagues, Archaeologists, Inc.* laboratory. Color of the dry sediments was determined with reference to a Munsell soil color chart. Texture was determined by wetting a small amount of sediment and working it between the thumb and forefinger.

Maps were drafted by MaryAnne Maigret at Kona Cartographics, and by Seamus Puette at *T. S. Dye & Colleagues, Archaeologists, Inc.*. Maigret developed a standard set of symbols, which were used in most of the maps (fig. 8). In some of the smaller maps drafted by Puette, slightly different symbols for pavements and waterworn coral cobbles were used.

Comparative Faunal Analysis

Vertebrate faunal collections from archaeological sites in coastal Kona were compared using a multivariate statistical methods known as correspondence analysis. Correspondence analysis is described for archaeologists by Shennan (1988) and Baxter (1994).

Correspondence analysis is an ordination method, whose aim is

to compress the information contained in a large number of variables into a much smaller number of new variables, ideally only two or three, while losing as little [information] as possible (Shennan 1988:266–267).

Commonly, two or three new variables are plotted on a scattergram, which, it is hoped, will reveal groups as areas of relatively high point density. A special form of scattergram, called a biplot, projects both the rows and the columns of a data table into the same low-dimensional space. In the case of the comparative faunal analyses reported below, this reveals associations between sites and categories of faunal remains, so that sites with relatively high proportions of seabird bones, for instance, plot together near the seabird bone category and away from other sites with low proportions of seabird bones.

Explanation of Map Symbols

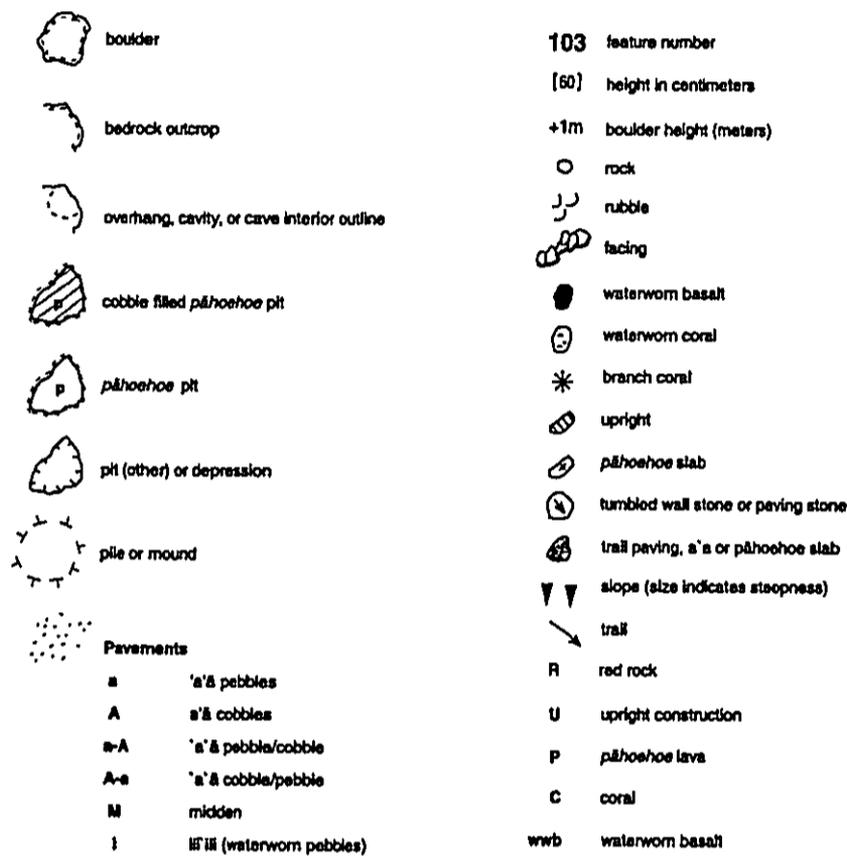


Figure 8. Symbols used in the maps. Note that pavements are expressed with cross-hatching and waterworn coral with a fish-scale pattern in some of the smaller maps.

The mathematics of correspondence analysis are too complex to describe here. Shennan (1988) provides a lucid geometric description of ordination methods and more details can be found in Baxter (1994). A thorough discussion of correspondence analysis is presented by Greenacre (1993).

Correspondence analysis is commonly applied to archaeological data. Orton (1996) uses correspondence analysis to search for patterns in the proportion of different species and different body parts represented at selected Roman sites in London. He distinguishes between casualty animal disposal sites, butcheries, and consumption sites based on a visual analysis of correspondence analysis plots. Holm-Olsen (1981) uses correspondence analysis to distinguish two groups of vertebrate faunal collections from

a deeply stratified Norwegian farm mound. A shift from faunal collections consisting of cattle, sheep/goat, pig, seal, and grouse in the older layers to collections dominated by fish and auk birds in the younger layers is explained as relating to the growth and commercialization of fisheries in the fourteenth and fifteenth centuries. Avery and Underhill (1986) use correspondence analysis of archaeological collections and modern monthly surveys of beached seabirds to investigate seasonality in the archaeological remains. They conclude that late Holocene coastal foragers at the Western Cape, South Africa were exploiting seabirds seasonally from October to January. Moreno-Garcia et al. (1996) adapt a method designed for the quantification of potsherd collections for use on vertebrate faunal assemblages. They illustrate the method with an analysis of changes in faunal deposition at sites in London from Roman through post-medieval times using correspondence analysis, charting among other things a steady decline in deposition of cattle bones accompanied by an increase in sheep, with horses confined primarily to the Roman period and rabbits to post-medieval times.

The analysis reported below compares collections from sites, rather than some smaller unit of analysis such as provenience, primarily to keep sample sizes relatively large, but also because collections made at the looted caves could not be provenienced more finely. Vertebrate faunal collections from archaeological investigations in elsewhere Kona are mostly small, so that division into layers or other sub-site units runs the risk of introducing considerable variability due to small sample size.

Dating

A primary objective of archaeological data recovery is to identify, collect, and analyze materials that can be used to establish chronologies of site construction and use. Site chronologies established in this way are used to test and add detail to regional settlement chronologies, such as the one developed for Kona district by Cordy et al. (1991) (see pg. 17). Chronology building has been a key component of archaeological data recovery plans for properties near the project area (Jensen et al. 1989; Jensen and Rosendahl 1988; Williams and Nees 1993), which typically propose to establish the age and duration of occupation of selected sites. A review of dating results from archaeological investigations near the project area (Goodfellow and Head 1995; Goodfellow et al. 1992; Sullivan et al. 1996; Walker and Rosendahl 1988; Head et al. 1995, 1996) indicates that this goal is rarely, if ever, achieved. The reasons for this failure are several and varied:

- poor control over sample provenience, in particular dating amalgams of charred material originally dispersed throughout a stratigraphic layer or collected from the sieve;
- failure to specify the archaeological event being dated and to distinguish it from the dated event (Dean 1978; Taylor 1987);
- use of the now-discredited volcanic glass dating technique (Olson 1983);
- inadequate characterization of ^{14}C dated material and failure to control for the

"old wood" problem (Dye 2000), whose effects are documented for Hawai'i (Dye and Carson 2002); and

- calibration without benefit of prior chronological information, which can be incorporated within a Bayesian statistical framework (Buck et al. 1996).

It was expected that collection of suitable dating materials to address the issue of site construction would be difficult in the project area, primarily due to the lack of soil development on the *pāhoehoe* and 'a'ā lava flows in the project area and the paucity of features on the mostly seasonal sandy beaches.

The issue of dating site use is more tractable. Excavations in lava tubes along the Kona coast typically yield a range of potentially datable materials that can be directly associated with archaeological events, including marine shells, *kukui* nutshells, and bird bones. Most abundant among these are marine shells, including 'ōpihi, pipipi, and leho, discarded at the sites as food refuse. Perhaps the best dating materials among these are the *leho* shells, because a ¹⁴C calibration correction for them has been worked out based on a sample of known age from a similar rocky coast nearby (Dye 1994). Seabird bones that were culturally deposited, rather than naturally deposited, as indicated by "end-breakage," which presumably resulted from a traditional Hawaiian butchering technique that rendered separate most major portions of the bird's body before cooking (Ziegler 2001), can be directly related to the capture and consumption of the birds as food. Bones require special sample preparation prior to ¹⁴C dating with accelerator mass spectrometer (AMS) (Stafford et al. 1991). *Kukui* nutshells almost certainly grew and were collected some distance from the arid lavas of the project area. Their presence in the lava tubes can be confidently associated with cultural activities such as the preparation of 'inamona or use of the kernel as fuel for lights. They are good examples of a short-lived material, whose dating controls for the possible effects of in-built age. Dating suitable materials such as these can be expected to yield point estimates of particular instances of site use. With some luck, multiple point estimates from a single site might yield some indication of the duration of site use. A Bayesian statistical framework, as implemented in the BCal software package (Buck et al. 1999), provides the functionality required to determine the posterior probability of occupation duration. The probabilities thus produced in the absence of stratigraphic information have two major limitations: the tails of the distribution are generally very long, and the estimate is heavily dependent on the oldest and youngest dates obtained. But to get beyond this presents a complex statistical problem that requires a relatively large-scale dating program (e.g. Zeidler et al. 1998), and is outside the scope of this project.

suitable dating material

kukui
 'ōpihi
 pipipi
 leho

'inamona



Chapter 4

Field Survey Results

This chapter presents descriptions of eleven sites and their constituent features recorded during the inventory survey (fig. 9). Most features within a site are described as parts of clusters, each of which arguably represents a functional unit, such as a *kauhale*. The goal of the cluster descriptions is to convey the sense of the place in human terms, without bogging down in details routinely collected, but rarely interpreted, by archaeologists. These details are presented separately in appendix A. The cluster descriptions are meant to be read while viewing a detailed plan map of the cluster, bound separately in over-sized volume two for viewing convenience.

Site boundaries generally take in many features in addition to those in the clusters. The features outside clusters are relatively isolated and the approach has been to describe them individually, with fewer references to their relationships with other features. The spatial relationships of the isolated features are displayed on a series of maps in which the features are plotted as symbols keyed to formal type. This approach makes for somewhat drier reading, and it opens the door to details, duly recorded, whose meaning is often not apparent when viewed in isolation. Photographs are an important part of the documentation of these isolated features, and these are provided wherever possible.

Trail Site 50-10-18-16059

Trail site 50-10-18-16059, described by Goodfellow et al. (1992), enters the project area from the north, crossing over the boundary with Kūki'o 1st *ahupua'a* on a *pāhoehoe* flow a short distance behind the beach at Kākapa Bay, near the northern end of site 50-10-18-23355. The *pāhoehoe* flow is narrow here, only about 25 m wide, with a high 'a'ā flow to the south and a lower one to the north. The trail follows the *pāhoehoe* flow toward the beach, a worn path in the lava that fades out near a group of petroglyphs about 30 m from the sand.

The trail provides an unobstructed view of a massive slab of lava at the edge of the 'a'ā flow to the south, whose nearly vertical face has been worked to expose red, rosy lava (see pg. 84). This slab, which stands out most brilliantly in the warm light

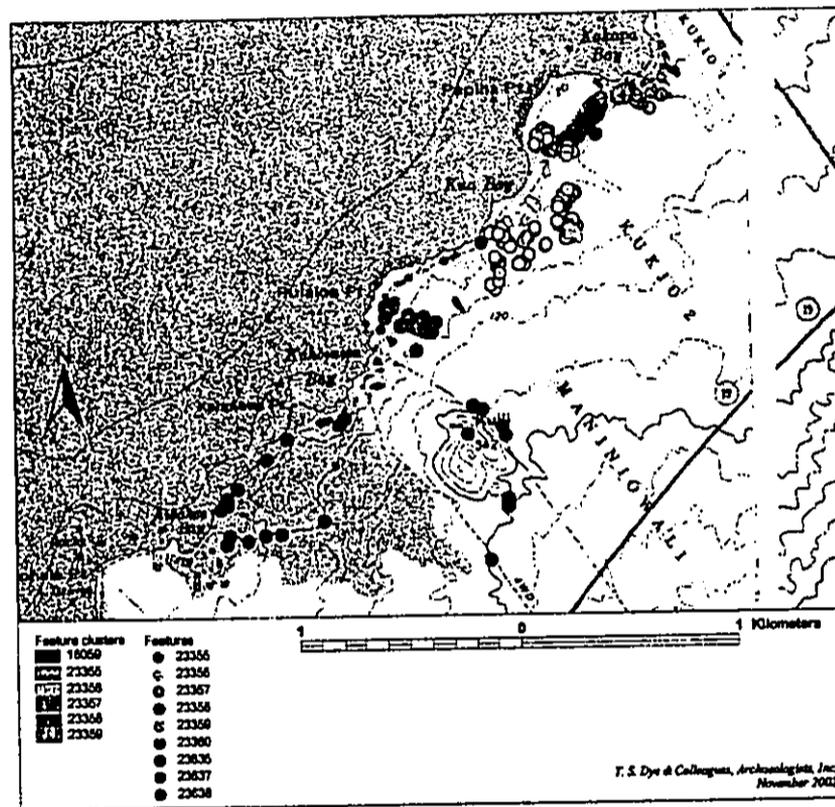


Figure 9. Archaeological site locations.

near sunset, might have functioned as a marker of some sort, with significance to travellers entering the village of site 50-10-18-23355. Its red color and vertical aspect evoke qualities of the god Kū (Valeri 1985:270), one of the major deities of traditional Hawai'i with particular importance on Hawai'i Island, and associated among other things with the male activity of fishing, one of the primary economic activities along the dry Kekaha coast. Although the precise meaning(s) signaled by the slab are now lost, its presence would have indicated quite clearly that the traveller was entering an inhabited area. It is not clear how visible the *kauhale* situated in the 'a'a flows on either side of the trail would have been when the massive slab came into view. Today, with the *hale* marked only by their foundations, they are almost completely out of sight.

Surrounding the trail on the *pāhoehoe* lava and the very edges of the 'a'a are 98 small features, typical of constructions found along trails in this region (vol. 2, maps 5 and 6). The most numerous of these are *pāhoehoe* pits, of which there are 72. They vary in size from feature 59, a 0.5 m long and 0.3 m wide opening to a lava tube connected to feature 150, to partially-filled feature 95, which occupies a lobe of *pāhoehoe*

TRAIL SITE 50-10-18-16059

surrounded by higher 'a'a and is 4 m long and 3 m wide. The *pāhoehoe* pits here resemble in most respects the *pāhoehoe* pits found farther *mauka* in site 50-10-18-5338 Pantaleo et al. (1992). The pits here might have functioned as quarries for building material used in the construction of the *makai* face of the *heiau* site 50-10-18-23355, feature 229 (see pg. 72).

Near the center of the *pāhoehoe* flow, just past the end of the trail at a high spot are two shelters. Feature 30 looks like a tunnel, with one natural wall of upthrust lava and one stacked wall. It is large enough to fit one or two adults, and the floor at the *makai* end appears to be paved, but given its location near numerous permanent habitation features, it probably was used for storage, rather than shelter. Just *makai* is an overhang shelter, feature 46, created when a *pāhoehoe* pit broke through one end of a lava blister. At the *makai* end of the flow is a third shelter, feature 62, where a *pāhoehoe* pit provides entrance to a small lava tube. A nicely stacked wall in the lava tube probably seals off a side tube that might contain a burial. A small cave, feature 61, at the edge of the flow does not contain any cultural material.

Five small walls were recorded. Two of them, features 18 and 22, near the middle of the *pāhoehoe* flow, are now almost completely broken down and might also be described as long, low mounds. The other three walls, features 40, 41, and 96, all located at the edge of 'a'a flows, are in better condition, having retained one or more faces. Two features classified as berms, features 78 and 79, located on either side of the trail just off the newly-graded road in Kūki'o 1st, might be modern features.

Five panels of petroglyphs are found on horizontal and nearly vertical surfaces. Three human figures, feature 13, pecked into the uneven, nearly vertical surface of a small *pāhoehoe* lobe (fig. 10) are best viewed in early morning light and are difficult to see at other times of the day. The largest panel, feature 33, contains five possibly human figures (fig. 11); all of the figures lack legs, so other interpretations are plausible. Feature 44 is a panel with a single human figure, and feature 57 contains a circular motif. The final panel, feature 81, displays two paddle-wielding figures facing one another (fig. 12).

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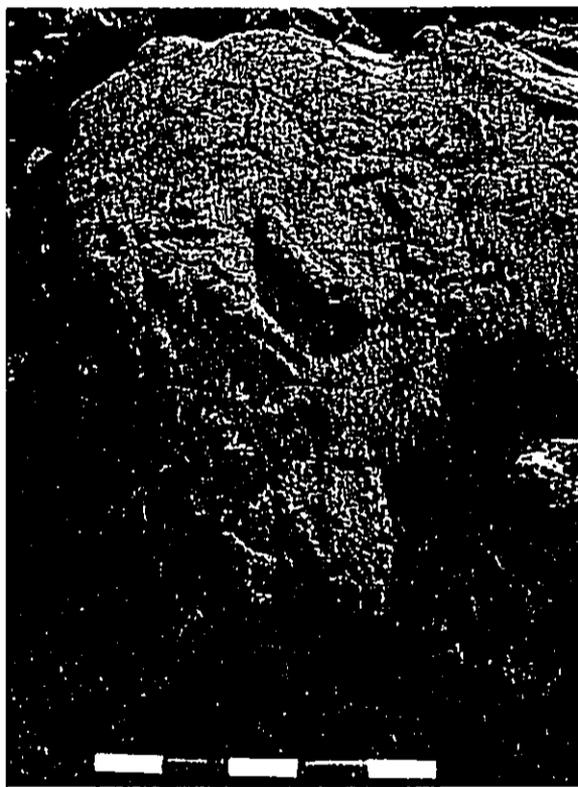


Figure 10. Petroglyphs of three human figures, feature 13, site 50-10-18-16059. The scale is marked in 10 cm increments.

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TRAIL SITE 50-10-18-16059

47

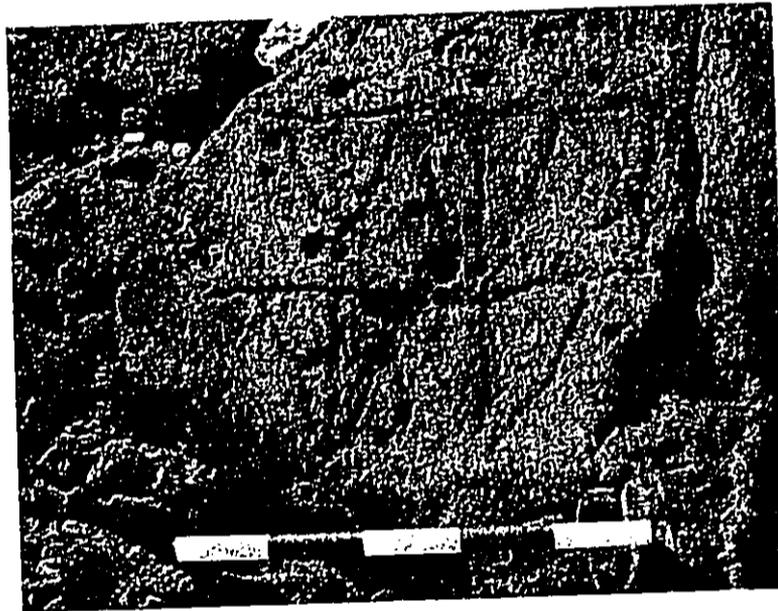


Figure 11. Petroglyphs of five figures, possibly human, site 50-10-18-16059, feature 33. The scale is marked in 10 cm increments.

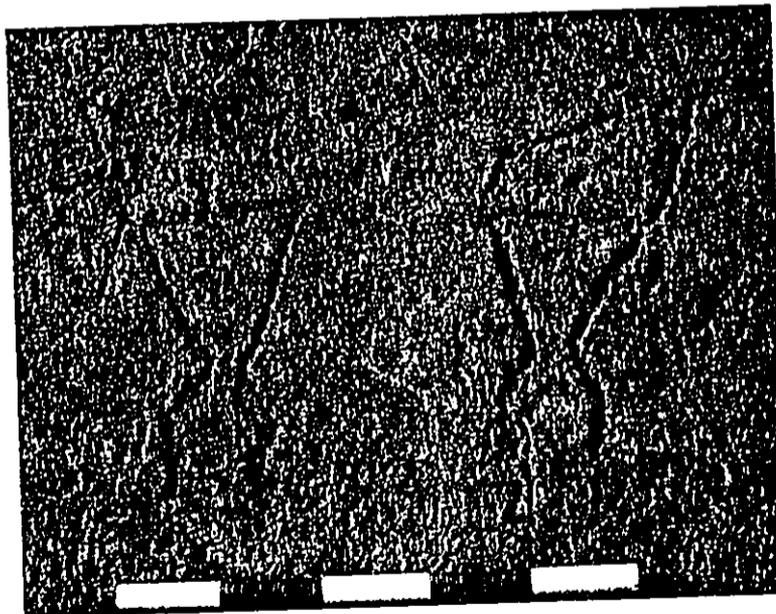


Figure 12. Petroglyphs of human figures with raised paddles, feature 81, site 50-10-18-16059. The scale is marked in 10 cm increments.

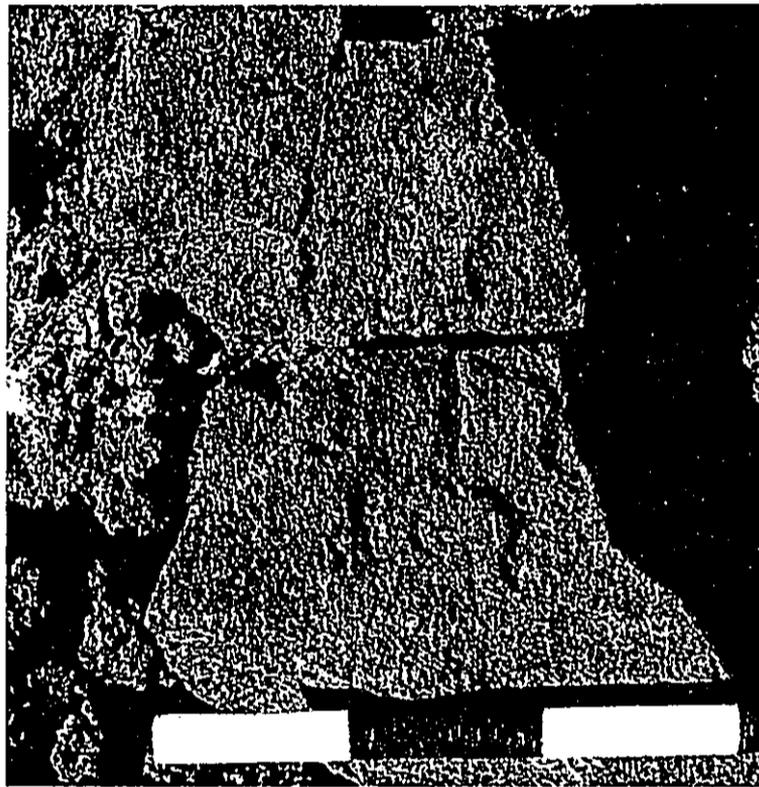


Figure 13. Petroglyph on broken *pāhoehoe* slab near feature 23, site 50-10-18-16059. The scale is marked in 10 cm increments.

An interesting find was a petroglyph of a human figure on a broken *pāhoehoe* slab near feature 23 (fig. 13). It is likely that this image was removed during construction of the one of the *pāhoehoe* pits in the vicinity, suggesting that pit construction was relatively late in time, after petroglyphs had already been created, and that sufficient importance was placed on pit construction to destroy a petroglyph.

Kākapa Bay Site 50-10-18-23355

Extending from the boundary of Kūki'o 1st and 2nd *ahupua'a* at the north to the survey area boundary at the south, this site encompasses the larger bay known as Kākapa, also called Kūki'o Iki, as well as a smaller bay to the south. The smaller bay will be termed Kākapa Heiau Bay for convenience here, since no other name is known for it. The features of this site form seven clusters, which have been designated feature clusters A-G and given descriptive names (fig. 14). These feature clusters, which frame the narrative description of site 50-10-18-23355, relate profoundly to the land forms, since the character of features changes with the flow type, and since the less modified

areas between feature clusters appear to correspond in large degree to differences in elevation, flow morphology, and substrate. However, a network of trails connects these clusters to the main *mauka-makai* trail, to the bay, and to each other. For this reason, Kākapa Bay has been designated as a single site. Given the fact that a low density of features spreads out beyond the coastal settlement, this site could undoubtedly be expanded if the survey boundaries were not limited to the area of potential development. However, dense concentrations of features are not expected, and only forms such as pits and small clearings would be likely; many such features may be found near trails, rather than in the open lava fields.

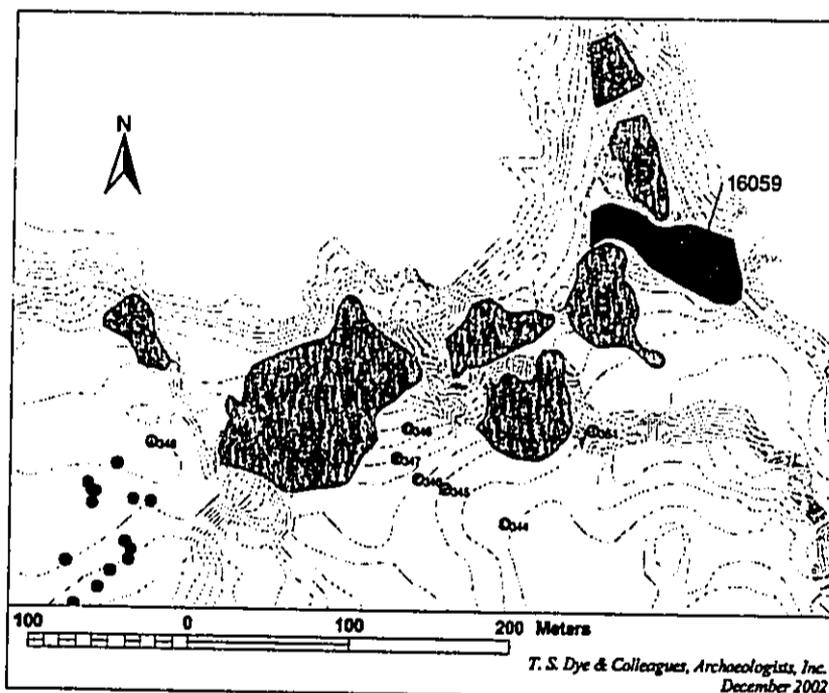


Figure 14. Locations of feature clusters and outlying features, site 50-10-18-23355. The blue dots are features of trail site 50-10-18-23360.

The *mauka-makai* trail, site 50-10-18-5337, forks in the 'a'ā lava *mauka* of the site, with one fork leading to the habitation clusters at the north end of the bay and the other to the *heiau* at the south end of the bay. The trail sections branch several times once they enter the site, providing the feature clusters access to the main trail. The branches of the trail have been designated features of site 50-10-18-5337.

Cluster A: Beach *Kauhale*

Located at the south end of the beach at the main Kākapa bay, this cluster of eighteen features appears to be a single habitation compound, or *kauhale*. Cluster A contains features 83–100 (vol. 2, map 3). Features 96–100, a complex of connected enclosures, platforms, and terraces forms the largest structure, and nearby is feature 93, another partially enclosed terrace platform. The landform on which the cluster is constructed is an 'a'ā flow that extends to the coast; it is much lower than the 'a'ā flows on which nearby clusters B and C lie. This area also differs in that human modifications to the landscape are more tightly focused than at cluster C, concentrating on the *makai* rectangular feature 96–100 complex and a secondary sub-cluster about 15 m to the south—there are few outlying features to this cluster.

A portion of cluster A was investigated by Cordy (1981) and assigned to site 50-Ha-D21-33. Cordy identified five features, which correlate with the cluster A features as follows: D21-33-1 is feature 97; D21-33-2 is feature 98; D21-33-4 is an open area that includes features 89, 91, and 92, and possibly portions of feature 99; D21-33-5 is feature 93; and D21-33-6 is feature 96. On the basis of two volcanic glass dates, Cordy believed the site dated to the traditional Hawaiian period of the eighteenth century. The feature 96–100 complex was interpreted by Cordy as a series of sleeping houses. The open area, including features 89, 91, and 92, was interpreted as a *hale mua*, or men's house. Feature 93 was interpreted as a special purpose structure.

The beachfront portion of this cluster is subject to occasional high surf, including the massive northwest swells that bring winter surf to Hawai'i. Because of this, cluster A as it appears now is undoubtedly a remnant of what once existed here. In addition, the Kekaha coastline has been hit by several tsunami recorded during the historic period, and must have been subject to numerous similar events during the site's occupation. High surf, storm waves, and tsunami have the potential to erode features and deposits, as well as to bury them. Although excavations would be necessary to prove it, there appear to be remnants of features on the eroded slope *makai* of features 96 and 97, and there are definite remnants north of this area. One, feature 94, consists of a double alignment of *pāhoehoe* slabs oriented along a *mauka-makai* axis, and a possible alignment abutting them parallel to the shore; all of these are rather firmly embedded in the sand, indicating that they are foundation stones, rather than a chance occurrence of wave-deposition. A fainter possible alignment bears north from the intersection of these, and is also firmly embedded.

Mauka of feature 94 are a pair of wall remnants designated feature 86. Oriented east-west along the sand parallel to the lava flow, these walls average 70 cm high, and are faced on both sides, with large cobbles filling the core. At its east end, the southern wall blends into the flow. The northern wall is much shorter, about 3 m long, and appears to have been damaged or dismantled. The location and form of feature 86 is consistent with a canoe shed. Additional features may occur farther north in the beach area, but a thick deposit of coral and sand left by the 1946 tsunami makes it impossible to see much. Also, modern features have been built with basalt stones presumably taken from this area. Features at the back of the beach are discussed under cluster B (pg. 56).

Features 96, 97, and 98 are all divisions of a large, rectangular platform terrace. At

tsunami

storm wave

its *mauka* edge, a high, double-faced, core-filled wall, 30–60 cm high along its interior face, and up to 2 m high on its exterior face, forms an abrupt back to the feature. At Feature 96, this wall appears to have been dismantled, with only the foundation remaining, and what may have been a side wall on the north is in very poor condition, collapsed nearly beyond recognition. Walls dividing these features are also in poor condition, although enough remains to indicate features 96 and 97 were completely separated, and that features 97 and 98 may have been as well. Access to features 96 and 97 undoubtedly occurred from the *makai* side, but a large flat stone on the south side of feature 98 appears to signal a doorway on that side; presence of a slab lined hearth on the surface further serves to differentiate this feature. Despite some disturbance, stones appear to form a continuous front, or *makai*, edge to features 96–98, making their interior areas 30 m², 33 m², and 20 m², respectively. Because there is no drop-off on floor level at this point, however, it is possible that feature 97 may extend farther *makai* to where a terrace of large *pāhoehoe* slabs are laid out horizontally, in which case the area would be more than 40 m². Feature 96 has a lower terrace in front, measuring 15–18 m², also using *pāhoehoe* slabs, but with at least two set upright. In front of feature 98 is another terrace, designated feature 99 because it extends well south of feature 98. This terrace, 20 cm high, is not as high as the terraces fronting features 96 and 97, which are 60 cm high. This is likely a function of natural topography, and the area of feature 99, about 26 m², is larger. Inside the corner created by features 98 and 99 is a terrace, feature 100, dropping off to the south and *mauka* directions. It has a square plan, with a surface area of about 6.25 m².

A small excavation was made in the firepit in feature 98 to collect wood charcoal for identification and dating. The firepit contained a grayish brown (10YR 5/2) ash, with abundant basalt pebbles, small pieces of marine shell, primarily *pipipi*, and abundant rootlets. Absent were macroscopic pieces of charcoal that might be identified; repeated use of the firepit evidently reduced all of the wood charcoal to unidentifiable ash. Such material is not suitable for ¹⁴C dating to establish when the firepit was used because it includes an unknown, but potentially great, in-built age.

It is likely that features 96–100 represent a variety of specific functions, and that the total structure emerged out of multiple construction events. The multiple-use hearth in feature 98 indicates cooking, while the location and small size of neighboring feature 100 would be consistent with some kind of specialized activity area. Features 96 and 97 may be sleeping houses, with their lower terrace levels and feature 99 being general activity areas, a *lānai* that lacks enclosing walls and is easily accessible along its entire *makai* edge. Although the surface architecture provides some clues to the relative ages of the features—architectural intersections suggest that features 100, and possibly feature 99, postdate feature 98, and that feature 98 postdates feature 97—extensive excavation would be required to make reliable inferences about the sequence of development for these features.

In front of feature 99, an area of 'a'a cobbles, 'ili'ili, and coral pebbles indicates that a pavement, feature 92, is present, but a cover of beach sand makes it impossible to judge the integrity and precise boundaries of the feature without excavation. Approximately 23–30 m² of these materials exist, and although there is a hearth remnant near its center, it may be that this was simply a floor, and that no enclosing walls ever formed part of the feature. It is also possible that feature 92 may have spanned the

entire area between features 99 and 93, or even extended along what is now a beach slope *makai* of features 96, 97, and 99; if so, the pavement would have covered upward of 150 m².

A small excavation in the hearth near the center of feature 92 was undertaken to recover identifiable wood charcoal for ¹⁴C dating. The hearth contained a light gray (10YR 7/1) ash, with common basalt and calcareous pebbles and marine shell pieces, some blackened by exposure to fire. Macroscopic charcoal pieces that might be identified were not found, however; these were reduced to ash through multiple uses of the hearth over time. The ash is not a suitable material with which to date use of the hearth because of the possibility of substantial in-built age.

Feature 93 occupies the edge of a point jutting out from cluster A to the northwest. The northeast and northwest sides of the feature rise well above the coastal outcrop, and it appears that a wall enclosed the entire feature. Marine shell midden is actively eroding from the northeast, where the *mauka* end of the facing appears to have been recently stabilized. Because of the prominent location and large interior area of 55 m², Cordy interpreted this as a special purpose structure, although an interpretation as a men's house is also consistent with the size, form, and location of the feature, as well as the presence of two large upright stones inside the southeast wall.

Test unit 1 at feature 93 was a 1 m² excavation located at the inner face of the platform's north wall, approximately midway along its length. The unit was positioned to expose the base of the wall so that suitable dating material might be recovered to establish a *terminus post quem* for wall construction. Excavation revealed two layers (fig. 15). Layer I, to a depth of 6 cm, is basalt and coral 'ili'ili in a loose matrix of recently deposited organic matter and silt. Cultural materials from this layer were collected as field catalog 5. Layer II, from 6–30 cm below surface, is primarily basalt and calcareous cobbles and boulders in a very dark gray (10YR 3/1) silt, with common calcareous coarse sand and gravel and basalt gravel. Cultural materials from this layer were collected as field catalog 6. Basalt boulders in layer II represent the surface of the 'a'a flow upon which the platform was constructed (fig. 16). The silt matrix is structureless, loose, and noncoherent. Near the center of the unit, at a depth of 15–20 cm, was a concentration of fish scales and charcoal about 10 cm in diameter beneath a water-worn cobble. This concentration was collected separately as field catalog 7.

Excavations yielded a small collection of artifacts associated with the manufacture of bone and shell fishhooks, including a broken piece of finished hook, fishhook blanks and waste pieces, sea urchin spine files, and volcanic glass flakes. Also recovered were marine invertebrate shells and vertebrate faunal remains. These are all described in chapter 5.

Although TU-1 was positioned to explore the interior face of the northeast wall in the hope of recovering charcoal or other material suitable for dating the age of the structure, this proved not to be possible. The 'a'a substrate contains so many voids that cultural material readily moves down through the stratigraphic column. Materials recovered from beneath the wall could have been deposited there at any time after the wall was constructed, thus violating the principle of stratigraphy. Unfortunately, this situation appears to hold for most of the structures at site 50-10-18-23355, where construction was located preferentially on 'a'a flows.

Several other features in Cluster A are ancillary to these main structures, and none

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KĀKAPA BAY SITE 50-10-18-23355

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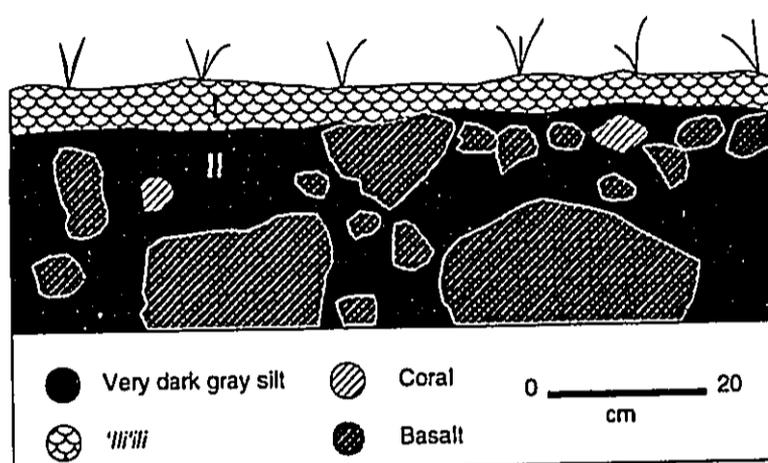


Figure 15. Stratigraphic profile of test unit 1 west face, site 50-10-18-23355 feature 93.

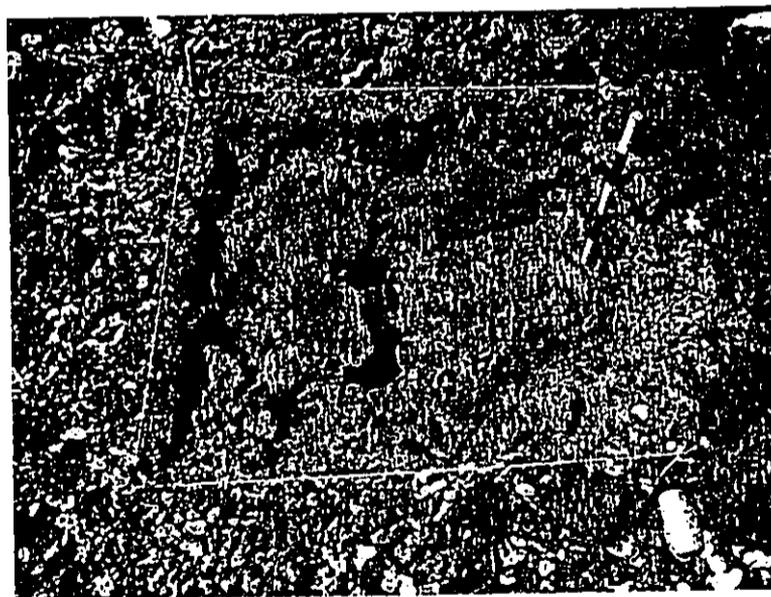


Figure 16. Test unit 1 after excavation, site 50-10-18-23355 feature 93. Note the basal 'a'a lava. The scale is marked in 10 cm increments.

exhibit enough volume or engineering prowess to suggest major labor investment. Feature 91, a cleared, level area southwest of feature 93, is below the surrounding ground surface, but lacks any indication of a precise function. The stacked stone facing that defines its southeast edge—the other sides are not faced—may in fact be the edge of the feature 92 pavement. South of this, is a small platform, feature 89, with a surface area of 8–9 m². It has stacked facings, an 'a'a cobble fill, and a small cupboard, which contains sea urchin bodies. This feature might be a burial. A few meters west of this is a tall cairn, feature 90, that may represent a boundary of some sort. A similar cairn, feature 84, is located at the opposite end of Cluster A. Southwest of features 99–100 are two irregularly shaped, small features built around 'a'a boulders. Feature 87 has an L-shaped *mauka* wall of stacked small boulders, and a level interior paved with coral and basalt cobbles. Attached to the west end is a cupboard that goes below ground surface, featuring a stacked stone lining and a boulder slab roof. The wall, which partially encloses an area that is open *makai*, the nice paving, and the branch coral found on feature 87 are all attributes consistent with a shrine, probably associated with fishing. Although not directly in front of the ocean, its position next to the main habitation structure and the main *mauka* trail are interesting. Feature 88, just a few meters to the northwest, is a small enclosure with an interior surface of 3.5 m² and an entry on the east side. Although partially collapsed, the enclosure wall is at least partially core-filled, and reaches as high as 120 cm; the floor consists of a large boulder and some pebble pavement. Absence of branch coral, nice paving, and a *makai* orientation argue against interpretation of this as a religious feature, although its proximity to Feature 87 may suggest otherwise; it may house some other special use area associated with the general habitation.

Just *mauka* of feature 98 is a rectangular platform covering 10.5 m² and averaging 40 cm high. The platform facings are roughly constructed of small boulders, and the fill is primarily cobble-sized clinkers with some 'ili'ili and coral. It is likely that this is a burial feature.

A faint trail leads from the vicinity of features 88 and 89 to several features at the edge of cluster A (fig. 17). Feature 101, a squarish C-shaped enclosure with stacked boulder and cobble walls, has a cobble and pebble floor covering a 9 m² area. Several large boulders are incorporated into the walls and the floor, and the open side faces southeast to a ravine a few meters away. Two meters to the north of feature 101 is a small pit, feature 102. The pit is 50 cm in diameter and 50 cm deep, and contains four coral beach cobbles. Features 103–105 lie at the base of a higher 'a'a lava flow, 5–10 m to the south of feature 101. They consist of a series of enclosures and overhang shelters below the surrounding terrain. With a pebble floor 100 cm below surface, feature 103 is the deepest of the three. It extends under a large boulder to the north whose top surface has been abraded and worn, and slightly under a large boulder to the south. This shelter has been looted, although a fair quantity of midden material remains. Feature 104, 60 cm higher than feature 103, has a stacked stone lining and a cobble and pebble floor that covers an 8.5 m² area. Feature 105 occupies the base of the higher flow, and is separated from feature 104 by a stacked stone wall; the 3 m² interior is paved with pebbles, and lies 90 cm below the surrounding surface. Thirteen meters north of Feature 101 is a pit, feature 106, with stacked lining. It is wider than feature 102, but of a similar depth. This feature is situated on the east bank of the

ravine.

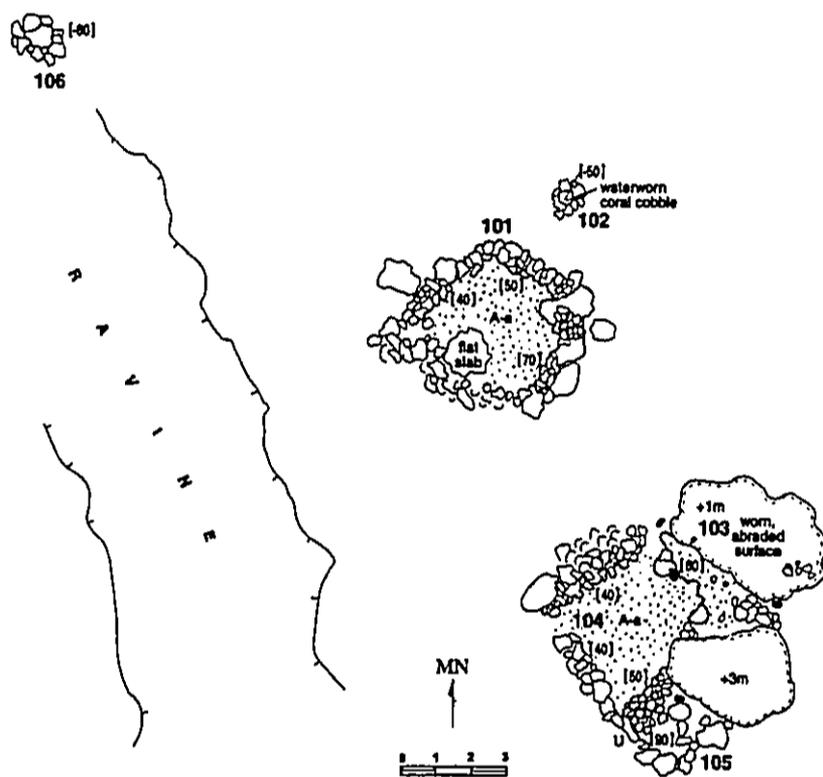


Figure 17. Portion of cluster A, site 50-10-18-23355. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

Cluster A stands apart from other feature concentrations at Kākapa not just because of its location by the shore, but also the dominance of rectangular feature forms. The contiguous nature of Features 96-100 suggest that the overall structure was a cohesive whole, but the interior walls and multiple entrances show that it did not serve as a single, undifferentiated space. Wall intersections indicate that the structure grew, and perhaps was reconfigured, over time. While the other large rectangular feature appears to have been conjoined by a common courtyard, the other outlying features, particularly 101-106, contrast with the main complex due to their location amid rough lava, their relative isolation, and their less rectilinear form. Without delving into particular functional interpretations for each feature, Cluster A certainly fits the common pat-

tern for residential compounds, or *kauhale*. It also fits the more detached, but widely applicable operational criteria used in this project: evidence of sustained habitation, including midden and substantially constructed features, its own access to the ocean, and a buffer of more than 10 m between it and the next cluster.

Cluster B: Lower Bluff *Kauhale*

The base and brow of an 'a'a flow overlooking the beach at Kākapa Bay has 36 features, designated features 47–82 (vol. 2, map 2). Several of these features appear to comprise a second *kauhale* compound, and were recorded as such by Reinecke (1930). Cordy (1981) investigated a portion of this feature cluster, and assigned three features to site 50-Ha-D21-31. He interpreted the three features to be two sleeping houses and a special purpose structure.

The most substantial structure of cluster B is a multi-component feature on the highest elevation at the cluster's *mauka* edge. Enclosure feature 53, square and enclosed by double-faced, core-filled walls averaging 80 cm high, is most intact. A doorway on the *makai* wall provides access to an 18 m² interior paved with pebbles and cobbles; numerous water-worn stones and a conspicuous red stone are incorporated into the wall north of this entry. In the southwest corner is an oblong depression (10–20 cm below the floor) in which beach sand and 'ili'ili pebbles, both basalt and coral, predominate; more of these materials are strewn about for about a 1 m radius, and it is possible that this represents a cursory attempt at excavation by looters. A short spur from the east wall may have divided this enclosure into two rooms, since several boulders embedded along the same axis indicate that it once extended farther and has been dismantled. Feature 53 exhibits use of slabs in an upright position in the wall construction, but these lack attributes of ritual uprights (e.g. phallic or anthropomorphic shape, smooth or pecked surface, conspicuous placement), and instead appear to be a way to maximize wall height while minimizing labor. Water-worn cobbles and boulders are also more common in this feature than in others, particularly in the north wall by the entrance and at the intersection of the spur and east walls, both spots where the walls become wider, expanding into small platform surfaces. Although small platforms with 'ala stones could be construed as altars, the absence of branch coral and the overall form of feature 53 indicate that its primary function is residential.

Adjacent to feature 53 is a partial enclosure open to the sea, feature 54. This structure is oriented 30 degrees to the east of feature 53. Construction is similar to feature 53, but the core-filled wall gives way to lower, simple stacking at the southwest end. In the east corner, a 4 m² area raised 30 cm high is defined at the edges by a large cobble alignment, and has a very nice basalt and coral 'ili'ili pavement. Incorporated into the back wall of this are two upright stones, that have the general appearance of ritual upright stones. The remainder of feature 54 is paved with 'a'a pebbles, with some basalt and coral 'ili'ili. Overall, this feature shares attributes of both a sleeping house and a shrine, although the absence of branch coral and unambiguous uprights argues for the former as the primary interpretation.

In front of this is feature 55, a pavement of slabs and large cobbles with some 'a'a and water-worn pebbles filling the interstices. The southern edge is difficult to discern, and may extend beyond feature 54. The *makai* edge of this pavement is defined by an

alignment of embedded boulders that parallel neither the back wall of 54 nor the front wall of 53. It is possible that the southwest wall of 54 once extended to this alignment, forming a pentagonal structure, but excavation would be required to determine whether 54 is complete in its current form, or has been partially dismantled.

Southwest of feature 55, feature 56 is a terrace paved with cobbles and pebbles, and a small area of sand and water-worn basalt and coral pebbles. The northwest and southwest sides of feature 56 are clearly defined by stacked facings, but the *mauka* side is unclear, and appears to have collapsed. This highlights an attribute of construction common in cluster B, the use of 'a'ā boulders and slabs to raise a platform with many open spaces inside, with a surface pavement hiding the deceptively hollow substructure. Although this method of construction does not create the cubicle spaces associated with the *pao* style of hollow-core construction, the construction does appear to show intentional maximization of structure volume by creating vacant spaces in the fill. The boundary between features 55 and 56 is unclear, and has been based on differences in pavement; functionally, both appear to have been part of a single *lānai*. At the south edge of feature 56 is the beginning of a trail bearing southwest toward cluster C. Mostly consisting of clearing amid the rough 'a'ā lava flow, this trail also exhibits judicious use of slabs set into the surface.

Makai of the alignment defining the front of feature 55, a small ring of stones, feature 57, appears to be the remains of a modern camp fire. Surrounding this and fronting feature 53 is a gentle to moderate slope on which outcrops have been modified through bashing to create a stepped front "yard." Just before the slope down to the beach is feature 60, a mound that, although only 40 cm tall, is visible from below and is adjacent to the trail from the beach, which is paved with water-worn stepping stones. North of this, just below the brow of the hill is feature 64, an enclosure with a 7.5 m² interior paved with pebbles and beach sand. The *mauka* wall is stacked cobbles and small boulders, whereas the *makai* wall includes large boulders set into the steep slope. The northeast wall borders a shallow ravine, and blends into a very small enclosure, with an approximately 80 cm² interior, at the east corner. Within the ravine, feature 67 is a small 1.5 m² pavement of 'a'ā and coral cobbles set amid large boulders that appear to have been roughly set in place. Farther east, feature 66 is a terrace made of boulders and stacked stone that retain cobble fill at the north edge of the cluster B yard.

Adjacent to feature 56 at the southern perimeter of this yard is feature 58, a terrace with cobble fill. Numerous water-worn cobbles dot this feature's surface, which is rough and does not appear to have been intended as a pavement. At the northeast end of this terrace is a large boulder rising above its surface, around which the water-worn stones cluster; this concentration suggests that the stone was a focal point of some sort, since the water-worn stones clearly do not form a trail or pavement. A shallow overhang on the east side of this boulder may have functioned as a cupboard, but no stacking or excavation indicate augmentation of this natural shelter.

Adjacent to feature 58, and sharing a common wall with it, feature 59 consists of a large cupboard excavated beneath ground surface, with a large slab and stacked cobbles forming the roof. The cupboard has an interior area of more than 1.5 m². Stone fill extends beyond the cupboard, creating a triangular platform-like surface 3 m² on top, faced with a small boulder terrace on the west and north. Half a meter lower, feature 61 is a similar, cobble filled terrace. Together, the surfaces of features

58, 59 and 61 are an interesting conglomeration of multi-level, irregular features amid more regular features. None appears to have the right shape or sufficient size to have been the foundation of a pole and thatch structure. It is possible that these features represent a repository for stone cleared from paved areas, or possibly that there are burials within them. Alternatively, the terrace surfaces may have been used to dry fish.

Below these three features is feature 62, an enclosed cobble and pebble pavement set below the surrounding ground surface. Like the peripheral features in cluster C (pg. 60), this feature appears to have been constructed by clearing out large stones, resulting in a pavement surrounded by large cobbles and boulders. At the north end, down slope and *makai* of this 7 m² pavement, a trail marked by a small cairn atop a large boulder, feature 63, connects the main portion of cluster B with more features to the southwest.

After just a few meters traverse through the rough 'a'ā lava, two large slabs 150 cm high signal the entry into the southwest portion of the cluster. On the *makai* side of the trail, feature 72 is a single slab set upright with a small cobble cairn on top. *Mauka* of this, feature 71 is a similarly set slab, but is concave on the west side, and has remnants of a stacked stone cupboard on that side, and a mound of stacked cobbles on the *mauka*, southern end. Extending southwest from these two features, feature 73 is a pavement cut into the slope, covering an 8 m² area with pebbles, cobble, and basalt 'ili'ili. Separated from feature 73 by a low stone alignment is feature 74, a 6 m² cobble and pebble pavement strewn with several water-worn coral cobbles.

Mauka from feature 71, feature 70 is another pavement, also about 6 m² in area and paved with pebbles and cobbles on the south, with some embedded boulders in the north. Immediately east of this, feature 69 is an enclosure in the form of a figure eight. Walls of stacked cobbles and small boulders average 50 cm high, and the interior covers about 4 m² with cobble and pebble pavement with a few water-worn basalt cobbles. Access is via an opening on the east side, connected to a 3 m long trail that runs from this enclosure to feature 56. South of feature 69 is a 4 m² cobble and pebble pavement cleared amid the 'a'ā.

Descending toward the beach from features 73 and 74 are three more features, none of which is in very good condition. Feature 75, the uppermost, is also in the best condition, having a double-faced, core-filled wall descending the slope at the southwestern edge and on the *makai* side; the *mauka* and northeastern sides have collapsed, but appear to have been terraces combining natural boulders and stacked stone. Water-worn and branch coral are found inside the estimated 5 m² interior. The *makai* wall of feature 75 also serves as the back of Feature 76, an 8.5–9 m² pavement of 'a'ā and water-worn coral cobbles. The north boundary of this pavement is a stacked stone retaining terrace. A trail from the beach to cluster C passes immediately *makai* of feature 76, following the southern edge of a shallow ravine. Just *makai* of the trail is feature 78, an irregular mound of stone and coral without any formal construction.

Between the points where the trails to clusters B and C begin the ascent from the beach to the lava flow, feature 77 appears to be a shrine, damaged by a tsunami or high surf. Stacked stone facings define a low, rectangular terrace platform, now mostly collapsed, but measuring 3.5 by 2.25 m, fronting a very large 2.5 m wide and up to 3 m high slab set upright against the lava flow slope. Unlike most features at this site, feature 77 incorporates numerous *pāhoehoe* slabs in its construction, and has relatively

abundant water-worn and branch coral and water-worn basalt on its surface and in the fill. Although proximity to the ocean warrants caution in overstating the significance of the coral, the pieces on this feature are gray and weathered, unlike the white storm wave and tsunami-deposited coral found all across the beach.

Several other features line the base of the 'a'ā flow beneath the heart of cluster B. Feature 79, a double-faced, core-filled wall whose east end has mostly collapsed, appears to be a retaining wall, set at the back of the beach where the flow begins. This resembles the inland wall of feature 86 in cluster A, and may even have been contiguous with it at one time; being east of the trail to cluster C, this wall may be functionally related to these clusters, and is included in cluster B merely due to its proximity. Feature 80, conversely, appears much more closely related to cluster B. It consists of a stacked stone terrace extending 5.5 m *makai* from the base of the flow, defining the southern edge of a pool. Unfortunately, this pool has been largely filled by tsunami deposition, and its original size cannot be determined without excavation. The high ground south of this terrace is covered with water-worn basalt and coral cobbles. Excavation would be needed to determine whether this represents a pavement or wave deposition. Nine meters north of feature 80, across a ridge of beach material, feature 81 is another pool, less filled with sand and beach rock. Measuring approximately 50 m², this depression has a smaller, about 9.5 m², deeper portion adjacent to a large, round boulder. The *makai* edge of the larger depression is lined with large, water-worn *pāhoehoe* slabs, which have afforded some degree of protection from storm wave and tsunami deposits. Feature 82 is a stacked stone terrace that may be related to the pond, since it juts out from the base of the flow in a manner similar to feature 80.

Robert Punihaole, long-time resident of the coast, recalls watering donkeys here at the pools, and catching 'ōpae. These ponds were also important traditionally for impounding *āholehole* and other fish tolerant of fresh and brackish water, functioning as an "icebox" that held food for times when fishing in the ocean was not possible. The salinity of these ponds has not been tested, but a test probe, removing rocks from Feature 80, revealed that moisture is indeed present. Oral histories gathered by Hannah Springer (1985) also speak of these ponds as a place to gather bait and store fish.

Back up on the 'a'ā flow, several outlying features complete cluster B. A short trail consisting of gravel and some set slabs leads *mauka* from feature 54 to feature 47, a 5.5 m² cobble pavement in a low spot in the lava. Other than a dozen water-worn coral cobbles, there are no cultural modifications or deposits evident here, and the function is not known. Just over 5 m *mauka* of feature 54, but not easily accessible due to lack of a constructed trail, feature 48 is an even smaller 2.5 m² pebble and cobble pavement partially enclosed by larger stones that appear to have been removed to make the floor. Four meters north of this, feature 49 is a small cairn adjacent to a faint trail leading from feature 53 to a ravine. Presence of goat bones and bullet cartridges indicate this cairn is probably a relic of modern hunters. North of the same ravine, but farther *makai* and therefore closer to the core of cluster B, is an enclosure, feature 50, whose stacked stone walls surround a 6 m² pavement of cobbles and pebbles. Just northeast of this is a small circular alignment, feature 51, with a similar pavement covering just 1 m². Another 5 m to the north is a high outcrop boulder on which a cobble cairn, feature 52, has been erected. Rising 200 cm above the surrounding terrain, which is in turn a ridge that is above the ground encircling it, it is very likely that this feature is a boundary

marker, perhaps the boundary between Kūki'o 1st and 2nd. There does not appear to be a trail near this feature, thus eliminating trail marker as a plausible function.

Features of cluster B above the beach appear to represent a residential cluster, with a few major core features situated around an open "yard," and several areas of outlying features. The two large upright slabs of features 71 and 72 seem to divide the cluster into two distinct areas, although the trail from feature 56 to feature 69 indicates multiple access routes across the intervening rough lava. The enclosure north of the ravine from the core area and the clearings *mauka*, reinforce the concept that the *kauhale* includes some features isolated from the rest. Features below the lava flow on the beach may be related to cluster B, but whether they form part of that *kauhale*, or common area, or even another habitation cluster cannot be determined from the available data. Presence of a shrine and brackish pools would seem to suggest that they are common features, not functionally restricted to cluster B.

Cluster C: Upper Bluff *Kauhale*

South of Cluster B and *mauka* of cluster A is a higher 'a'ā flow, atop which is another *kauhale* cluster that provides some of the best examples of an 'a'ā flow modified for human use, as well as illustrating the variety of feature types associated with habitation on these flows. Among the 46 features here, labeled features 1-46, are enclosures, platforms, terraces, modified caves, mounds, cleared surfaces, cupboards, pits, modified boulders, and trails (vol. 2, map 1).

Central to the cluster is an extensive paved area, feature 26, around which the most substantial features are arranged. The pavement basically forms a yard or common area, and consists of a relatively level expanse of pebbles and cobbles, with the occasional larger stone embedded in the surface, and a well-worn trail traversing it from east to west. It extends from the steep slope at the east edge of cluster C, westward to feature 8, and from the line of small cave features 22, 23, and 25 at the south to features 15-19 on the north. The features defining the perimeter, therefore, are a combination of natural limits and constructed features, many of them incorporating boulders removed from the yard. Feature 26, in other words, represents the top of the flow after protruding boulders were removed and irregular surfaces were leveled out with pebbles and cobbles.

At the eastern end of the yard, platform feature 21 rises a half meter above the surrounding surface. Besides being one of the larger features in cluster C, with approximately 17.5 m² of interior surface area, several other factors indicate that this is an important feature. First, its position as the easternmost feature is significant, given that east is the cardinal direction traditionally associated with "life, wealth, blessings, and benefits" (Kamakau 1976:4), where the life-giving sun makes its first appearance each day. More concretely, the use of 'ili'ili stones on the surface, of substantial boulders to form the retaining wall on the west, and of a double-faced, core-filled wall on the east all show that a relatively high degree of attention was given to construction of this feature. Finally, this platform's location adjacent to the major *mauka-makai* trail, and overlooking the central yard suggests that it is a core feature of the site.

Adjacent to feature 21, a line of overhang caves defines the south end of the yard. Unfortunately, all have been completely excavated and disturbed by looters, and it is

not possible to know how these features originally appeared. Remaining construction shows that these caves mostly make use of large, flat boulders that appear to have naturally occurred here. Given the depth of the cave floors, well below the surface of feature 26, it is likely that the caves were made by a process of excavating beneath the large slabs; the roofs were augmented by carefully stacked rocks that filled in gaps and maximized the sheltered area. Ranging in size from the 1.5 m² of feature 22 to about 6 m² at feature 23, and with present interior heights generally well under 1 m even after looters removed plentiful material, none of these shelters were large, and they would have only provided enough shade for one or two people. The presence of stacked wall remnants at feature 24, and on either side of the feature 25 cave and of boulders and cobbles strewn about by looters shows that the exterior sections were walled, but we cannot know to what extent. These caves may have had stacked walls that either extended and defined the boundaries or perhaps sealed them. Abundant vertebrate and marine invertebrate midden in the looter piles and some remaining within the caves shows that they were used for disposal at some point. A general absence of human bones suggests that they did not function as burial features. Certainly, the shade afforded by these features would have made them attractive as shelters during the midday heat, and possibly for storage of food and other materials. It should also be noted that these caves may once have been encompassed by pole and thatch structures, rather than open to the air as they are now.

A large quantity of looters' back-dirt from these caves, most of it located outside feature 23, was sieved through 0.125 in. mesh screen. Artifacts, vertebrate fauna, floral remains, and wood charcoal were collected from the screen. These cultural materials are described in chapter 5.

The inland side of the cave features is an outcrop that rises higher than the rest of the cluster, and separates it from a cleared area *mauka* of the main cluster. The most readily definable portion of this is feature 44, a 21 m² area occupying a low spot in the topography, essentially a clearing in which large stones have been removed and a relatively level pavement has been created. Natural stones *in situ* and some that have been cleared from the interior have been placed around the clearing to form a rough wall. At the west end, a 2 m wide gap in this wall affords access from the main site cluster. This is also the location of a small cupboard, feature 45, excavated beneath a large boulder.

Rising above the rest of the cluster, a large terrace defines the western edge of the yard. Measuring just less than 15 m long, and as much as 1.2 m high, the upper surface of this terrace is divided into a series of features, labeled features 28–31, and is the core of another set of features within Cluster C. At its *mauka*, southeast end the terrace melds into the surrounding ground surface, where feature 31 forms a low platform with cobble and pebble paving. Although larger at 14 m² than the other components of this terrace, the surface is also less evenly paved, and has fewer water-worn stones and midden traces than the others. Feature 30 differs from feature 31 in that the surface is lower, and the space is enclosed; the interior area measures 8.25 m², and includes a greater proportion of water-worn basalt cobbles and pebbles, sandstone, red lava pebbles, as well as a coral saw. The back, southwest wall is a single course that includes a few slabs of *pāhoehoe* lava, an unusual construction material in cluster C. Feature 29, next along the high terrace, is the highest platform, and has on its 9.6 m²

surface a water-worn slab-lined hearth open to the northeast. As with feature 30, the back wall is a single course that includes some *pāhoehoe* slabs. The amount of midden, red and orange lava, and water-worn stone is greater here than the other features. Some calcium-encrusted basalt, a type of stone that is found in the pools by cluster B, is incorporated into the terrace facing at the front of this feature. Immediately to the northwest is feature 28, an enclosure whose surface is lower than the surrounding level. The 3.25 m² interior of this feature is covered with midden and pebbles. Unfortunately, the walls of feature 28 have tumbled inward for the most part, and it is not possible to determine their original height, although they appear to have been higher than the adjoining feature surfaces.

Extending out from the face of the large terrace and abutting features 28 and 29 is a high-walled, but small enclosure with an area of about 2.25 m². Collapse of the northwest wall is extensive, and the interior surface is not visible, having been obscured by tumbled stone. However, it is clear that the top of the wall is even with the terrace level, and that the enclosure appears to be a later addition. The shape of this feature is roughly semi-circular, and the squared corner depicted on the map is the result of a buttress on the eastern curve, rather than a corner. No entrance is evident, and the function is unclear.

The "back" side of the terrace features, toward the southwest, consists of a broad level area, feature 32, paved with pebbles and small cobbles—a surface essentially like that of the feature 26 yard. The edges of feature 32 are somewhat less clear, however, and seem to indicate something of the history of the site. For example, the boundary between this pavement and feature 29 is an alignment of stones that appears to rest atop the pavement surface, and the distinction from feature 30 is a matter of finer paving material on feature 32. A red lava boulder protruding above the surface north of a large boulder in line with the southeast end of feature 31 seems to mark the *mauka* edge of this surface. Features 34 and 35 rise higher than the paved surface, forming the back edge. A disturbed area with strewn boulders and a bedrock outcrop are all that separate features 32 and 39, with the lack of a continuous surface being the only distinguishing factor. The *makai* end of feature 32 has a substantial amount of midden, as does feature 39, which occurs at the same level and has a boulder terrace marking the *makai* edge. Below feature 39, feature 40 is a second terrace that is anchored on large natural boulders, and appears to be a supporting structure for feature 39, helping stabilize the slope rather than creating another activity surface.

Together, features 28–32 and 39 appear to form a core habitation area. Features 31, 32, and 39 appear to be general activity areas, with feature 29 a cooking area connected to them at the same level. The difference in surface cultural materials would suggest that the *makai* end was more heavily used, at least for food preparation and consumption. Features 27, 28, and 30, all enclosures with surfaces lower than the surrounding pavement, appear to be special activity areas. The intersections of walls, variation in construction materials, and degree of cultural deposition all seem to indicate at least two phases to the construction of this area. Features 28–30, all situated along the large terrace wall that forms their northeast sides, seem to have been the initial phase, although it is possible that the current surface of feature 29 may represent an augmentation of the original. The larger boulders and rougher stacking of feature 31 raises the possibility that it was a later addition, and feature 27 almost certainly was

added on to the existing terrace. It is not clear whether feature 32 was made during the first phase, since it is higher than features 28 and 30 (alternately, these may have been built lower at the same time, or excavated out later). It does appear, however, that the division between features 32 and 29, at least, occurred toward the end of occupation, since it exists only as a line of stones on top of the paved surface, and is very rough in its appearance. A trail leading *makai* from feature 32 cuts through the retaining terrace, and appears to be a post-abandonment phenomenon.

Mauka of features 32 and 39 are additional features, including a complex cupboard, terraces, enclosures, and cleared areas. Most of these exhibit roughly stacked or single stone facings and conform more to the natural distribution of large boulders than to a rectangular plan. Feature 35, for example, forms a substantial enclosure, but consists of several large accretionary boulders that appear to be in situ, augmented by alignments of smaller boulders forming the northwest and southeast walls, and a stacked, core-filled wall to the west. Much of the material used on the walls appears to have been cleared from the interior, an area of 15–17 m², such that a single activity resulted in construction of both wall and interior pavement. Abundant midden just inside the northeast wall, separated from the main interior area by a line of cobbles, shows variation in depositional patterns within this feature, suggesting differentiation in activity areas, or perhaps a specific disposal area within. The placement of the northwest wall boulders near the surface and incompleteness of their span is inconsistent with the rest of the feature, raising the possibility that they are a later addition.

Outside and to the south, feature 37 represents an even more pronounced expression of this simple clearing technique, consisting as it does of a 22.5 m² cleared central pavement surrounded by piled stones that lack any formally defined facings. A line of embedded small boulders running through feature 37 divides a pavement with pebbles to the west from one with mixed cobbles and pebbles to the east, showing that something more than minimal effort was put into the floor. Features 34 and 36 are two small terraces, each with a single course of stone defining its facing; these simply modify the naturally irregular terrain into two small, relatively level areas. Of the two, feature 34 has much more midden evident on the surface.

Feature 33, although it contains a relatively smaller volume of stone than the other features nearby, represents an ingenious construction feat. This 1 m high cupboard incorporates boulders in what appear to be their natural position, and through a combined approach of removing “interior” cobbles and stacking slabs and cobbles between the large boulders creates a roofed feature capable of holding a couple of adults or a cache of goods. The uneven interior surface contrasts with the pavements common at this site, suggesting storage rather than shelter as the primary function. Entry is possible from the north and east, and midden is relatively abundant surrounding each entrance, as well as inside the cupboard.

A few more features occur near a small trail spur passing *mauka* of features 33–37. Feature 43 is an enclosed clearing similar to feature 44, and measuring about 20 m² in area; the presence of smaller stones in both the pavement and wall reflect the type of material available in this vicinity, rather than a stylistic difference between this feature and feature 44. Farther *mauka*, a pit, feature 46, with a stacked and faced interior lining sits just east of the trail. Opposite this is a natural boulder that has been bashed extensively, revealing a deep red, ropy lava interior.

The *makai* portion of this cluster consists of a boulder-strewn knoll upon which sit numerous modifications, but few of the stacked walls or other more formal characteristics normally associated with features. The landform drops off precipitously to the east, north, and south, the latter being a ravine within the larger flow and the others being the edge of the flow. At the eastern extreme is a platform feature 20 that, although in poor condition now, clearly had a 3–4 course stacked perimeter of small boulders, with smaller stone fill. The form is commonly associated with burials, although its prominent location next to a well-used *mauka-makai* trail indicates additional or alternate significance as a trail marker for people coming in from the coast.

Modifications centered near a very large boulder west of feature 20 combine to form a wholesale alteration of the ground surface. The highest and most *makai* of these is feature 13, three areas covering a total of 11 m² of pebble and cobble pavement separated by embedded boulders. Midden and a coral abrader on the surface suggest general habitation and perhaps tool manufacture here, and the view of the ocean is excellent, enhancing the usefulness of this location as a lookout point.

Just behind feature 13 is a double-faced, core-filled wall section, feature 14, connecting natural boulders. Although the form is a wall, this construction does not create a windbreak, enclosure, or other type of feature, and it is possible that it is actually a burial feature; red rock is noticeably more abundant on feature 14 than on the surrounding features. Adjacent to feature 14 is a small cupboard, feature 16, formed by excavation beneath a boulder. Although the interior volume is not large, approximately 0.3 m³, the contents appear undisturbed, and include unburnt *kukui* endocarp, branch coral, a flat basalt beach cobble, and whole *wana* bodies without spines. Although *kukui* and *wana* figured in the diet of Hawaiians, the fact that both of these materials were intact shows that they had not been consumed, and the presence of branch coral indicates that this was a shrine. Other features in this vicinity, in particular features 15 and 17–19, exhibit cleared surfaces, but generally are not level, lack pebble paving, and have only a few pieces of shell midden and coral pebbles, suggesting a low level, if any, of habitation activity. They appear to be filled, and may contain human burials. The presence of branch coral here also indicates ritual significance, as may battered boulders where red rock is exposed.

An enigmatic feature at the base of this lava flow appears to be functionally related to features 13–20. Designated feature 83 (see vol. 2, map 3), it is entirely below the surrounding lava, and is in the form of an oblong open hole oriented along a *mauka-makai* axis. The 8 m² interior includes stacked facings, but some portions appear to be simply the undisturbed rocks left after removal of interior stones. The exterior ground surface is nearly level with the interior at the *makai* end, but a stacked wall blocks entry, extremely rough lava separates the feature from cluster A, and no trail is present in this direction. In contrast, a trail clearly leads from the *mauka* end of the open hole to feature 20 in Cluster C, and the pit is clearly visible from the large boulder and feature 13 there. Feature 83 most resembles a small canoe shed in size and shape, but is poorly situated for such a function. Relative to many features at this part of the Kākapa site, the labor invested in it is large, and so it would seem to be a significant part of the site. In what way it was significant, however, remains a mystery due to the lack of cultural deposition or analogous known features to provide clues.

A zone of unmodified lava 5–8 m wide separates features 13–19 from the next

area, which straddles a branched trail leading *makai* to cluster A. Feature 1, in fact, is a terrace that retains the surface of what appears to be the primary trail. One to three courses of boulders and cobbles form the facing, which ranges from formally stacked to barely modified slope; the surface is a mixture of pebbles, cobbles, and outcrop boulders.

Above and to the east of feature 1 is a line of natural and set boulders that form the edge of a pebble-cobble pavement, labeled feature 7. This level surface covers 19 m², has some shell midden, as well as water-worn basalt and coral pebbles, and may have been the floor of a habitation structure. One trail passes *mauka* and west, and another to the east, rather than passing through this otherwise clear area. At the *makai* end, feature 6 is a small mound that appears to have been built atop the feature 7 surface. Like feature 20, it is visible from below, and may be a trail marker. If feature 6 is a trail marker post-dating feature 7, then the eastern trail is probably more recent, and may in fact be a recent trail used by looters. Feature 10 is a similar faced mound opposite the trail from feature 6, and may also be a marker. However, its foundation goes beneath the surface of adjacent feature 9, a roughly circular, 2.5 m² pavement, indicating that this mound predates its neighboring pavement.

Feature 8 also yields evidence of change over time. A fairly simple terrace consisting of cobbles and boulders stacked between outcrop boulders, it appears to have been 8–10 m long originally, but the southern half has collapsed, apparently because the feature 1 trail passes through it. Like feature 7, or even the southern end of Feature 1, the southern end of this feature is large enough to have been a house floor, although it could simply be the edge of the feature 26 yard.

Features 11 and 12, both pebble and cobble pavements, occupy the brow of the ridge, and have excellent views of the ocean, similar to the one from feature 13. Other than a small area of stacking at the northeast corner, feature 12 is bounded by roughly piled stone lacking formal construction. Almost no cultural materials are evident on its 12 m² surface. Feature 11, bisected by an embedded boulder, is surrounded by boulders, although the degree to which these represent human modification rather than natural lava is debatable. The only cultural material observed here was a complete urchin body in a small cavity beneath one of the boulders, and a slab set upright on the *makai* side.

The ravine at the east side of this cluster has a few features within it and on the east side. Feature 2 is a rough, unfaced pit. Red rocks surround the opening, and a scoria abrader and water-worn coral and basalt cobbles are inside. Feature 3 is a small, 1 m², cleared area just below feature 1, with a pebble surface and a few pieces of shell. Features 4 and 5 are large cupboards with small amounts of stone placed amid natural boulders to augment the roofs. Each has a few pieces of shell and water-worn basalt and coral inside, but neither has much of a deposit, or enough room for a person to fit inside comfortably.

Opposite the ravine, feature 42 is a natural overhang shelter with some evidence of interior midden and an exterior retaining wall. However, the feature is used by goats, and is very disturbed. About 5 m *mauka* of this, feature 41 appears to be a looted burial crypt. Although open to the surface now, remnants of a roof and collapsed stones suggest that the entire feature, 1.5 m² in area, and 0.9 m high, was roofed at one time. Although this feature is close to cluster C, a trail leads from this feature toward the

cluster F *heiau* complex to the south.

Finally at cluster C is an outlying *ahu*, feature 38, consisting of a large, flat-topped boulder with a 0.3 m high enclosure wall of cobbles stacked around the top edge. Inside these, the surface of the boulder is extensively battered, revealing ropy, red lava. Some of this material is among the pebbles and cobbles that surround the base of this 1.3 m high boulder, the perimeter of which has been cleared of large stones. A trail beginning at feature 41 connects this feature to the *heiau* complex, indicating a closer functional relationship with that cluster than with cluster C.

Mauka of cluster C are numerous additional features that extend well beyond the project area. These are marked as "graves" on the USGS Makalawena quadrangle map. A cluster of features straddles the *mauka-makai* trail (Sinoto and Pantaleo 1990), and is apparently the core of a burial area known to local Hawaiians. In addition to the recorded features are more subtle modifications, such as very small pits, clearings, and filled cracks. These probably contain burials, and it is possible that some such features exist within the project area, difficult to discern and impossible to confirm without dismantling and exposing any burials.

Cluster C clearly has habitation components, and may represent a set of two households occupying opposite ends of the central courtyard. Situated on a bluff overlooking Kākapa Bay, the location would suit a *heiau*, but the amount of midden and the feature forms appear to be more consistent with a sustained residential function. Evidence suggesting ritual significance occurs only in a few features, suggesting family level activity, and contrasting with the extensive ritual precinct developed in cluster F. Additional testing would be required to determine particular functions of features and areas within cluster C, but the large number of features, the network of trails and peripheral features extending into the surrounding lava, the high degree of land form modification, and the evidence of multiple construction phases all appear to indicate a long term domestic function.

Cluster D: Rough *Pāhoehoe Kauhale*

North of the smooth lava traversed by site 16059, a much rougher flow rises. A series of trails runs through this broken terrain, connecting what appears to be a *kauhale* cluster with a shrine and cairns that probably mark the boundary between Kūki'o 1st and 2nd. The new beach access road and parking lot for the Kīkaua Point portion of Kekaha Kai State Park marks the northeast edge of the site, having been built in Kūki'o 1st *ahupua'a*.

The features forming the probable *kauhale* cover approximately 550 m² at the *makai* edge of the lava flow and the *mauka* edge of the beach (vol. 2, map 7). This proximity to the beach has resulted in wave damage to two terraces that appear to have been the features with the largest surface areas. Feature 218, now only 3.8 m long, would have created a level surface of 20–28 m², depending on its original size, and has a substantial midden deposit on its surface now. Feature 219, a terrace platform in slightly better condition with stacked boulder facing on the *makai* and south sides, would have an area of slightly over 20 m², and is also covered with midden. It is uncertain whether either or both ever had a pole and thatch structure, or were simply *lanai* terraces.

Immediately *mauka* of feature 219 is a heavily damaged structure, feature 220, whose original form is difficult to discern. Because the inland portion has sustained the most damage, and midden is heaped on the surface, it appears that feature 220 was dismantled, possibly by looters breaking open feature 221, a deep pit. The front of feature 220, a stacked stone terrace facing 50 cm high, remains relatively intact. *Mauka* of feature 221 is a cleared area with cobble paving covering about 8 m², feature 223. Adjacent to this, a mound of stones, feature 222, built on higher lava rises well above the surrounding landscape and features. Proximity to the modern boundary between Kūki'o 1st and Kūki'o 2nd *ahupua'a* hints at a boundary function, but this feature does not line up with the other boundary cairns, features 182 and 203. Therefore, feature 222 may represent a different alignment, a meandering boundary, or some other function entirely.

North of feature 220, also on the first lava shelf above the beach, is a C-shape enclosure, feature 217, with a midden-covered interior area of just over 4 m², and a small cupboard at the interior base of the east wall. The back, south wall is massive, nearly 1 m tall and more than 1.5 m thick at the base. The northernmost feature of the cluster is another C-shape enclosure, feature 216. This is the most massive stone construction in cluster D, and is in fair condition, clearly retaining a box-shaped plan opening *makai*, with a low boulder terrace across the front raising the 8–9 m² sand and midden floor 30 cm above the beach. Two stone alignments border a short trail from the opening to the beach. At the back of the feature, a 5 m² cobble-paved clearing is adjacent to a large pit, feature 214, broken through the *pahoehoe*.

This pit, along with two other relatively large pits, features 211 and 212, *mauka* of feature 217, and several smaller pits farther *mauka*, features 206-210, show repeated instances of breaking through the *pāhoehoe* crust to gain access to open spaces below. No cave large enough to occupy seems to be connected to these pits, and their function remains unclear. The largest ones occur adjacent to the C-shape enclosures on the surface, and in a general sense, must be related to habitation, perhaps serving as storage or refuse containers, and likely contributing stone for feature construction. Given the density of features here and the low elevation, it is also conceivable that they could have provided access to fresh water. The small pits could easily have held house posts, but the ground surface in the vicinity is rough and unpaved; wooden images may also have been placed here, although there is no evidence to support this interpretation. A faint trail heads inland from this concentration of pits, but quickly fades into the rough lava.

Another trail, feature 204.1, connects features 220 and 204, the latter being a 9.5 m² clearing amid the lava, paved with cobbles and containing several water-worn basalt cobbles. From the interior of the northwest corner, a cupboard, feature 204.2, extends nearly a meter below one of the boulders. An opening through the northeast corner provides access to feature 205, a 6 m² clearing with a rougher surface than feature 204. Like feature 204, feature 205 has some water-worn basalt cobbles on the interior surface, and it has two cupboards, each under a large boulder. Immediately to the south is another roughly paved clearing, feature 203.1, covering 4 m² at the base of a large mound, feature 203, constructed on a high outcrop. Feature 203 appears to be on the boundary between Kūki'o 1st and 2nd *ahupua'a*. A trail cleared through the lava, feature 203.2, goes around this outcrop, and also connects features 204 and 205 with a

concentration of pits, features 195–198, to the south, after passing between a cupboard and three pits, features 199–202.

Pit features 199–202, being on the margin of a habitation area and adjacent to an *ahupua'a* marker, seem to be associated with one or the other of those functions. Given their location, it is quite likely that stone broken to make the pits was used in constructing feature 203. Pits to the south of this, however, seem to have more in common with those found in sites 50–10–18–5338 and –16059, since they cluster near a trail, but have no clear indication of function.

Beginning from the smooth *pāhoehoe* flow of site 50–10–18–16059, a nicely constructed trail, feature 188.1, with *pāhoehoe* slab stepping stones ascends the flow and terminates at feature 188, a shrine consisting of a wall abutting the base of a prominent boulder and enclosing a pavement with four water-worn basalt uprights (fig. 18). Branching westward from this trail, a much rougher trail, feature 193.1, cleared with only intermittent stepping stones, passes two pits, features 192 and 194, before fading out just past feature 193, a roughly cleared pavement covering 14 m². Just south of this surface, feature 191 is another roughly paved area bounded by broken *pāhoehoe*, the exposed northern edge of which provides access to three small lava tubes, features 191.1–3, and a pit, feature 190. A small cairn, feature 189, marks this location, one of the few pit areas where stones appear to have been taken away. It appears that feature 191 was a large lava blister whose surface was broken up, perhaps providing the slabs used to pave the trail to the shrine.

East of the shrine, another concentration of pits, features 183–187, occurs on an outcrop where another boundary marker, feature 182, sits atop a prominent rise. These also appear to be quarry pits, with stone taken away to form the mound. In a similar vein, a cluster of pits, features 195–198, next to a short section of slab-paved trail, feature 195.1, seems to indicate another episode of quarrying stone for local use. Much less clear, however, is why there would be a nicely constructed trail segment there in the first place. One terminus is clearly the pit concentration, but the east end simply fades into the lava. Looking at the site map, it is plausible to conclude that because the trail ends between the two boundary markers, features 182 and 203, that another such *ahu* was to have been constructed here, or was built and then dismantled.

Finally, two features to the southeast of feature 182 are even more enigmatic. One, feature 225, is a pit like many other pits of undetermined function that dot the entire project area. The other, feature 224, however, does not resemble other features. A large, 2.5 m by 1.5 m, *pāhoehoe* slab that is much smoother and flatter than any surrounding natural stone, and therefore apparently introduced to this location with great effort, is bordered on the west side by a narrow pavement of fairly well-fitted *pāhoehoe* slabs. A faint trail with almost no *pāhoehoe* stepping stones leads to the northeast, where it has been truncated by the new access road. No midden or artifacts are present, and it is not possible to squeeze a reliable interpretation out of the available evidence. Although feature 224 does not lie within a major feature complex, or close to any apparent resources, Hawaiians clearly invested both labor and careful technique in its construction, although the question of whether the boulder was rafted in naturally on the *'a'a* flow or was placed there by Hawaiians remains open.

Cluster D represents another household cluster, somewhat smaller in scale than clusters A–C on the opposite side of trail site 50–10–18–16059. The smaller features



Figure 18. Shrine feature 188, site 50-10-18-23355; looking east. Note the perforated lava slab behind the enclosure and mound feature 182 on the boulder in the rear. Hualālai is in the background. The scale is marked in 10 cm increments.

may simply reflect the constraints of the landscape, a very rough lava flow, with platy *pāhoehoe* and jagged clinkers that would be difficult to work with. Still, the cluster does have peripheral features extending into the *mauka* lava. In addition to the shrine, cairns appear to be boundary markers between Kūki'o 1st and 2nd; with these functions, they may not be closely related to the activity of the *kauhale*, which is firmly oriented to the ocean. Proximity of the household to the border indicates that in this case no uninhabited buffer between the *ahupua'a* existed, as one might expect between *ahupua'a* that share the same name. Although not a massive site, the degree of labor invested in making pits and paving trails, as well as the accumulation of midden, seem to indicate that this site had repeated, if not sustained, occupation.



Figure 19. Feature 224, site 50-10-18-23355, looking west. Note mound feature 182 on the boulder in the top of the photograph. The scale is marked in 10 cm increments.

Cluster E: Remnant North Side *Kauhale*

Toward Kīkaia Point, a few last features lie between cluster D and the northern project area boundary. Perched on the coastal *pāhoehoe* closer to the point, these features are not protected by a bay and beach, and therefore have been much more drastically impacted by tsunami and storms. Enough remains, however, to indicate that another *kauhale* cluster may have occurred at the northernmost extreme of Kūki'o 2nd.

The primary indicator of this is a series of remnant features in the narrow coastal bench between the high water mark and a later lava flow rising three meters and more on the *mauka* side (fig. 20). The largest of these features, a remnant enclosure, feature 226, is bounded on the *mauka* side by a retaining wall built into the base of the higher flow. At the southern end of this terrace, a massive core-filled wall juts out to the southwest for 8 m before turning toward the coast. Unfortunately, it is here that the site becomes difficult to follow, and it is uncertain how much longer the wall may have been, and what relationship it bore to other features. Features 226.1 and 226.2 appear to be remnants of an enclosure and a platform, respectively. The former may have been

features would be a large-scale removal of wave-deposited cobbles, an undertaking that could also reveal that the walls and foundations have been obliterated.

Farther north, several modifications surround an outcrop of the higher flow. At the *makai* edge, feature 245 is a wall segment beginning at a large boulder and heading *makai* for just 2 m before collapsing into the cobble beach. A slight rise in the beach *makai* of this could be the badly collapsed remnant of a structure, but was not assigned a feature number. Continuing *mauka* from the large boulder, feature 246 is a wall that splits to become a very small enclosure with cobble fill that does not reach quite as high as the surrounding stacked perimeter. After another boulder intervenes, feature 247 is an area of cobble fill with a wall on the eastern edge, and then feature 248 is a rough mound of stones. Together, these features present yet another enigmatic concentration at Kākapa Bay. Based on size and form, they could easily be burials, but the location—so close to the shore—is not typical, and raises doubts as to the antiquity of these features, given that a severe tsunami hit the coast in 1946. Without dismantling the features, however, it is not possible to discount the possibility that they were protected from damage by the outcrop, and that they are indeed ancient. Feature 149, a cave under the large boulder with a pavement outside of the entry, is protected from the direct impact of waves, and probably is an old cupboard, or possibly a shrine.

Cluster E probably represents another habitation cluster, but wave damage makes it difficult to discern the extent of its features. With an apparently unmodified lava flow rising immediately *mauka*, the cluster does differ from others in not having a *mauka* periphery. The large enclosure wall epitomizes a tendency observed throughout the project area for use of local materials. The *makai* edge has numerous water-worn stones from the beach, while the *mauka* retaining wall has none, consisting entirely of the rough lava from the immediate vicinity. The presence of a large enclosure, rather than smaller C-shapes and enclosures along with platforms, may signal that this cluster belongs to a later period, when *kauhale* were walled in to keep out animals, or perhaps could indicate that the feature was rebuilt to hold animals, such as the donkeys used for moving goods along the coast and to the *mauka* agricultural lands.

Cluster F: *Heiau* Complex

At the south end of Kākapa Bay is a small bight referred to during this project as the “Heiau Bay,” since the crescent of cobble beach here is dominated by a *heiau*. This structure, recorded as site 113 by Reinecke (1930) and 50-Ha-D21-32 by Cordy (1981), does not have a recorded name. Its history is known from a field survey notebook written by J. S. Emerson in 1882, which notes that it is “one of Kamehameha’s old ‘heiaus’ now destroyed by the sea” (Maly 1998:34). Its location is somewhat unusual, being on low ground behind the beach berm; thus surrounded by higher beach and lava flow, the ground around the *heiau* occupies a hot, windless hollow. Other than a small notch at the east corner, probably to work around an impinging outcrop, rather than some stylistic mandate, the feature is rectangular (vol. 2, map 9). The long axis being 45° east of magnetic north, this *heiau* is oriented so that it is more or less parallel to the local shoreline. Although some outcroppings are incorporated into the foundation, the structure is remarkable for its rectilinearity and nicely stacked courses of stone. Moreover, the quality of stone used in the facings is fairly high, it being *pāhoehoe* broken into blocks

and slabs generally 50 to 100 cm in length, and of fairly consistent thickness. Although not the fully dressed stone typical in Western architecture, the appearance of this stone is decidedly more rectangular and blocky than usual in Hawaiian architecture.

Unfortunately, the front of this feature has been damaged by waves, and possibly by removal of stone for use elsewhere. A trench along the makai face and the appearance of some upper courses suggest an attempt at renovation in the recent past, but the job is far from complete, and it is not certain that all the materials from the original face remain. Where the pavement is gone, the overall construction methodology is visible. The platform fill consists of boulders and cobbles; although excavation was not attempted, it appears that many hollows are included in this fill, although they appear less regular than the more formal *pao* style of construction. The fill was then covered with 'a'a slabs and flat water-worn stones, and finally the interstices were filled with water-worn basalt and coral cobbles and pebbles. Branch coral is scattered on the surface from end to end. Pits, features 229.1-5, ranging from 0.25 to about 1.25 m² in area, and 20-60 cm deep occur on the southwestern half of the platform. The smaller ones would support wooden images or posts for construction, and the larger ones could be for disposal of offerings; it is possible that a careful exploration of the somewhat disturbed surface could uncover more pits. A double-faced, core-filled wall more than a meter above the pavement is obvious on the *mauka* side, but the sides are either very collapsed or never were higher than the platform. Double facings and core fill are obvious on the southwest wall, but cannot be discerned at the opposite end.

Outside the *heiau* itself, the current ground surface consists of storm or tsunami deposited beach cobbles on the makai side and a talus slope from the *mauka* 'a'a flow. North and east of the *heiau*, there appears to be a layer of water-worn cobbles beneath the loose surface material, hinting at the presence of a paved courtyard; excavation might determine its presence and extent. Possible modifications may occur along the lava flow slope, but are very subtle and/or heavily damaged, and only definite features are reported here. In an outcrop forming part of the southwest wall foundation, a small, natural cave, feature 229.6, forms a cupboard containing a piece of branch coral. On the slope behind the *heiau*, feature 230 is a rough terrace whose facing is a roughly even mix of 'a'a and water-worn basalt. Approximately 25 m² of pebble paved surface remains, although more may have been present prior to facing collapse and colluvial deposition from above, marked with occasional pieces of branch coral. At the back edge of the terrace, feature 230.1 is a cave, just 60 cm high, but having about 3 m² of interior area, a terrace alignment in front, and containing a coral abrader, water-worn basalt, and midden.

Cluster F encompasses not just the *heiau*, but 90 more features surrounding it on the high 'a'a bluff that juts out to form the south tip of Heiau Bay and wraps around the platform in a formation resembling a rough amphitheater. One of the larger clusters in the project area, cluster F subsumes several concentrations of features that could be treated as functional units, but is reported here because the overall conglomeration appears related to the *heiau*, and to the two major trails that traverse the area. The degree of overlap between habitations, shrines, and trails would result in odd boundaries were cluster F to be subdivided, and although one or more *kauhale* may be present, it is not easy to tease out such units without contorted descriptions and possibly distorted conclusions.

That said, the northernmost portion of cluster F seems to offer the most promising location for habitation that may not be as closely related to the *heiau* as are the other locations in the cluster (vol. 2, map 11). Here, the lava flow juts out toward the ocean, forming a rocky point much different in character than the water-worn cobble surface around the *heiau*. The coastal trail follows the base of the steeper portion of the flow, and passes by feature 234, a natural boulder beneath which an excavated cave forms a habitable shelter, and in front of which is a paved *lānai*. Although this has been completely looted, the remaining piles of midden, charcoal, and volcanic glass indicate habitation activity, and absence of upright stones or branch coral would indicate against interpreting this as a part of the ritual complex. Five meters to the east, two C-shape enclosures and a terrace, features 235, 236.1, and 236, respectively, combine to form a complex structure where a deposit of similar materials is evident. At the beginning of the cobble beach below, there appears to be a basalt and coral pavement, but it is buried by similar wave-deposited materials, and could be part of the *heiau* courtyard, rather than a habitation surface. *Makai* of the coast trail, feature 231, a small, crudely constructed C-shape enclosure that appears to be a temporary shelter for travelers and fishermen, and two pits, features 232 and 233 occur near the trail (fig. 21). Like these, it appears that features 234-236 are not part of the ritual precinct of the *heiau*, and more likely represent habitation areas used by people visiting this coast. It may be possible that the structures on the slope represent permanent habitation, but the Hawaiian practice of having *o'io'ina* by major trails seems to be illustrated here.

o'io'ina

At the extreme *makai* edge of the cluster, feature 367 is the back end of a U-shape enclosure constructed mostly of 'a'ā whose original size is unknown (fig. 21). The outer facing and ends of walls have collapsed, but this once was a substantial feature. The interior facing is in much better condition than outside, and somewhat squared. Located at the north end of the *heiau* bay, the structure opens toward the cobble beach at an angle, neither directly *makai* nor parallel to the shore. Its location and shape indicate a *hālau*. Although the scale of the feature seems consistent with the *heiau* nearby, the placement is at the periphery of the *heiau* complex, where it likely represents the terminus of the ocean route to the *heiau*.

Feature 238, another terrace located just above, also has a deposit of sand and midden, and could be part of this habitation area. However, this feature is on the opposite side of the lava ridge, sloping down toward the *heiau*, rather than to the trail and ocean and incorporates a large red boulder and a conspicuous *ahu*. The *ahu*, a high platform with stacked stone facing and a modern addition of water-worn coral veneer has been interpreted as a burial, is consistent with high-status examples of that function, and regardless of function is a prominent feature of the *heiau* landscape. Contiguous with this, a large, but partially collapsed terrace, feature 239, more than 20 m² in area, incorporates an upright stone, and has a smaller attached pavement, feature 241, and deeply-excavated cupboard, feature 240. Next to this on the south, feature 250 is a partially collapsed terrace with an enclosed upper surface and a substantial interior area of just over 20 m². A branch of the main *mauka-makai* trail, feature 10 of site 50-10-18-5337, passes just down slope of this terrace on its final descent to the coast next to the *heiau*. Certainly, it is possible that one or more of features 234-236 are components of this trail, but the placement east of and orientation toward the *heiau* suggests that this *kauhale* would have been occupied by priests or chiefs. Likewise, the

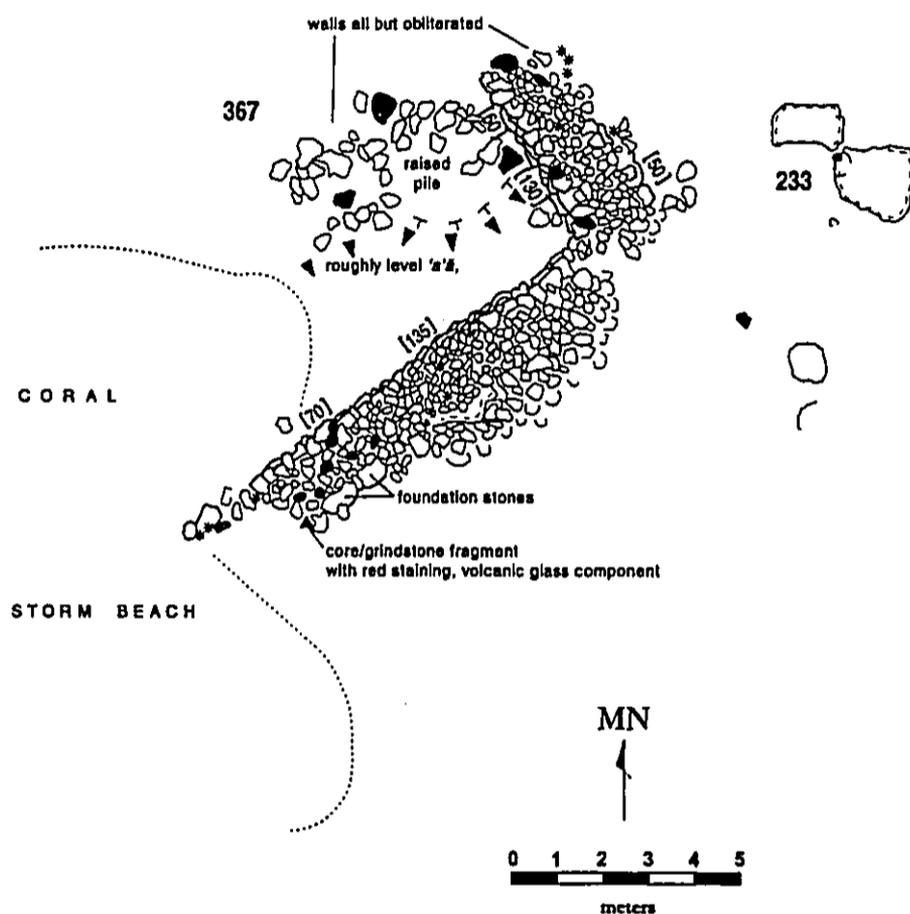


Figure 21. Plan map of site 50-10-18-23355, features 233 and 367. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

elevation of these features above those by the trail speaks of a higher status in Hawaiian settlement space.

Feature 250 also occupies a nexus of trails. Site 50-10-18-5337, feature 10 passes just *makai* on its ascent from the *heiau* through the complex of shrines above, and feature 9 of the trail strikes out toward features 38 and 41. Feature 9, although a branch of the main trail, has a nice alignment of water-worn stepping stones nearly the entire distance to feature 38, and is more nicely cleared and constructed than many portions of the main trail. It heads nearly due east from feature 250, passing an immense boulder, feature 254, bashed to reveal ropy, red lava, surrounded by a small enclosed clearing, feature 255, and several pits, features 254.1, 254.2, 256, and 257, and several other unmodified but prominent boulders and formations along the way.

Amid the 'a'ā makai of this trail, several other features interrupt the jagged landscape. Most prominent is feature 258, a faced platform very similar in appearance to feature 237, although slightly smaller. Immediately to the southwest, the surface has been modified, but boundaries blend into the surrounding landscape, and no feature was designated. This pattern occurs throughout cluster F, and there appear to be few areas that are completely unmodified. About 8 m east of feature 258 is a more formally defined clearing, feature 244, which has a 7 m² pavement surrounded by an alignment of cobbles. To the north and east are isolated areas where boulders and outcrops have been hammered to reveal ropy, red lava. Ten meters south of feature 258, a concentration of water-worn coral and basalt, as well as some branch coral, indicate some significance to a pair of boulders there, designated feature 242.

The area south of the trail, feature 9, has a scattering of features and modifications surrounding prominent boulders, among them the previously mentioned features 254–257. A few meters west of this, feature 252 consists of a terrace whose surface inclines down to the north, and whose facing incorporates a series of boulders. To the south, a large boulder, feature 253, has been extensively hammered to expose the ropy, red lava, and producing several large blocks and abundant gravel of the red stone. A heavy 'alā hammerstone lies at the boulder's base.

Farther south, two large boulders, features 263 and 265, have been hammered so intensively that chunks exceeding a meter in length have cleaved away (vol. 2, map 12). The northeast and southwest ends of feature 265, a 3 m high boulder now 5 m long, have been modified into vertical faces of ropy, red interior, and the latter has a faced pit, feature 264, against its base. Inside the pit are red rock fragments. The exposed top of this boulder has been hammered down less deeply, revealing layers of cortex that appear to have been used as abraders. South of this, a roughly leveled cobble surface, feature 263.1, is bordered by 'a'ā boulder berm to the west and another battered red face, feature 263. This area is more heavily hammered than most, and the large number of fragments makes it hard to tell whether red lava or abraders have been removed. In the context of a sacred site, it seems unlikely that, if quarried, this stone was available for general use, and the large exposure of red interior stone may be more important than production of abraders.

Just a few meters to the southeast, but unconnected by a trail, feature 260 presents yet another battered outcrop, this time exposing red and black stone. The boulder itself stands 2 m above the surrounding terrain, and is flanked by two deep pits, features 259 and 261. Adjacent to these features is an unmodified boulder, under which a cupboard, feature 262, has been made by excavating beneath the boulder and stacking a stone lining to the exposed pit.

A branch of the main mauka-makai trail, site 50–10–18–5337, feature 10, cuts a nicely-paved, in places terraced, swath through cluster F, and is flanked by a dense cluster of shrine features. Feature 273 is a large pit adjacent to the trail, and although the absence of offerings and rough construction make it difficult to determine whether this functioned as part of the shrine, it is included in the complex due to its proximity. Makai of this, the trail, site 50–10–18–5337, feature 10, passes between a split boulder, and then changes from a surface of pahoehoe slabs to a pebble and cobble paved terrace. This pebble and cobble paved branch of the trail is designated feature 274. The south end of this feature is more of an enclosure than a terrace, with a 30–80 cm tall alignment

of small boulders surrounding pebble pavement. A red boulder punctuates the north end of feature 274.

Down slope from this causeway, two large boulders with hammered red faces anchor several shrine features. The first *pōhaku*, feature 275, rises nearly 3 m tall, and has a 3 m wide vertical face of exposed, ropy, red lava. At the base of this, feature 276 is a triangular enclosure bounded by features 274 and 275, and a stacked wall on the north. In the northwest corner of the enclosure, a niche holds a single 'alā stone upright. Opposite the north wall of feature 276 is feature 277, a terrace at a middle level between features 274 and 278.1; it is paved with cobbles and pebbles, and although an 'alā stone is present, it is not upright. Several similar stones lie within feature 278.1, a 70 cm deep pit sharing the same shape and orientation as feature 276; it also has a battered boulder face, feature 278, an impressive upright boulder 4 m tall, forming its southeast side. The 'alā stones in this pit, although not all upright, share the form of stones found in shrines at Kākapa.

Passing *makai* of features 277 and 278 is a branch of site 50-10-18-5337, feature 14, which leads to feature 270, another large *pōhaku* with shrines at the base (fig. 22). No single, massive face has been hammered from this 3 m high boulder, but three sides have red exposures, and a shelf has been hollowed out high on the *makai* side. Below this shelf, a square enclosure, feature 269, houses two 'alā stones on a pebble floor; to either side on the boulder are red exposures and on the ground coral cobbles. On the south side, feature 271 consists of an overhang hammered out of the *pōhaku*, with stacked walls extending outward on either side and a pebble paved floor. Inside is a water-worn 'alā upright. Less than 2 m from the open front of feature 271 is a narrow, 80 cm deep pit with two coral and one basalt water-worn cobbles. Several more coral cobbles occur in the lava surrounding feature 270.



Figure 22. Features 269 and 270, site 50-10-18-23355, panorama looking east. The scale is marked in 10 cm increments.

The northern segment of the shrine complex is surrounded by branches of trail site 50-10-18-5337, with feature 14 on the south and west, and feature 15 wrapping from north to east to southeast before again merging with feature 14. One large *pōhaku* occurs within this loop, but it has not been hammered. Between this boulder and a much smaller one to the south, the northern half, feature 267.1, is cobble-filled, and the southern half is a nicely faced pit, feature 267, the south end of which is overhung by the boulder. Both features are rectangular, and are defined on the east edge by a continuous alignment of small, embedded boulders. Southeast of the pit, feature 268 consists of a cobble and pebble pavement surrounded by rough walls. The best defined section of stacking corresponds with trail feature 15, and the remainder represents what was cleared out of the pavement.

On the ground, the shrine complex is a procession through a landscape of huge boulders hammered to reveal their red interiors, each one with a shrine at the base. Neat little enclosures house the 'alā stones, and trails meander among them. From the bird's eye view of the mapper, a pattern emerges in this tight cluster of features. The shared orientation and triangular shape of features 276 and 278.1, similarities already noted, are replicated on a larger scale. These two features along with feature 277 form a larger version of the same triangle with feature 274 as the west side. At this scale, the inherently wavering lines of stone features are evened out a bit, and the shape becomes a right triangle whose other angles are 25 and 65 degrees, and whose hypotenuse is oriented to 30 degrees east of magnetic north. Extending the base and hypotenuse, features 267 and 268 are in tolerable position to be vertices of an even larger, congruent triangle. Further still, the battered faces of features 265 and 263 are in good position to be a vertex at the end of a 25 m hypotenuse. Replication of triangles, especially at the smaller scales, could be the unintended result of constraints imposed by the boulder locations and a need for feature 274 to follow this particular course. Knowing the site chronology here is crucial, in that a construction sequence beginning with feature 274 and expanding eastward would mean that triangles are the "leftover" spaces resulting when the linear trail and terrace, feature 277, meets with the oblique boulder faces. Alternatively, if the feature 275 and 278 boulder faces and shrine compartments beneath them are the original core of the cluster, replication of triangles at larger scales seems to be an intentional design. What it meant to the devotees of these shrines, however, is information not accessible through archaeology.

Several features west of the causeway trail also appear related to the shrine complex. Feature 279 is a 2 m high boulder whose *mauka* face is heavily battered, and atop which is a small mound of cobbles. Surrounding the *pōhaku* on all sides is an enclosed pavement, feature 279.1, with two terraces, features 279.2 and 279.3, forming steps that ascend south and east back to the trail. Just west of this complex of features is another boulder, feature 280, with a hammered red *mauka* face, beneath which is a roughly cleared pit, feature 280.1. North of the boulder, feature 289 is a small, roughly triangular cobble pavement. A pit, feature 281, at the base of a larger boulder to the northwest contains several water-worn coral cobbles.

Following the trail, feature 10, *makai* from the shrine complex, a band of unmodified lava is followed by a 12 m² pavement, feature 266, surrounded by a discontinuous alignment of boulders and large cobbles—another example of stones cleared from a pavement forming the "enclosure" around it. Given the presence of cowry shell on the

surface, the rough construction, and the intervening rough terrain, this is not considered a part of the shrine complex, although its isolation from other habitation features suggests it could occupy a sort of liminal function. The feature 10 trail turns right, roughly east, behind feature 266, but becomes indistinct within a few meters.

Branching north from the main trail, feature 13 passes *makai* of feature 266 and disappears down the slope. Just 7 m from its departure from the main trail, another branch, feature 12, cuts *makai* from feature 13, traveling the perimeter of several habitation features. These occupy the brow of the flow from the beginning of the slope to where it becomes very steep. Several natural overhang shelters here have been augmented by additional excavation and by constructing terraces and walls in front of the openings. Unfortunately, looting here has been extensive, not only removing the cultural deposits, but apparently dismantling and rearranging features as well. So the largest cave, feature 296, now opens onto an exposed outcrop where rough piles of stone and a berm, feature 300, are all that remain of what was probably a nicely terraced *lānai*. One terrace, feature 298, appears to be in good shape, but an adjacent natural overhang, feature 299, appears to be a disturbed remnant of a modified cupboard. Feature 301, an L-shaped segment of wall, appears to have been a larger feature, perhaps connected to feature 303, a partial enclosure oriented in the opposite direction. A *papamū*, abundant midden, and an upright stone testify to a mix of habitation and sacred activity at this location. Just to the west, another cave, feature 306, too small for habitation nonetheless functioned as a cupboard, containing several scoria abraders. Behind the habitation features, a couple of pits, features 293 and 294, and some cleared and filled areas, atop feature 303 and feature 297, appear to be activity areas, or possibly burials. Rising above all of these features, boulder feature 295 has a 2 m high exposed red face on the *makai* side, a deeply hammered indentation on the *mauka* side, and a pile of cobbles on top. About 10 m southwest, where the main trail nears the habitation concentration, feature 291 is an immense boulder, more than 5 m long and 3 m high, with a northeastern face that has been hammered flat to expose the red interior. *Makai* of this boulder, a cobble pavement, feature 292, covers 10–12 m². On the *mauka* side, a squarish alignment of boulders surrounds an approximately 5 m² cobble and pebble pavement, feature 291.1.

Together, these features show that Heiau Bay was a substantial neighborhood within the Kākapa Bay settlement. Set off from the other *kauhale*, cluster F stands apart with its shrines and *heiau*, yet is intimately connected to the community through a network of trails. It is important enough to be the terminus of a major *mauka-makai* trail that leads directly to it. Because this trail meets the coastal *alaloa*, cluster F also represents something of a hub in the ancient transportation system, a further link to which is signaled by the canoe shed. It is possible that habitation features at the northeast end of cluster F were used by travelers, rather than as permanent residence of a particular family. Less equivocally, cluster F was the religious neighborhood of its time. Besides the *heiau*, numerous shrines surround boulders on the lava flow above, exposing the red insides of the stone, protecting 'alā stone uprights, and standing tall on the horizon. The quality of workmanship evident in the shrines and trails through this area is outstanding. Habitation features inland of those by the coastal trail line the edge of the lava flow above the *heiau*, and must have been occupied by the priesthood. It is possible that the habitation caves and features immediately *mauka* of the *heiau* represented

alaloa

a second, distinct habitation area.

Cluster G: South Heiau Bay *Kauhale*

At the southwest end of Heiau Bay, the final cluster of site 50-10-18-23355, features represents another habitation area. It is possible that two *kauhale* are present, given that there are concentrations of features at the north and south ends of cluster G, but difficulty in determining what exactly was the nature of occupation in the intervening space makes it impossible to rule out a single, larger *kauhale*. Regardless, the *makai* orientation of this area is clear, with the underwater formations extending west from Pāpiha Point being visited frequently by fishermen to this day, and a cobble beach landing a few meters from the site.

The southern portion of cluster G begins on a low ridge rising above the beach cobble surface of Heiau Bay to the east, and the broad, relatively flat flow of Pāpiha Point to the west and north. Here, a boxy C-shape enclosure, feature 309, sits atop a larger terrace, feature 310 that forms a *lānai* and courtyard wrapping around the northeast and *makai* sides (vol. 2, map 22). The inland route from Kākapa to Manini'ōwali Bay along trail site 50-10-18-23360 passes *makai* of the ridge, and through the southern features. Along the Heiau Bay side of the cluster, feature 318 is the remnant of what was a long terrace retaining the entire upper edge of the lava flow, possibly connecting to feature 321. The original route of trail site 50-10-18-23360 descended from the flow to the beach cobbles *mauka* of the current beach crest at Heiau Bay, as evidenced by an abandoned alignment of water-worn basalt slabs. To the right of this trail, feature 316 is an enclosure formed by stacking stones between several large boulders, one of which is a vivid red color; with a rough interior and no entry, it would appear that this was an animal pen, rather than a human habitation feature. A cupboard, feature 317, was found hollowed out beneath one of the boulders here. Farther *mauka* along the lava flow slope, additional minor modifications occur.

Opposite the trail, several other features also appear around outcrops and large boulders. Feature 314, an enclosure whose 7 m² interior is below ground surface, makes use of a large boulder for one wall, a nicely made core-filled wall on another side, and a stacked facing on the other. The boulder also creates a shelter used as a cupboard, feature 315, and has been battered to reveal red interior stone. South of this, feature 311 is a depression, roughly walled on the west and faced on the south, whose function is unclear, given its uneven, sloping interior. Amid the otherwise unmodified flow to the west, feature 312 is a small mound, and feature 313 is a pit.

Straddling the trail north of feature 314, a few features may indicate that the "empty" middle area between the northern and southern feature concentrations of cluster F may not be so empty. As mentioned before, feature 321 is a terrace along the outside edge of the lava flow. The trail traverses its surface from north to south, and on the opposite side lies feature 319, a section of stacked stone terrace facing. Because features 319 and 321 are similarly oriented, and share the same elevation, it is possible that they form opposite faces of a platform. This section of trail is a modern route and may simply have taken advantage of a feature with a flat surface.

The northern portion of cluster G consists of several paved areas and shelters on a lava point above the shoreline. The largest of these, feature 326, is terraced on three

sides, and blends into an outcrop on the east; the facings make use of round accretional boulders, especially in the south wall, where large, greater than 1 m diameter, boulders form the foundation. At the southeast corner of this feature, a smaller platform, feature 323, rises above the surroundings; its small surface is covered with 'ili'ili, coral, cobbles, and a single water-worn basalt stone. Two meters west of this on the surface of feature 326 are clues to the internal structure. Two pits, features 324 and 325, flank a large red boulder embedded in the surface. Pit feature 325 seems to be excavated after abandonment, and reveals a stratum of water-worn basalt stones about 20 cm below surface; these might be a buried pavement. Beneath this level, both pits show that the foundation of feature 326 is a mixture of boulders and cobbles with open spaces. Concentrations of 'ili'ili and coral pebbles show that there was an upper level of fine pavement in portions. An embedded boulder at the northeast corner of the pavement has been hammered to create a small, cupboard-like opening. Just to the east is a ropy, red outcrop that has been extensively hammered. In its southwest face, feature 26 has a large ropy, red boulder, next to which is a deep cupboard extending beneath the floor.

North of feature 326 are several interconnected enclosures and modifications surrounding two caves. Feature 328, the farthest *makai*, just inland of the coastal trail, is located beneath a large slab, with a front exposed area surrounded by a facing from the ground level to the cave floor. In all, the interior covers approximately 4 m², about half of it sheltered. Feature 339 is very similar in form, although the 3 m² open-air section is larger. East of these features, feature 342.1 is a cobble and pebble paved corridor defined on the other side by other features, leading *mauka* to feature 342, an 'ili'ili, sand, coral and cobble paved floor surrounded by a combination of large boulders and stacked stone facings associated with other features. One of these boundaries is the triangular platform forming the back wall of feature 341, a very narrow, 1 m wide, partial enclosure open to, and collapsed at, the *makai* end. The coastal trail passes immediately *makai* of feature 341, about 5 m in from the high tide mark, and continues in a southeasterly direction to the cobble beach of Heiau Bay. Just in front of feature 326, the trail passes *makai* of a mound, feature 343; between feature 341 and feature 343 is abundant midden, currently being eroded down to the beach.

Whereas the ocean abruptly marks the *makai* boundary of cluster G by dropping to the ocean, *mauka* limits fade away into the 'a'ā. Behind the dense network from feature 323 in the south to feature 338 in the north, features 327–332 carve the lava into a series of clearings. Beginning below the western face of feature 326, features 327, 330, 331, and 332 are pavements of 'a'ā pebbles and cobbles, walled in by the larger stones cleared during the process. The first two of these, features 327 and 330, are 8–11 m² oblong floors wedged between large boulders; a small stacked wall from a boulder to feature 326 defines the north end of feature 327, but appears later than the rest. Features 328 and 329 are cupboards in the walls, and feature 330.1 is in the center of a pavement. Features 331 and 332 have a more rectangular shape, and appear to have been added on after feature 330, partly dismantling the older feature's outer wall. A low alignment between the additions could be a similarly leveled older feature, but the terrace facing on the northeast side of both features appears continuous, and like the southwest wall, terminates at a 1–2 m high boulder. Feature 337 is a lined pit and excavation beneath the *mauka* boulder.

Feature 322 lies a similar distance from feature 326, but is less accessible; its form

and location are consistent with a human burial. Farther away, features 334–336 are pits, and it is possible that more subtle modifications could be found in the surrounding 'a'ā. Farthest away, feature 333 is anything but subtle, a flat-topped boulder standing 2 m above the surface. Like feature 38, there is an enclosure of cobbles on top, but in this case much of the enclosure "wall" is a natural rim.

papa

Cluster G, located at the beginning of a bay, and where a long *papa* of reef and lava forms rich nearshore fishing grounds, occupies an attractive area for settlement. With 41 features, it may include two households, but their proximity, and the fact that they appear to be the only habitations on the Heiau Bay, suggests close interaction, perhaps sharing feature 326 or other areas. Construction techniques resemble those found around the main Kākapa Bay, and though the cave shelters form a larger proportion of the site here, that probably results from local availability of large slabs for roof elements. Presence of storage features, possible burials, and extensive midden indicates a sustained occupation.

Miscellaneous Features

Eight features of site 50–10–18–23355 fall outside the boundaries of the plane table maps drawn in the field. One of them, feature 350, is located at the south end of cluster F, but the others all fall outside the cluster boundaries (see fig. 14, pg. 49).

detritus

Feature 344 is an 'a'ā lava outcrop that has been worked on all sides to expose reddish, ropy interior lava (fig. 23). The outcrop is worked most heavily on the east side, where a broad detritus of gravel and pebbles is located at the base of the outcrop (fig. 24). The gravel and pebble detritus resulted from the effort to break away the outcrop's exterior. An alignment of four cobbles just south of the boulder edges a small, flat area paved with gravel.

Feature 345 is an accretionary 'a'ā boulder whose top surface has been broken away to expose reddish, ropy interior lava (fig. 25). The boulder is 2.5 m long, 2 m wide, and stands more than a meter high (fig. 26). Reddish interior lava is best exposed in an area 2 m long by 1.2 m wide at the center of the boulder. The exposed interior lava is bordered on the north and south sides by gravel detritus.

Feature 346 is an accretionary 'a'ā boulder that has been worked mostly on its east side to expose reddish, ropy interior lava (fig. 27). Reddish interior lava has been exposed over an area 2.7 m long by 2.0 m wide on the east side of the boulder (fig. 28). The boulder is split naturally near the middle, and three boulders have spalled off the west side. Reddish, ropy lava is exposed within the boulder's natural split.

Feature 347 is an 'a'ā boulder about 6 m in diameter with overhang shelters at the north and southwest ends, and a possibly enlarged crack on the east side (fig. 29). The shelters on the north end (fig. 30) include a small eastern shelter with a sloping 'a'ā pebble floor, and a larger, western shelter with a nearly flat 'a'ā pebble floor. Both shelters are only minimally modified, with construction limited to removing 'a'ā cobbles and small boulders, present elsewhere at the base of the boulder, to create a shelter under the margin of the boulder. A water-worn cobble is present in each of the shelters, where it might have been used to reduce the size of the materials that make up the shelter floors. The shelters on the southwest end are constructed where the outer crust of the boulder has spalled, exposing reddish interior lava (fig. 31). These shelters

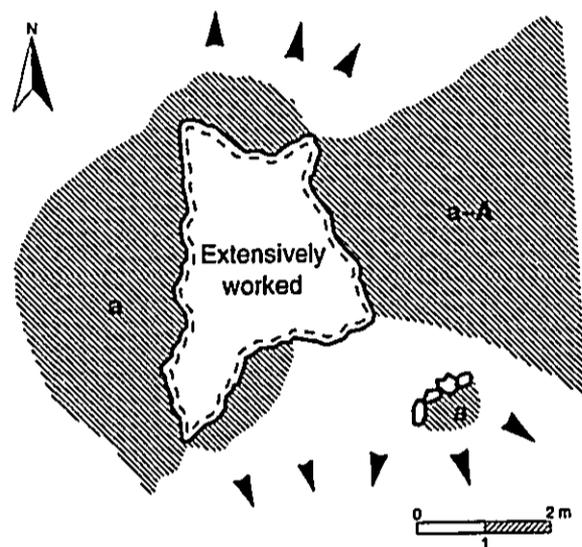


Figure 23. Plan map of modified boulder, feature 344, site 50-10-18-23355. Tape and compass map drawn by T. Dye. The legend is on page 39.

are small; the one to the west is 90 cm long, 60 cm deep, and 40 cm high, and the one to the east is 1.2 m long, 40 cm deep, and about 40 cm high. The effort needed to construct these two small shelters was limited to removing a small amount of material from the base of the boulder. Material was possibly removed from a natural crack on the east side of the boulder to create a pit 50 cm in diameter and 80 cm deep.

Feature 348 is a large 'a'ā boulder with pebble and small cobble paving to the east, north, and west, a small overhang shelter at its southwest end, and an alignment of 'a'ā cobbles on top (fig. 32). The boulder measures 3.2 m by 2.3 m in plan and is about 1.5 m high. The paving is about 1 m wide and was likely created by removing larger cobbles and small boulders, leaving behind the smaller 'a'ā pieces (fig. 33). A few pieces of cowry shell are present on the surface of the paving. The overhang shelter measures 1.4 m long, 0.7 m deep, and 0.5 m high. The cobble alignment on top of the boulder is approximately 30 cm high.

Feature 349 is a complex of modifications on and around a massive boulder, including a petroglyph, a portion of the boulder worked to expose reddish interior lava, an enclosure, and a clearing. The petroglyph is located at the west end of the boulder and is visible from trail site 50-10-18-23360. It consists of a square with two short line segments extending from the middle of its top and bottom, and a longer, curved line extending from its bottom, right corner (fig. 34). The petroglyph does not appear to be an anthropomorphic figure; it might represent a turtle. The south side of the boulder has been worked over an area of about 1 m², exposing reddish, interior lava at a depth of about 50 cm. Material removed from this area is scattered at the base of the boulder. Just east of this scattered material is a circular enclosure 1.4 m in diameter (fig. 35).

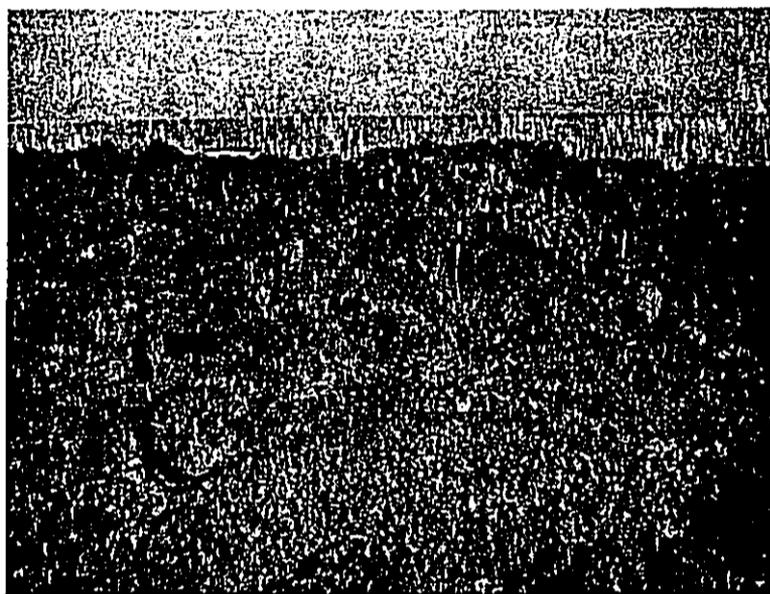


Figure 24. Modified boulder, feature 344, site 50-10-18-23355, looking west. Note the gravel and pebble detritus in the foreground. The scale is marked in 10 cm increments.

The interior is paved with 'a'ā pebbles and gravel and ringed by a low, stacked wall of 'a'ā cobbles and small boulders typically 40 cm high. Coral cobbles and pebbles and an 'ōpihi shell are present on the surface of the enclosure. East of the enclosure, at the east end of the boulder, is a rectangular cleared area 1.8 m long and 0.7 m wide. This area is free of large 'a'ā cobbles and boulders, which sets it apart from the surrounding terrain.

Feature 350 is an overhang shelter at the base of a massive 'a'ā boulder at the south end of cluster F. It is located just south of map 12 (see vol. 2). The shelter is 2.2 m long, 1.7 m deep, and 0.5 m high. A roughly stacked semi-circular wall of 'a'ā cobbles and boulders fronts the shelter. It has a typical inside height of 0.5 m. The wall's outside height is negligible; in most places it does not stand out from the uneven surface of the surrounding 'a'ā cobbles and boulders. The interior of the shelter is primarily 'a'ā gravel and bedrock, but also includes some 'a'ā cobbles that have likely fallen into the shelter since it was last used. In front of the shelter and to the south is a wall of lava that has been worked to expose reddish, ropy interior lava (fig. 36).

Feature 351 is a massive, flat slab of lava tilted nearly upright at the edge of an 'a'ā lava flow. The slab has been worked extensively to expose reddish, ropy interior lava (fig. 37). It is about 3.6 m high and 6.9 m wide and is visible from a fairly great distance along trail site 50-10-18-16059 leading into the site from the north (see pg. 43). At the base of the slab is a large pile of detritus and several water-worn cobble hammerstones.

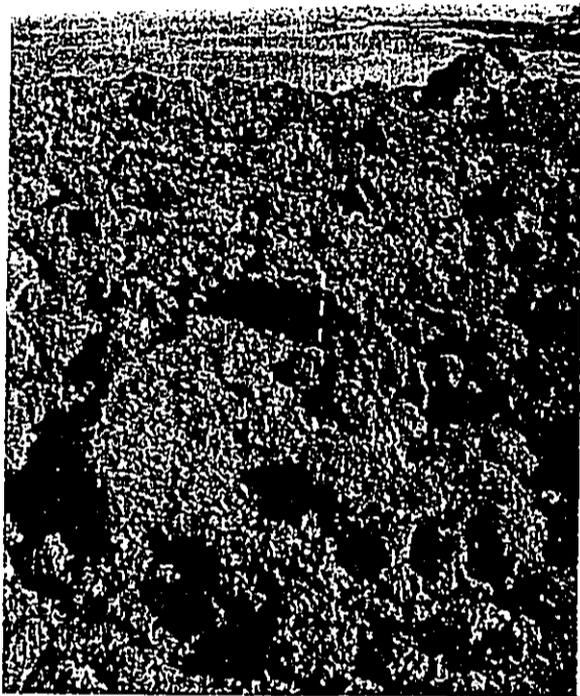


Figure 25. Modified accretionary boulder, feature 345, site 50-10-18-23355, looking north. The scale is marked in 10 cm increments.

Summary

Features surrounding Kākapa Bay provide abundant evidence of settlement, with half a dozen clusters containing nearly 300 features. Most of these have attributes such as storage features, internal trails, peripheral/ancillary features, direct beach access, and midden, often with variable deposition, indicating specific disposal areas, that suggest long term occupation, rather than temporary camping. While it is possible that some clusters, such as clusters D and E, which have fewer features, did not see year-round occupation, it is also possible that they were revisited year after year. The accumulation of dozens of feature components within some clusters indicates a relatively long occupation, and evidence of multiple construction phases reinforces that notion. At clusters C and G, and perhaps at clusters A and B, multiple households appear to be represented, sharing central areas. The beach itself may have been a larger common area, although it may also be possible that one or two additional *kauhale* occurred there, but have been buried or washed away by waves.

Clusters B and C illustrate adaptation to 'a'a flows, a landform conceived of as

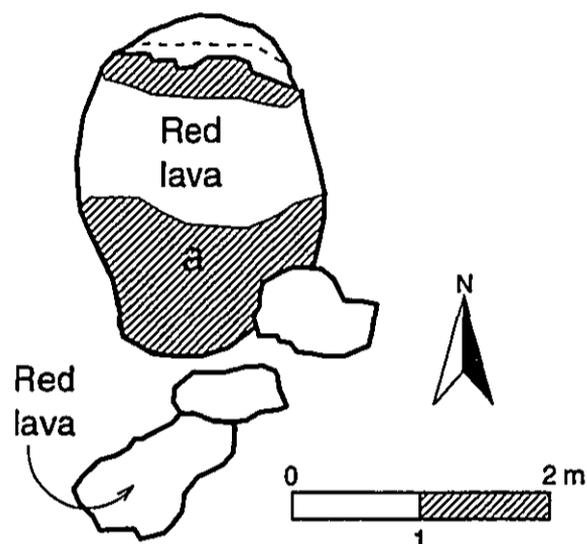


Figure 26. Plan map of site 50-10-18-23355, feature 345

harsh and uninviting to modern people. The fact that this particular flow has relatively abundant accretionary large cobbles and boulders makes it an easier place to modify, however, since the cobbles and boulders can be moved easily, and provide good materials for constructing walls, platforms, pavements, and terraces. Slabs, too, occur in the flow, some large enough to roof habitable shelters, others useful for cupboards, *pao*-like construction, and pavers. The overall nature of 'a'a flows, too, allows for a high degree of malleability—clinkers and small boulders can be moved around and leveled out. The clearings surrounding habitation clusters show that a simple exercise of sorting out large stones yields a nice pavement of cobbles or pebbles. The web of trails emanating from these clusters leaves an excellent trace for archaeologists interested in the activity areas beyond major features. Because the habitation clusters occupy the *makai* edges of high flows, they benefit from a view of the ocean and exposure to sea breezes, without the risk of inundation by tsunami or high surf.

Oral history of this area reveals that the 'a'a was preferred for planting, and that pumpkins, gourds, watermelons, and sweet potatoes were grown at Kūki'o. Along with the brackish pools that were stocked with *awa*, *āholehole*, and other fish, this agricultural potential suggests that Kākapa Bay could be inhabited by a permanent population not solely dependent on day-to-day fish catches. A large cemetery in the flow *mauka* of cluster C strengthens this interpretation, as does the extensive *heiau* complex of cluster F and the several branches of trails that head *mauka* into both Kūki'o and Manini'ōwali.

The *heiau* complex at Kākapa departs from expectations on several counts. First, the structure itself incorporates blocky slabs of *pāhoehoe*, material that was brought here, and which has a more uniform, rectangular form than is typically found in Hawai-

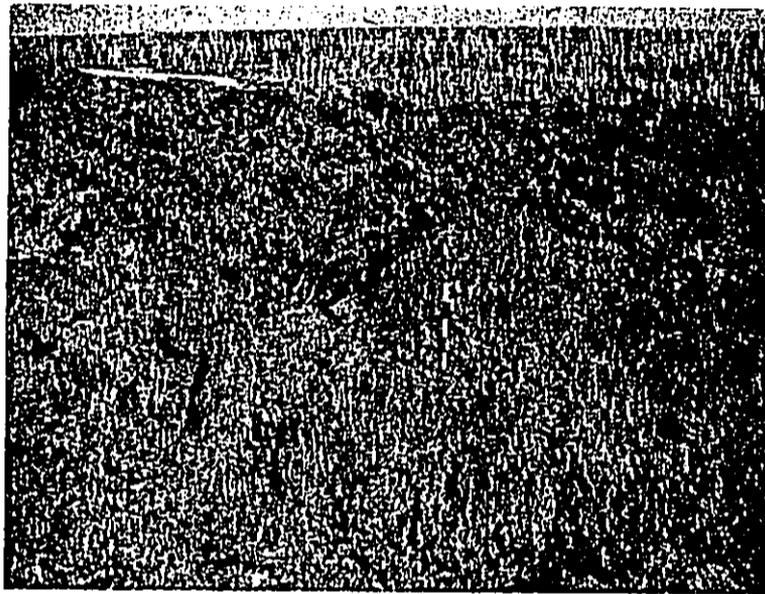


Figure 27. Modified boulder, feature 346, site 50-10-18-23355, looking west. The scale is marked in 10 cm increments.

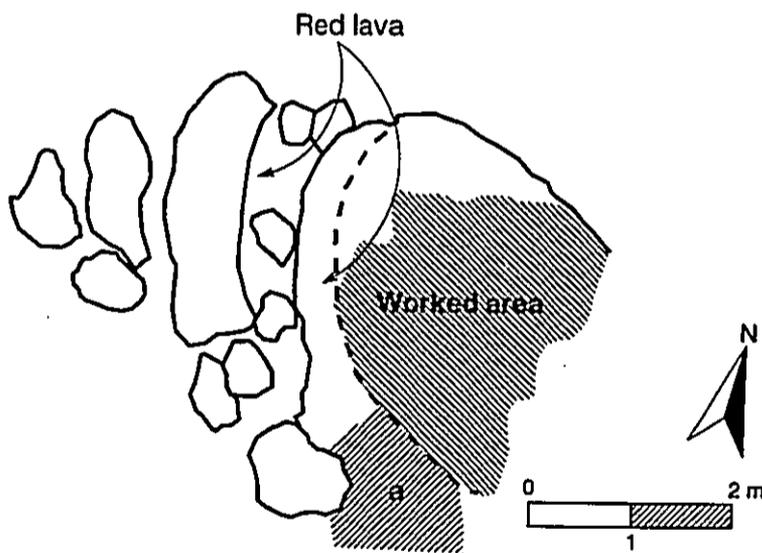


Figure 28. Plan map of site 50-10-18-23355, feature 346, a modified boulder. Tape and compass map drawn by T. Dye. The legend is on page 39.

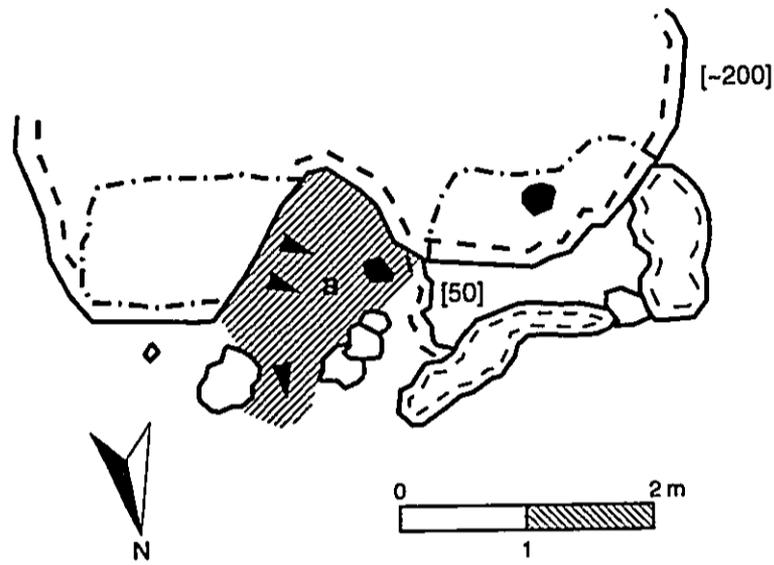


Figure 29. Plan map of north enclosures, feature 347, site 50-10-18-23355

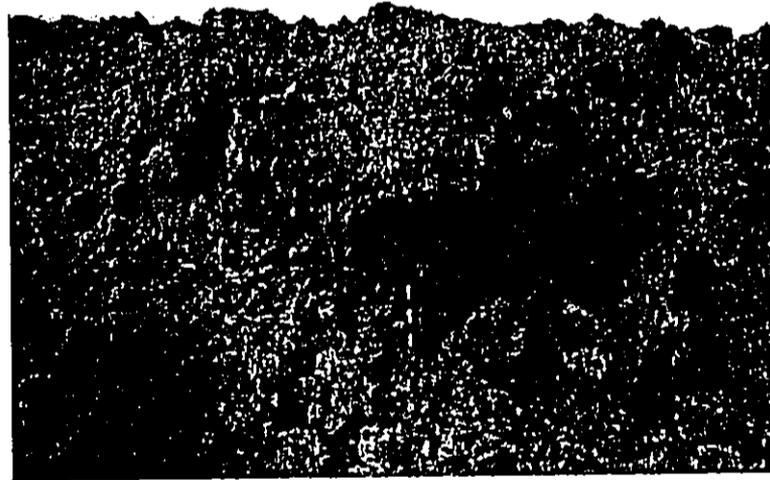


Figure 30. Overhang shelters at the north end of feature 347, site 50-10-18-23355, looking south. The scale is marked in 10 cm increments.



Figure 31. Overhang shelters at the southwest end of feature 347, site 50-10-18-23355, looking east. Note the exposed reddish, interior lava above the shelters. The scale is marked in 10 cm increments.

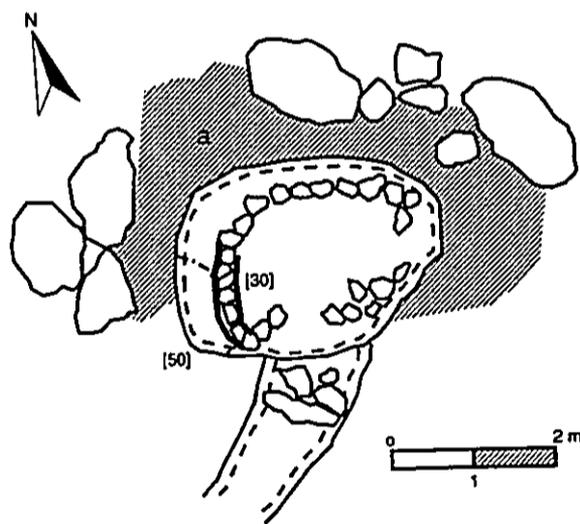


Figure 32. Plan map of feature 348, site 50-10-18-23355. Tape and compass map drawn by T. Dye. The legend is on page 39.

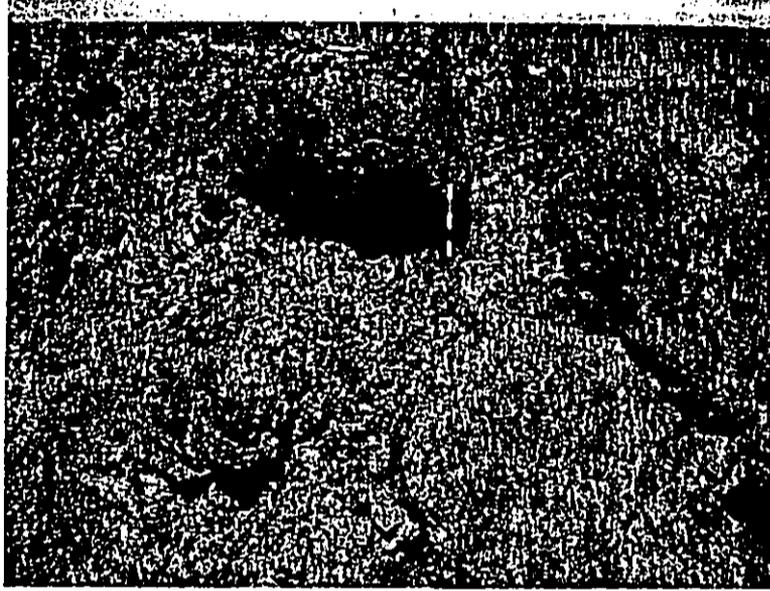


Figure 33. Feature 348, site 50-10-18-23355, looking west. Note the pebble and small cobble paving at the base of the boulder and the cobbles stacked on top of the boulder. The scale is marked in 10 cm increments.

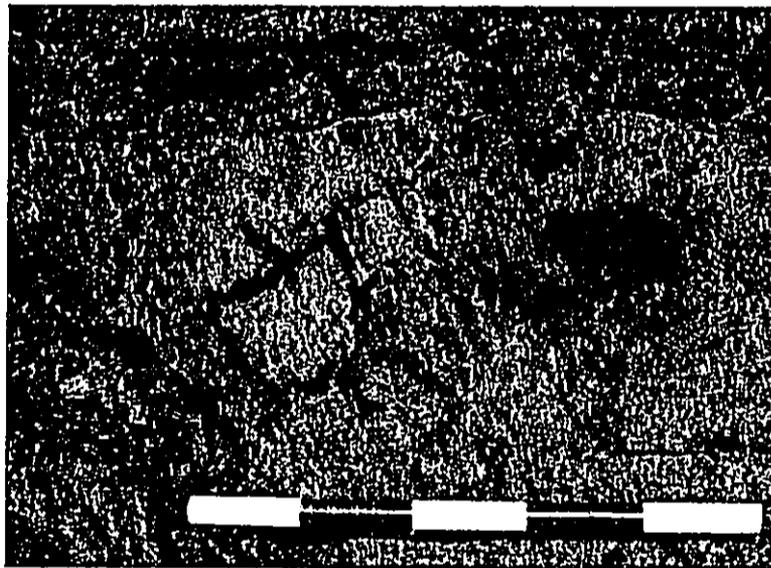


Figure 34. Petroglyph at feature 349, site 50-10-18-23355. The scale is marked in 10 cm increments.



Figure 35. Circular enclosure at feature 349, site 50-10-18-23355, looking east. The scale is marked in 10 cm increments.



Figure 36. Overhang shelter, feature 350, site 50-10-18-23355, looking south. The shelter is below and in front of the scale. Note the wall of reddish, ropy lava to the right of the shelter. The scale is marked in 10 cm increments.



Figure 37. Feature 351, site 50-10-18-23355, looking south. Note the mound of detritus at the base of the slab. The scale is marked in 10 cm increments.

ian architecture. Also, its location on very low ground, in a hollow behind the beach, contrasts with the common practice of placing *heiau* on high ground. The high ground does have features associated with the overall ritual character of cluster F, but stands out for the number of battered boulders that form the focal points of the numerous shrines here.

Manini'ōwali Bay Site 50-10-18-23356

The southern end of the 'a'ā flow traversed by trail site 50-10-18-23360 descends to the wide bight between Papiha and Punaloa Points. In the *ahupua'a* of Manini'ōwali, this bay was traditionally known by that name, but the sandy northern end is now generally known as Kua Bay. The sandy beach there offers one of the better canoe landings along the Kekaha coast. Behind the beach, *pāhoehoe* lava rises gradually *mauka*.

Nine habitation clusters, labeled A-I, were identified at site 50-10-18-23356, along with a large number of outlying features (fig. 38). Most of the outlying features are located on the large 'a'ā flow at the north end of the site (fig. 38, *a*). South of this, the features are scattered more widely on the predominantly *pāhoehoe* terrain (fig. 38, *b* and *c*).

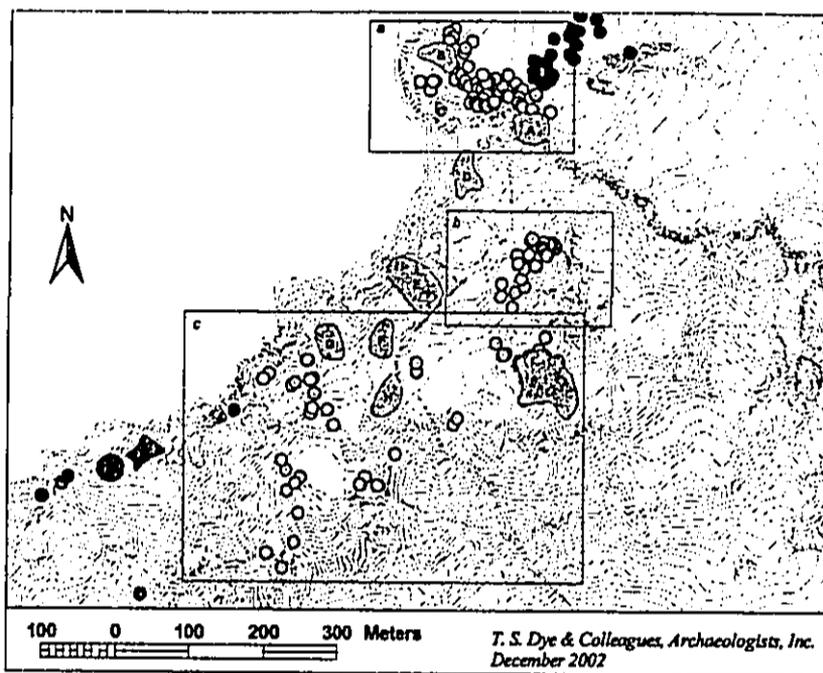


Figure 38. Clusters and outlying features, site 50-10-18-23356. *a*, see figure 53 on page 121; *b*, see figure 79 on page 141; *c*, see figure 94 on page 150.

Cluster A: Pondview *Kauhale* and Shrine

Located on the edge of the flow that forms the north edge of Kua Bay, these 40 features sit on an 'a'ā hill above the anchialine pond located behind the north end of the sandy beach there. Almost certainly, additional features occurred at the base of this landform, but extensive bulldozing there has obliterated traces of any features between the 'a'ā and the pond. Other than features 28-30 to the north that may not be functionally integrated with this cluster, all of the features here occupy the crest, flanks, and base of the 'a'ā hill, which drops off to lower ground in all directions. Site 50-10-18-23360, the trail from Kākapa Bay, comes in to the northern end of this cluster.

At the crest of the hill, a tight concentration of features appears to be a shrine complex (vol. 2, map 14). A massive boulder, feature 1, surrounded by an enclosed terrace, feature 1.1, has several attributes consistent with shrines. Battered surfaces on the boulder expose rosy red stone, and many red rocks are used in the wall and pavement surrounding the stone. An upright stone, although not the classical smooth 'ala type, rises from the center of the east wall. Although the overall size of the paved area is relatively large, approximately 24 m², the boulder occupies about 10 m² in the central portion, leaving little area for a roofed structure. Few traces of midden and no

anchialine

artifacts occur on this feature. At the base of the boulder, a small overhang has been hammered out, and stones used to further enclose the space of feature 1.2. The floor of this feature is set below the surrounding pavement, and has an 'ili'ili surface. Just over a meter to the west at the base of another boulder, feature 1.3 is a similarly constructed cupboard with a red slab forming much of the lean-to roof; both features 1.2 and 1.3 are partially collapsed, and may have been entirely sealed. Stone fill at the back of feature 1.3, which also forms the back of feature 10, another small shelter, raises the possibility that a burial may be sealed beneath this smaller boulder.

North of feature 1, the terrain rises slightly, and has been heavily modified, although the features exhibit rough construction. The largest, feature 6.2, is an irregular terrace defined at the edges by a boulder alignment. Most of the surface is rough, fairly large cobbles. Immediately east is a 0.7 m high bashed red and black boulder, feature 6, surrounded by a 0.8 m radius of small cobble pavement. With some loose stone piled haphazardly around and the paved area, it appears that feature 6.2 is a distinct platform, more or less square and measuring about 10 m². Pit features 7 and 5 occur at the north and east corners of this platform, respectively, and a similar pit, feature 4, extends 1.2 m deep just to the southeast. Abutting the base of a large boulder nearby, feature 3 is a larger, but less steeply walled pit with a maximum depth of 1 m. West of this is a depression, feature 9, surrounded on all sides by features, but which is itself not formally constructed. Instead, the notable attribute is that the entire 3 m long depression is filled with fractured cobbles; at the south end, a large black boulder has an overhang shelter, feature 9.1, within which is a single water-worn basalt cobble. It is possible that the rough character of feature 9 is the result of collapsed walls, but it appears that the area was intentionally used for the disposal of rock fragments.

The western edges of features 1.1 and 6.2 mark the beginning of a rapid decline in the degree of landscape modification. From the southwest corner of feature 1.1 to feature 14, a lined pit built against a boulder overhang 7–9 m to the west, a cleared area very roughly paved with cobbles and pebbles is designated feature 11. Several boulders in line with the south face of feature 1.1 may represent a remnant wall foundation defining the edge of this pavement, but are ambiguous. It is possible that a depression and stacked spur wall at the southwest corner of feature 1.1 are the by-product of looting, dismantling or incomplete construction of a feature 11 wall. North of the clearing, feature 11.1 is a boulder with cobble stacking on top, a typical form for trail or other markers. North of this on higher ground, feature 8 presents a larger mound of cobbles and small boulders, including many red rocks, and is large enough to be a burial.

At the opposite end of the clearing, feature 14 is another large boulder hammered in several places to reveal rosy red interior stone. On its northeast side, hammering has been so extensive as to create an overhang; stacked boulders and cobbles extend beyond this to create a small shelter, feature 14.1 with a 1.75 m² interior, below the feature 11 surface. The floor of feature 14.1 and much of the ground around the large boulder are covered with crushed red gravel. Smaller pits, features 12 and 13, also occur around feature 11, and another one, feature 16, lies several meters north in the rough 'a'ā. Feature 15, a 1 m section of stacked terracing, abuts a large boulder in this rough flow, and is of undetermined function. Although some water-worn cobbles occur in the 'a'ā, no other features were found other than a 6 m segment of cleared gravel trail that does not obviously link up with anything, but provides the most likely

connection between the eastern and western sections of cluster A.

On the *makai* brow of the cluster A hill, a large terrace and several ancillary features seem to be a habitation area. Perched on the solid bedrock of the 'a'ā flow, feature 24 is a massive terrace constructed of boulders stacked over a meter high at the southwest corner, with a paved surface area of about 22 m². Features 25 and 26 terrace the area below the corner boulders, and appear to be structural buttresses reinforcing the upper terrace. Parallel to the south facing, which blends into the hillside at the east, a wall remnant, feature 27, echoes the form of the main structure. The trail up the cliff passes below feature 25, and then between features 24 and 27, indicating that feature 27 was never a full enclosure around this side of the terrace.

The north end of feature 24 has a corner that turns *mauka* for just over a meter before fading into the slope and a tangle of thick *kiawe* that was not cleared. This part of the surface is extremely jumbled and uneven, as are other features farther north. A discontinuous terrace alignment of boulders, feature 23, up to 40 cm high, shares the same axis as feature 24, but has collapsed over much of its length; two large water-worn boulders may have been a part of the facing, which abuts a large boulder at the north end. A meter upslope of this is another collapsed terrace, feature 21, itself mostly covered by the collapsed stone of feature 19, a remnant enclosure whose interior has a shelf of lava outcrop that has been partially broken away. While the *makai* wall of feature 9 consists of small boulders and is in very poor condition, the *mauka* wall is stacked with facings on either side, and has a cairn-like high point at the south end that is twice the height of the rest. Just outside the southeast corner of feature 19, feature 20 is a narrow, but deep, cupboard with a slab roof. Behind the *mauka* wall of feature 19 is a cleared, cobble and pebble paved area designated feature 19.1. Behind this, a rough enclosure, feature 17, has a single course of boulders about a meter high on all sides except the *mauka* side, where stacked cobbles form a nice facing about half that high. In the southeast corner, a cupboard has been constructed by stacking the exterior wall and excavating beneath a boulder slab; inside are what appear to be the bones of one or more entire fish.

North of features 19-23, roughly aligned boulders separate the features from this outcrop, which offers a small, clear area before dropping off rapidly to a large depression. While no features were found within the lower level, it is naturally surrounded by the high 'a'ā flow on all sides except the west, *makai* side, where a low boulder wall remnant, feature 31, probably completed the enclosure before being damaged by modern bulldozing. Just inside the wall is a large, blocky boulder of ropy red lava. Inside the south end of the wall, a boulder overhang creates a shelter, feature 22, that has been augmented with a stacked retaining wall ascending the base of the outcrop beneath feature 23.

Cluster A appears to have two distinct areas, but is not divided into separate clusters because the areas are connected by a trail, and both occupy a distinct landform. Conversely, two pits and a partial enclosure so close that they were mapped at the same time seem to be more closely associated with coastal trail site 50-10-18-23360, and are below the hill and at least partially on the opposite side of the ravine surrounding the hill.

Unlike many *kauhale* recorded during this project, the habitation component of cluster A is dominated by one large feature, with the associated terraces generally

being too small to have held distinct structures, and only two small enclosures, neither of which seems to have had a nicely paved floor. This paucity of features could be explained in several ways. One is that other features once existed below, but were obliterated by the bulldozer. In fact, it seems likely that this lower, but relatively level ground between the cliff and the pond would have been an attractive area for habitation features; it is also likely that features there would have been pavements or low walls of the sort that would not have been recorded previously. It is also possible that these features may not be a habitation at all; the commanding location is certainly consistent with a *heiau*, and the lack of ethnographic information to that effect certainly does not rule out such a function. Another explanation is that this is a *kauhale* variant in which few features occurred, perhaps the compound of a priest attending to the shrines at the *mauka* end of cluster A.

Finally, it is not certain that the *mauka* features are in fact a shrine complex, and they may be part of a somewhat dispersed *kauhale*. For the reasons stated above, however, the primary interpretation is that feature 1 is the focal point of a shrine. Certainly, the fact that this boulder and feature 6 occupy the crest of a hill, have been battered to expose red interiors, and are segregated from the rest of site 50-10-18-23356 all suggest a ritual significance. Abundant use of stone, much of it red, to fill in cracks, construction of platform and mounds, and presence of relatively large pits in which human interments could fit all indicate that burials are likely to be present at this location as well.

Cluster B: Bashed Boulders

At the northern edge of site 50-10-18-23356 is a cluster of large accretionary boulders just inland of the cobble beach. Ranging in height from just over a meter to over 5 m, and in length from 2-7 m, the boulders have been heavily battered with large and small water-worn basalt cobbles. No consistent pattern of work emerges from this cluster, with all sides and even the tops of some having been hammered. Although some coral cobbles and small pavements and pits can be found at the base of some of these features, the small enclosures and oblong *'alā* stones typical of shrines at Kākapa bay do not occur here, nor do branch coral offerings. Another indication that these may differ from the battered shrine stones is that they do not occupy high ground or stand in an erect position.

With the coastal trail, site 50-10-18-23360, on one side and a branch trail between it and cluster C running through the cluster, it could be possible to assign these 25 features to the trail site (vol. 2, map 15). Feature 51, certainly, is in a location and of a form likely to be a resting place associated with the coastal trail. It seems likely, however, that the inland trail alignment was constructed specifically to go by the boulders, which are in their natural location, and certainly predate the trail. The hammered, exposed red surfaces of the boulders reflect cultural activity that took place extensively on this flow, rather than a behavior associated with trails (fig. 39). The boulders here have been extensively worked with a variety of hammerstones, some of which are only pebbles (fig. 40). Feature 50, a pit broken into the lava surface to reveal a vein of fine-grained basalt, indicates that one function of this cluster was procurement of stone suitable for tool manufacture. It is possible that some of the red stone was taken from this site as

well. In general, the other modifications, such as terrace features 47 and 49, or pavements 41.1 and 46.1 offer level surfaces too small to have been used for habitation, and instead seem to be the result of clearing areas for the boulder bashers. A series of 'a'ā pits, features 32-38, lie well north of the other features, 8-20 m from the trail, and lack any clear indication of function.

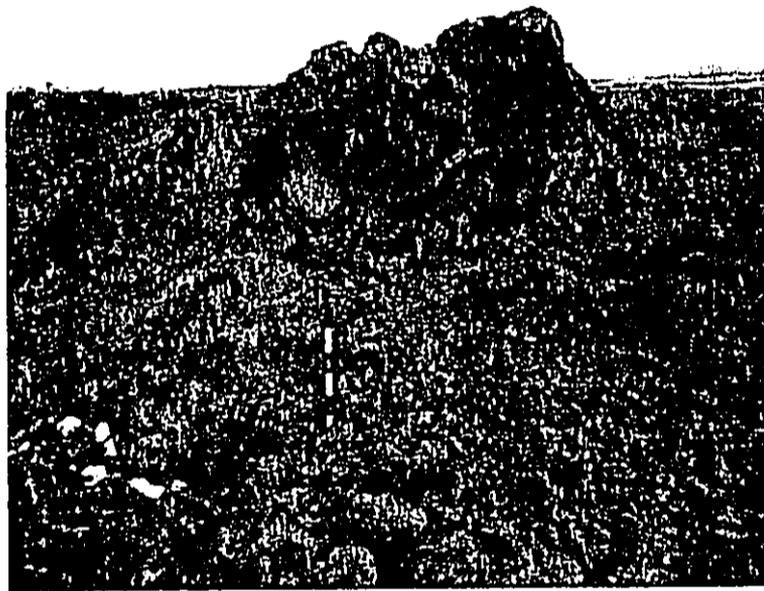


Figure 39. Worked boulder, feature 48, site 50-10-18-23356, looking northeast. Note the detritus at the base of the boulder, to the right of the scale, which is marked in 10 cm increments.

In summary, it would appear that cluster B represents a conspicuous part of the natural landscape that was transformed to become a part of the cultural landscape. The concentration of large accretionary boulders provides a natural focal point, and the cultural pattern of visiting and hammering such boulders made this a node on the route between Manini'ōwali and Kākapa Bays. Aside from the exposure of the boulders' red interiors, physical traces of sustained ritual activity such as those found in cluster F, site 50-10-18-23355 (see pg. 72) are lacking, and this cluster seems to be on the main travel thoroughfare, rather than in a segregated, higher area. The boulders here were worked extensively, however, with a variety of tools, including a pebble hammerstone indicating an attention to fine details of the work.

The pits at the northern edge of this cluster are possibly best understood as a chance concentration of the kinds of features that occur extensively across this lava flow, and may not be functionally associated with the bashed boulders.

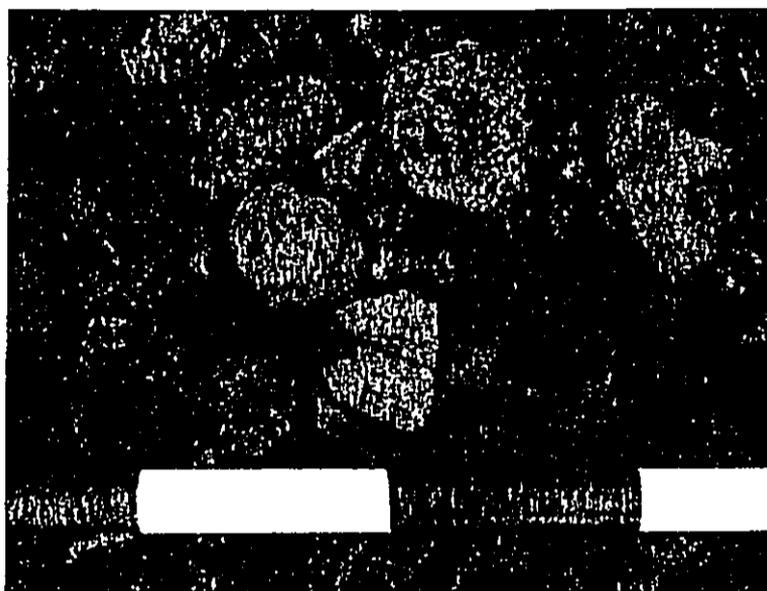


Figure 40. Pebble hammerstone at feature 48, site 50-10-18-23356. The scale is marked in 10 cm increments.

Cluster C: North Point of Manini‘ōwali Bay

In recent history, the sandy area popularly known as Kua Bay, has suffered numerous impacts from bulldozing that cleared a road to the beach, and from the four-wheel drive vehicles that followed. Cluster C, sitting atop the ‘a‘ā flow that defines the north tip of the bay, has been one of the most heavily impacted areas, as trucks climb the bulldozed road and park on the features that overlook the bay to the south. Foot traffic from the south also erodes the sandy slope, and campers rearranging the stone features have further obscured the archaeological record. Despite all of these impacts, the remnants demonstrate that here, as elsewhere in the project area, the margins of ‘a‘ā flows offered preferred settings for habitation.

This cluster is a substantial concentration of 26 features, an intensively modified landform that probably represents a *kauhale*. It is a node on two trails, that enter from the north and northwest (vol. 2, map 16).

The largest feature is a truncated enclosure, feature 76, previously recorded as State site 50-10-18-10233 (Cordy 1986), Bishop Museum site 50-Ha-D21-40 (Cordy 1981), and possibly site 110 (Reinecke 1930). The oblong plan, open toward the ocean, and not far behind the beach, indicate this feature may be a canoe shed. Disturbance at the *makai* end means that this could have been a complete enclosure, but the absence of any remaining foundation stones indicates that that end was open, and that the jeep path causing the damage probably ran through only the ends of the side walls. The remaining portions are well constructed with double-faced, core-filled walls and relatively minor collapse, suggesting maintenance into the historic period. A few meters west of

the feature, an eroding section of the slope down to the beach shows evidence of a sub-surface midden deposit. Excavation here revealed a four-layer stratigraphic sequence (fig. 41). The basal layer IV is an aeolian calcareous sand whose lack of cultural material and charcoal indicates that it was likely deposited before the traditional Hawaiian settlement was established (table 2). It contains some coarse basalt sand derived from the adjacent 'a'a flow. Layers II and III are cultural layers, whose relatively dark color derives from charcoal. They extend to about 89 cm below the modern surface of the dune. The lower boundaries of these layers are uneven, indicating cultural activity in addition to natural processes active on the surface of sand deposits. Two charcoal samples were collected, one from layer II and the other from layer III, for wood charcoal identification and dating. The results of these analyses, reported in chapter 5, indicate that a variety of native woods were being burned here late in the traditional Hawaiian period. Layer I is the modern surface; its light gray color, similar to layer III, reflects the current low level of use by campers and beach-goers.

aeolian

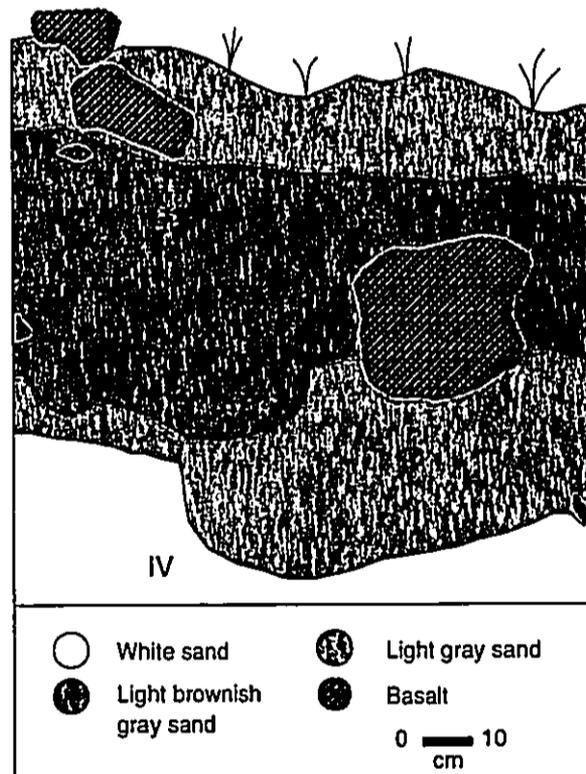


Figure 41. Stratigraphic profile at Manini'ōwali Bay dune. *a*, provenience of catalog 10; *b*, provenience of catalog 11.

North of this, at about a 50 degree angle to the canoe shed wall, is another similarly constructed wall, feature 75. Both ends have collapsed, and the east clearly has been

Table 2. Manini'ōwali Bay dune profile sediment descriptions

Layer	Depth	Description
I	0-17 cm	Light gray (10YR 7/2) fine calcareous sand with common medium-coarse basalt sand; structureless, loose, noncoherent.
II	17-54 cm	Light brownish gray (10YR 6/2) fine calcareous sand with common medium-coarse basalt sand, charcoal flecks; structureless, loose, noncoherent.
III	54-89 cm	Light gray (10YR 7/2) fine calcareous sand with common medium-coarse basalt sand, charcoal flecks; structureless, loose, noncoherent.
IV	89 cm to BOE	White (10YR 8/2) fine calcareous sand with common medium-coarse basalt sand; culturally sterile; structureless, loose, noncoherent.

bulldozed; the western end fades into the hillside. A concentration of stone connects this end to the *makai* end of canoe shed feature 76, suggesting that the feature may originally have been a triangular enclosure. However, disturbance by vehicles and campers renders any conclusion based on surface evidence alone premature.

West of features 75 and 76, modern campers have altered the original surface architecture radically. Features 71 and 74, both modern, represent use of stones from older features to make a windbreak and fireplace ring in the case of the former, and a rough mound that may have resulted from dismantling a feature to clear way for vehicle traffic. Features 69 and 70, alignments of embedded stones immediately west of these modifications, appear to be foundations of one or two older structures. Given the volume of stone used in features 71 and 74, and in feature 73, another nearby fireplace ring, it does not appear that features 69 and 70 had high walls. Feature 70, nearly a meter wide, could have been a free-standing wall, much of the material probably in the bulldozed mound at the north end. Feature 69, running approximately east-west along the contour, seems to have been a terrace facing. Three of the largest boulders in it are in an upright position.

About 10 m west of feature 69, the density of stone features increases suddenly. This corresponds with a change in the coastline below from sand to boulders and cobbles, and does not appear to be anything more than a change in the locally available material. Like elsewhere in cluster C, numerous disturbances demonstrate relatively recent impacts. Features 65-67 are fire pits and mounds built by campers, using stone from the original structures. Feature 62, a terrace platform previously recorded along with feature 63 as State site 50-10-18-10232 (Cordy 1986) and Bishop Museum site 50-Ha-D21-39 (Cordy 1981), has a remnant pavement of flat 'a'a slabs, a surface that has apparently been dismantled and perhaps removed from the site. Beneath the slabs, a mixture of 'a'a cobbles and pebbles, coral beach pebbles, and basalt 'ili'ili could either be a previous pavement, or simply a base course for the slab pavement. At the northwest corner of the platform, the coastal trail strikes out across the rocky shoreline. Immediately north of feature 62, a large low spot, 2.75 m², is filled with cobbles, and therefore has an unknown depth. Defining the north end of the pit, feature 60 is a short, 3 m, segment of core-filled wall that connects two large boulders; together, the boulders and wall create a 13 m long "outcrop." Were it not for the fact that prevailing winds almost always blow parallel to the wall, it would be interpreted as a windbreak,

but instead seems to be a highly visual boundary between constructed and natural landscapes.

Attached to the western side of feature 62, but offset to the south and paved with cobbles and boulders, rather than slabs, feature 63 is another terrace. Roughly rectangular and better defined than feature 62, this feature has a surface area of about 18 m², but some of this surface is lost to a boulder that rises about 50 cm above the surrounding pavement, and to a pit, feature 68, descending below. South of feature 63, a linear concentration of stones near the edge of the slope may be a terrace or wall remnant.

At the northwest corner of cluster C, feature 59 is a large terrace platform with edges defined by an alignment of large, blocky boulders, many in an upright position. Only the north and west walls are defined, but if these are taken as defining the width and length of a rectangular feature, its surface area would be 66 m². Near the center, a small area of cobbles and pebbles appears to be a remnant of pavement, the remainder being disturbed or covered by vehicle traffic. Just outside feature 59, a trail partially paved with 'a'ā slabs heads into the lava flow, terminating at the coast in cluster B. The trail passes between a large boulder and feature 59.1, another large boulder that has been hammered on its *makai* side, facing the trail, creating a hollow of exposed red rock.

Northeast of feature 59, feature 58 resembles shrines at Kākapa Bay, being a tall boulder hammered on one side to create an exposed red face, and topped by a few cobbles. Extending out from either side of the face, an enclosure, feature 58.1, surrounds a cobble and pebble pavement. Although no upright 'a'ā stone remains within the enclosure, the form closely resembles that of the shrines above the Kākapa *heiau* (see pg. 72 ff.). A short gravel trail, feature 58.2, leads from feature 59 to feature 58.1. Unfortunately, this site has been desecrated by modern beach visitors who have used it as a toilet. Inside the enclosure and behind the boulder, the stench of human waste, toilet paper, and garbage provide evidence of how this site is misused. East of feature 58, a trail heads into the 'a'ā flow, passing several pits and other outlying features. The trail and outliers are described as features of site 50-10-18-23360 (see pg. 207).

East of the trail, feature 57 appears to be a remnant enclosure, the south and west walls obliterated by bulldozing, and further disturbed at the northwest end by what appears to be a looter's excavation. This feature was initially recorded as site 111 (Reinecke 1930), and later as Bishop Museum site 50-Ha-21-41 (Cordy 1981) and State site 50-10-18-10234 by Cordy (1986), who described it as a C-shaped wall with an interior area of 27 m². Remaining is an L-shaped, double-faced, core-filled wall, inside which is a cobble and pebble pavement. Like other features along the margin of cluster C, feature 57 has been used as a toilet and dumping ground by modern beach visitors. Immediately outside the northwest wall, feature 56 is a cupboard comprised of cobbles and a slab stacked around an outcrop. To the northeast, feature 55 is a pit at the base of a boulder, next to which, an area of cobble fill, feature 55.1, may be a burial.

About 10 m east of features 55 and 57, feature 53 is another large boulder, about 2 m high with a cobble cairn on top. A metal spike has been hammered in the top. At the base, feature 54 is a pit with stacked stone lining. Like so many other features here, the pit has been used as a trash receptacle and toilet.

At the center of cluster C, no features remain. In part, this is the result of bulldozing

and subsequent vehicle traffic and camping, activities that can easily remove surface traces of sites. Mounds of bulldozed rubble toward the center seem to indicate that this indeed happened, although the volume does not suggest many features. The surface remains do not show how many features may have been present. With excavation, courtyard or lanai pavements and wall foundations may be discovered, but the depth to which modern impacts have disturbed the integrity of the archaeological record is not yet known.

The incompleteness of features in cluster C renders difficult an accurate assessment of overall function. Abundant midden demonstrates habitation, and the feature forms—*terraces and enclosures*—certainly fit with this function. Because of the location at the edge of an 'a'ā flow on a bay shore, the fact that most features have substantial foundations, and the overall area is more than 2000 m², cluster C probably represents a permanent habitation. The large size of features 59 and 76 suggest something more than a typical *kauhale*, since the former could be a high status house or *heiau*, and the latter is likely to be a canoe shed.

Cluster D: North *Pāhoehoe Kauhale*

Located on the margin of a *pāhoehoe* flow behind the sand beach, cluster D consists of 15 medium-sized features, modified surfaces, and a generalized scatter of midden (vol. 2, map 17). Looting has disturbed cultural deposits, including the single small cave shelter, and modern beach use has resulted in additional impacts. All except features 90 and 91 share the same landform and proximity to each other and to the beach, and based on their form and associated cultural materials, appear to be a *kauhale*. Although this area is being presented as a distinct cluster, it is part of a pattern throughout much of Manini'ōwahi in which the *pāhoehoe* shelf behind the beach is used for habitation. Because of the regular impacts of winter surf, sporadic damage by tsunami, and modern disturbance by vehicles, we cannot know how much the beach in front of these features was incorporated into this settlement pattern, at least not on the basis of surface features. It is likely, however, that the ocean alone makes intact subsurface remains here a low probability, although pockets may remain close to the lava flow.

None of the features here are very large, but the construction of feature 78, a platform that may have had an enclosure on top, certainly bespeaks of something more than a temporary feature. Cordy recorded this feature as Bishop Museum site 50-Ha-D21-42 (Cordy 1981) and assigned it State site 50-10-18-10237 (Cordy 1986). He interpreted the platform as the sleeping house of a commoner household. Even after modern depredations, including dumping, dismantling for fire rings, and so on, the north side is nearly 1.5 m tall, and facing remnants show well stacked, nearly vertical construction incorporating about 50% water-worn cobbles and boulders (fig. 42). Water-worn material is harder to stack than *pāhoehoe* or 'a'ā, both available within a reasonable distance, and suggests that either water-worn stone was preferred, or that the benefit of using immediately available material outweighed the cost of more difficult stacking. The northeast facing rises into a wall that was above the interior cobble-paved surface, but disturbance makes it difficult to determine if other sides were enclosed as well. Although parallel to the lava flow edge incorporated into the northwest facing, the orientation of the overall structure, 305° from magnetic, is interesting in that it does

not mirror the coastline.



Figure 42. Platform, feature 78, site 50-10-18-13356. looking east. The scale is marked in 10 cm increments.

About 12 m to the south, feature 80 shares nearly the same orientation, this time made more noticeable by the fact that the platform does not even align with the *pāhoehoe* margin immediately *makai*. Feature 80 has a more clearly defined wall atop the *mauka* edges of the platform, and has a much nicer pavement of water-worn basalt and coral pebbles, but resembles feature 78 in terms of shape, wall materials, and location on the landform. Although the *makai* facings lack enclosing walls and rise only 20–30 cm above the surrounding surface, it remains possible that walls once existed; a modern fireplace ring, feature 79, and the cobbles filling a crack to the northwest may have come from wave-damaged or intentionally dismantled walls.

Continuing along the *pāhoehoe* ledge behind the beach, feature 81 consists of a terrace tucked into a naturally protected inlet in the flow. The disturbed facing rises just 40 cm above the beach now, but probably was another 10–20 cm higher originally, and creates a level, sand and midden covered surface about 6 m² in area. The sand in front of this feature is gray and contains midden, suggesting that a cultural deposit may still be intact beneath surface here. Due to the protected nature of the landform, an inlet about 10 m deep and 4 m wide, oriented more than 45 degrees off of the prevailing surf, this area might preserve subsurface deposits that offer a unique chance to sample how a currently "featureless" beach was used in traditional Hawaiian times.

Inland of features 80 and 81, the *pāhoehoe* surface has no unambiguous signs of modification, although water-worn stone and marine shell there could be a generalized scatter of human-introduced debris. Farther north, low areas and cracks have been intentionally filled. Feature 83, a 12 m² area of cobble and pebble fill, creates a pavement that blends into the level *pāhoehoe* surrounding it. A couple of meters south, a shallow depression has been pecked into the *pāhoehoe* surface. To the north and east, some

low areas and cracks have cobble fill, but because of their small size and lack of above ground structures, have not been assigned feature numbers.

Feature 84 resembles both the simple filled depression of feature 83 and platform features 78 and 80. A high spot on the *pāhoehoe* here combines a natural ledge and introduced cobbles and boulders on the north and east to create a terrace. The back, or south, edge is a 1.5 m high *pāhoehoe* ledge, and the west is a cobble alignment flush with the surrounding surface. Unfortunately, both terraced sides have collapsed almost completely, making it difficult to define precise boundaries, but the remaining midden concentration and pavement, consisting of *pāhoehoe* and water-worn basalt cobbles and pebbles, still covers more than 20 m². Looting pits at the center and southeast corner show that at least some of the damage here was caused intentionally by people searching for artifacts, and a coral abraded fragment that escaped theft remains on the surface.

On the higher *pāhoehoe* behind feature 84, features 85–87 appear to be remnants of an enclosure—these were previously recorded as Bishop Museum site 50-Ha-D21-43 (Cordy 1981) and State site 50-10-18-10238 (Cordy 1986), and interpreted as the sleeping house and special purpose structure of a commoner household. Feature 85 consists of an amorphous mound of stone, but features 86 and 87 both have remnant sections of interior and exterior facings, respectively. These sites appear to be in much the same shape as they were when Cordy studied them. If connected, the entire structure would have been a C-shape enclosure with an interior of about 15 m²,¹ midden, 'ili'ili, and coral pebbles between the features strengthen this interpretation.

Just outside feature 87, a small lava blister shelter, feature 88, with a 3 m² interior surface, has been looted, spreading cobbles and midden around the opening, which appears to have been intentionally bashed open to provide access to the original occupants. At 1 m high, the interior provides enough room for a couple of adults to crouch, but the rather large midden pile left by looters indicates that the floor would have been closer to the ceiling, and perhaps the feature simply provided storage or disposal space. Three meters north, a pecked depression, feature 89, covers less area than feature 82, but at 20 cm deep is better defined; it is unclear whether this is an abandoned attempt to break through to an underlying natural cavity, or simply to create an in-ground "bowl."

A trail, feature 90, passes east and south of the *pāhoehoe* mound on which features 85–89 are built. Following the most naturally convenient route across the *pāhoehoe* from the bulldozed road to the beach, this feature may be modern, and is relatively rough, lacking the smoothly worn path typical of historic and ancient trails across the *pāhoehoe*. It mostly follows a natural trench in the flow, and some areas have cobble fill to create a better surface. At the *makai* end of the trail, a wall, feature 90.1, extends out from the *pāhoehoe* into the sand, but has been identified as a modern feature by locals familiar with Manini'ōwali Bay over the past few decades.

Included in cluster D due to its relative proximity, feature 91 actually lies 10 m south of the trail, and 25 m from the closest definite archaeological feature. As such, it either represents an outlier to the functional unit of Cluster D, or is unrelated. Occupying a small niche in the *makai* edge of the *pāhoehoe* flow, certain attributes indicate that this small enclosure could be an animal pen. Compared to the exterior, the interior

¹Cordy (1986) estimated 24 m².

facings exhibit more carefully constructed vertical facings, which reach up to 1 m in height. The bare pahoehoe interior measures just 3 m², enough room for a pig or two, but quite small for habitation purposes, unless intended as a temporary sleeping shelter for one person.

Cluster D represents a departure from the clusters at Manini'ōwali and Kākapa described above, in large part simply because the pahoehoe substrate imposes different constraints on construction and settlement. Functionally, 'a'ā clearings and *pāhoehoe* fill areas seem to be the same—a level surface to support habitation activity—despite the fact that the former are subtractive and the latter are additive features. On the *pāhoehoe* itself, terraces and their variants appear much less frequently than on 'a'ā, resulting in the construction of platforms and platform enclosures such as features 78 and 80 wherever an elevated living surface was desired. Rather than anchoring features to large boulders, ledges and niches provide the natural focal points for *pāhoehoe* features. Being a more rigid substrate, the overall surface here bears fewer traces of modification, such as clearings and pits, that typify habitations on 'a'ā. Instead, modifications either make use of added fill to create level pavements, or target raised areas where minimal augmentation can create terracing, or bashing can provide access to natural underground chambers. Otherwise, the approach is much less one of wholesale modification than of using natural microtopography to its best advantage, such as level areas for general habitation, or a trench for a trail.

Cluster E: Small *Kauhale* and Pit Complex

Located on the beach south of cluster D, this cluster consists of six structures at the edge of the beach and a series of a dozen pits extending *mauka* nearly 50 meters (vol. 2, map 18). Although there is sand at the northwest end, this end of the beach begins the transition to a rockier shore. Extremely dense thickets of *kiawe* back the beach, and although examination indicates an absence of noticeable above ground structures, it may be possible that subsurface deposits exist in the sand, or that a small pit may have been overlooked in the *pāhoehoe*. The *pāhoehoe* itself occurs in thin, brittle layers, with a finely rippled surface. Pits mostly appear to be man-made, and in some cases the water-worn hammerstones presumably used to make them remain inside or nearby.

Embedded in beach sand, rectangular feature 104 still today offers 21 m² of flat, sandy surface for camping. Excavation of a test unit inside the southwest corner of feature 104 revealed a stratigraphic profile with four layers (fig. 43). The basal layer IV is a natural storm deposit of primarily calcareous sand and gravel mixed with basalt sand and gravel derived from the *pāhoehoe* flow behind the beach (table 3). It overlies uneven *pāhoehoe*. Layer III is a cultural layer containing traditional Hawaiian materials, which are described in chapter 5. The calcareous sand matrix is fine, indicating a gentler deposition mode than layer IV. Layer III extends beneath the west wall of feature 104, which is set into the top of the layer. Layer II is a compact calcareous silt that lacks cultural material. The fine texture of this layer indicates a continuation of the trend to gentler deposition modes, presumably during the early historic period. Layer I is the modern surface and contains a variety of modern trash.

Ten meters down the beach from feature 104, feature 103 measures less than 4 m long, but could be a remnant of a feature on the scale of feature 104. Such features

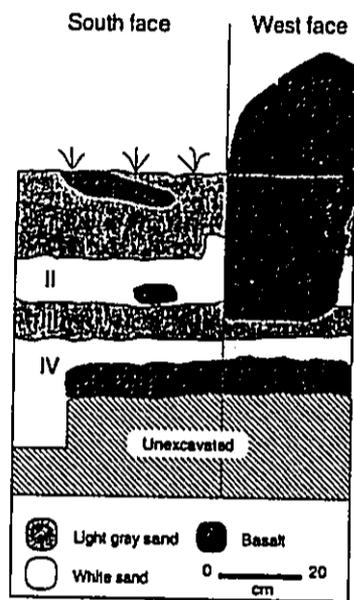


Figure 43. Stratigraphic profile, south and west faces, test unit 1, site 50-10-18-23356 feature 104.

Table 3. Sediment descriptions, feature 104, site 50-10-18-23356

Layer	Depth	Description
I	0-20 cm	Light gray (10YR 7/2) medium calcareous sand, many coarse-very coarse basalt sand; structureless, loose, noncoherent.
II	20-30 cm	White (10YR 8/2) calcareous silt; structureless, soft, weakly coherent.
III	30-38 cm	Light gray (10YR 7/2) fine calcareous sand with common coarse basalt sand and basalt gravel; structureless, loose, noncoherent.
IV	38 cm to BOE	White (10YR 8/2) fine calcareous sand with common very coarse basalt sand and basalt gravel and calcareous gravel; structureless, loose, noncoherent.

typically signal habitation in pre- and post-contact Kona. More than 10 m north of feature 104, feature 105 has been battered by waves, and perhaps altered by visitors, but retains a rectangular foundation. What appears to be a wall remnant rises above the *makai* face, and a small mound sits on the platform, and a partially collapsed line of large *pāhoehoe* blocks appears to have paralleled the northwest wall 1.2 m farther inside. The coast trail passes *makai* of features 103–105, and some people now pass through feature 104, but no formal construction remains of it.

Unfortunately, the trail now takes a detour to feature 102, the first enclosed pit, where people now defecate and leave their bath tissue, underwear, broken beer bottles, and other trash. Just 1.5 m in diameter, the nearly-vertical interior face extends 1.2 m down to a pit broken through the *pāhoehoe* into the roof of a small lava tube that trends *mauka-makai*. Nearly filled with sand at the time of the survey in late March, 2002, the tube height could not be directly observed, but people familiar with the area during low sand periods do not know of a sizable tube here.

If not connected with the same tube, *mauka* pit features comprise a set of forced entries into the same tube system, mostly exposing segments too shallow for human access. Features 101 and 94–99 range from less than 3 m² to more than 10 m² of open area, and have occasional overhang cupboards, but none provide habitable space. Near the beach end, feature 100 is only a cupboard, but on the *pāhoehoe* above lies a concentration of shell midden, sand, water-worn pebbles, and coral from the beach. One function of the remaining pits appears to be local quarrying, judging from the quantity of stone left at the pits and the use of *pāhoehoe* blocks in all the coastal features. Feature 98 has more stone fill than other pits, feature 94 has an interior stacked wall segment, and feature 95 has a small C-shape enclosure outside its rim. Just like the smaller pits, lobes of the larger ones are 1.5–2 m wide.

At the *mauka* end of cluster E, feature 92 closely resembles feature 102, but has midden inside. At about the same distance from the coast, Feature 93 looks like another pit, but provides access to more than 10 m² of sheltered area. Thoroughly looted, diverse midden covers the floor and surrounds the entry.

Cluster E consists of settlement features along the beach with an extension onto the *pāhoehoe mauka* of the beach. Two high-walled, small enclosures rise around skylight entries to pits broken through the *pāhoehoe* at both the *mauka* and *makai* ends of cluster E. Both extremes also have evidence of habitation, but the intervening space has little, instead consisting of a series of midden-less pits. *Makai*, feature 102 sits just a little bit farther from shore than the belt of habitation features along the Manini'ōwali shore. *Mauka*, pits follow the meandering tube system nearly 50 m to where it becomes large enough to shelter people; besides yielding building material, the pits, intentionally or not, probe tube volume up to the point where it becomes habitable. Regardless of intent, cluster E illustrates the relationship between coastal clustering and *mauka* resources on a small scale.

Cluster F: Tube Habitation and Shrine Complex

Located south of cluster E and farther inland, this cluster of 44 features appears to include habitation and shrine components (vol. 2, map 19). A lava tube just big enough to provide habitable shelter, and with a smooth outer surface for walking, descends

makai, abruptly marking the eastern edge of cluster F. Unlike the sandier shoreline, beach features here either never existed, or have been claimed by the sea. At the uphill end, a causeway departs from the flow toward what may be a shrine area. Below this, two entries into the tube open out onto an area of nearly level *pāhoehoe* and pavement in the low spots, and a *makai*-side lava flow that forms a natural terrace. On the rougher lava below, a few pits and modifications extend a few meters out from the base of the higher flow. On the western margin of cluster F, a plain of smooth *pāhoehoe* stretches to cluster G, traversed by a worn footpath, and perforated with pits along the near edge.

The lava flow defining the northeast edge of cluster D stretches inland as far as the bulldozed beach access road, but *mauka* of that it blends back into the larger *pāhoehoe* field. Wear on the surface from the road down past feature 110 provides evidence of its use as a branch of the coastal trail, site 50-10-18-23360, a function for which this natural formation is perfectly adapted. The antiquity of this route, however, remains uncertain, since features within cluster F indicate an alternate route, and the trail does not continue *mauka* of the road. At the edge of feature 113 and within the jumble of mound feature 112 are numerous thick slabs of *pāhoehoe* and water-worn beach rock that appear to have been stepping stones. They resemble the pavers covering much of the trail from cluster F to the shore, and differ from the much thinner material, also present in feature 112, used as the pavement of feature 116. A faint pathway over the smooth *pāhoehoe* passes between features 115.1 and 116 before branching on either side of feature 117 and fading away. Visually striking, it may be that the flow was spotted in recent history by people waling down the bulldozed road, and turned into a trail.

Beneath the flow, however, traditional Hawaiian occupation undoubtedly occurred. One large and one small opening broken through the roof crust near feature 113 provide access to a tube that is large enough for many people to sit in. The mound, feature 112, and surface midden show that looters thoroughly ransacked the deposit within the habitation area, which appears to have extended into the twilight region, but not into darkness. With the large and small openings and the *mauka-makai* orientation, the cave is well situated to be ventilated by typical breezes here. Unfortunately, trash disposal and excreta have become the modern functions of this tube. From the amount of midden remaining in and near the tube, it is clear that this cave sheltered people frequently, or perhaps permanently.

Based on the landscape, feature forms, and the presence of midden, habitation seems to have been the primary function west of the cave as well. Feature 116, a terrace connecting two high spots in the lava terrain, creates a 24 m² floor with complex construction; beneath the partially dismantled surface of thin *pāhoehoe* slabs, cobbles with pebbles filling the interstices provides a level base course. Although simpler and smaller, feature 120 appears to be constructed on the same principle, using fill and a low terrace alignment to maximize level area. *Makai* of feature 116 a low, level area of the flow naturally offers a habitable surface, in which cracks have been filled with pebbles, cobbles, and midden. Feature 113, a pavement, represents filling of the lowest ground with cobbles and pebbles to create a more level surface, but the entire area is strewn with midden. As mentioned previously, a cross-slope flow creates a natural terrace defining the habitation area, which measures more than 100 m². It should, however, be kept in mind that a trail presumably crossed this area, making it a commons or

general use area.

Below the natural terrace, a small overhang, feature 108, represents a similar cobble and midden filled low spot, although there is not clear evidence that the cave itself was inhabited, since it has a rough floor and low interior. This area may be a temporary habitation associated with the trail, rather than the more formally defined, and perhaps permanent, habitation features.

Above features 113 and 116, several well-constructed features may either represent more habitation, or perhaps a shrine complex. While the structure forms—platform and various types of terraces—would be consistent with habitation, less midden occurs on these upper features, and some attributes indicate a more sacred function. Previously recorded as a special purpose structure (Cordy 1986) and labeled Bishop Museum site 50-Ha-D21-46 and State site 50-10-18-10242, feature 117 sits atop a prominent knoll, has high side and back walls but is open to the ocean, has some branch coral, and also features a lower step below the front edge—attributes that occur on shrines, particularly *ko'a*. An anomalous line of stones, feature 117.1, too low to be a wall, but too uneven to be a paved trail, extend from the eastern wall of feature 117 to a set of three stones set firmly into a bed of cobbles. The easternmost is *pāhoehoe*, set in an erect position. The next is also upright, but is 'a'a; it has a red interior, but like the final stone has a whitish coating on much of its surface. Although lacking the finer pecking, smooth surface, or animal or human forms sometimes associated with religious upright stones, all of these are conspicuous when approached from the *makai* trail, and have fractures indicative of rough modification.

ko'a

Below the uprights, features 115 and 114 connect the lava tube and trail to the higher ground of the possible shrine. The latter clearly functions as a causeway, although its width exceeds that necessary for a trail, and could conceivably function as a base for habitation. Likewise, feature 115 could be a habitation, but lack of midden and the overall placement indicates that these two features function instead as a formalized route to feature 117. *Makai* of feature 117, feature 118 is a very well constructed, concave terrace incorporating several upright slabs. Besides presenting a finely made face *makai*, feature 118 also serves to retain a level area in front of feature 117.

From the upper, western surface of feature 118, a natural, smooth ridge extends *makai* about 5 m before encountering an unusual formation, a stone that juts up a half meter and has a concave edge. Numerous pieces of branch coral have been placed inside this cavity, feature 121, and on a small cobble pavement that sits above and *mauka* of the stone. A crushed stone trail, feature 119, connects this shrine to a more ambiguous, but possibly related formation and mound, feature 122. The formation consists of a high lobe of *pāhoehoe* with a deep crack in the upper surface; part of this crack and the entire *makai* end of the flow is covered with cobbles, fairly well sorted in the 10–20 cm size range. Some coral and midden occurs on the surface between this and feature 121, and about 5 m to the west is a low depression filed and paved with cobbles and pebbles.

About 4 m west of feature 117, a small terrace, feature 135, could conceivably be an ancillary habitation feature, but instead appears to be a burial platform. Two nearby cobble mounds, features 134 and 136, lack the size to be burials, and their position instead suggests that they function as trail markers, feature 134 in line with the trail to cluster G, and feature 136 perhaps a reminder to stay *makai* of the shrine and burial.

Mounds *mauka* of feature 177, including features 139 and 142–144, may also have a trail marking function, although at least one must mark the *mauka* boundary of a historically subdivided lot.

A series of pits, features 128–131, 137, 138, 140, 141, and 145, along the western edge probably represent outlying activity associated with cluster F, but their precise purpose remains a mystery. Although some have been filled with cobbles and were not excavated, the others all provide access to small lava tubes, none of which appears large enough to provide a passage, much less a habitation shelter. Burial is one plausible explanation, especially since even some of the open pits have interior rocks apparently blocking off small tubes.

The *makai* end of cluster F sits just below the steep slope created by natural lava flows. Features 123 and 124 each consist of pits broken through to small lava tubes, and although it is conceivable that rubble in feature 124 could hide a passable tube, it appears unlikely given the steeply sloping roof. Likewise, feature 126, another pit, provides a skylight entry into a very small tube, although the existence of feature 125, a cobble-filled terrace at the base of the higher flow atop the feature 126 tube, could conceivably be a sealed entry. To the west around the base of the same flow, feature 127 is an isolated small mound of undetermined function.

Natural terrain provides the foundation for cluster F. On the eastern edge, a small lava flow offers means of both transport and shelter. At the top of the cluster, a knoll presents the perfect location for a feature overlooking Manini'ōwali Bay. Interestingly, the extremely level *pāhoehoe* west of the site bears almost no signs of human activity, an observation punctuated by the single trail corridor to Cluster G, suggesting that proximity to the cave, and perhaps even the low, sheltered bowl landform around features 110 and 113, was preferred. Cluster F seems to be well organized with respect to particular activities. Features 110, 113, 116, and perhaps 120 represent generalized habitation activity, while feature 108 may be a resting area or temporary habitation associated with the trail. The ridge extending down from feature 117 through feature 121 and perhaps feature 122 has attributes of a shrine complex, with features 114, 115, and 118 forming an elevated causeway leading to the uppermost *ko'a*. Features at the western margin suggest a burial ground. Although the shoreline fronting this cluster lacks the typical beach habitations or a convenient canoe landing, the very existence of cluster F on the *pāhoehoe* behind the beach, and the well constructed trail connecting it to the ocean, strongly indicate that cluster F represents a center of activity for some Manini'ōwali inhabitants. The shrine attributes raise some doubt as to whether the associated habitation is a typical *kauhale*, but the abundance of midden and existence of a good shelter cave make it hard to imagine that this was not a heavily used habitation.

Cluster G: *Pāhoehoe* Point Caves and Remnant Features

About 250 m southwest of the 'a'a flow marking the north point of Manini'ōwali Bay, a portion of the *pāhoehoe* flow juts out to divide the larger bight, with sandy beach confined to the northern section. Cluster G sits just behind the point, on a smooth, level portion of the flow. Like cluster F, this area has a habitable lava tube, surface features, and a pattern of cobble pavements filling the low ground (vol. 2, map 20). Unlike cluster F, cluster G occupies terrain more easily traversed by truck, and therefore has been

extensively damaged above and beyond the looting, trashing, and defilement typical of Kua Bay today. The forms and locations of remnant features suggest a traditional Hawaiian habitation.

A spur of the bulldozed road to the beach, although barricaded, has been treated as the launching point for a road that traverses the *pāhoehoe* with a few low spots filled in. Bounding cluster G on the eastern edge, this road eventually goes all the way to a small, protected cove. Marked with white spray-painted lines, a tuna-shaped fish, and the initials "V.G.," "D. L.," and "J.A.," the route clearly lacks antiquity, and no worn indications of an older trail were observed near it. One branch of this road turns west just *makai* of feature 148, the heavily damaged corner of a walled feature. Occasional stones lie across the 10 m separating the corner from feature 149, an even more damaged wall segment. Apparently, visitors dismantled the wall to drive another 20 m to a low spot paved with coral pebbles and 'ili'ili, feature 153, used as a parking space. Feature 150 mirrors feature 149 on the opposite side of this sand-covered driveway, and a *pāhoehoe* pavement, feature 151, mirrors the destroyed part of feature 148. Lack of surface architecture or even the potential to excavate precludes proof, but it is possible that features 148-151 once formed a single large enclosure. Alternatively, features 149 and 150 could be a separate enclosure remnant. Near feature 148, feature 147 consists of a crack entry to a small tube chamber in which two or more people could sit, but not stand. Feature 146, a partially filled pit broken through the *pāhoehoe*, lies just 3 m away, and defines the southern extreme of cluster G.

Feature 153, although just the right size for a truck, may not have been constructed for that purpose. The coral and basalt water-worn pebbles used in its construction occur in traditional features, but would also be easy to bring in a truck. At the eastern edge of the feature, two unusual, hole-filled rocks have been placed together. Again, these could have been set months or centuries ago.

East and north of feature 153, a series of cobble pavements, features 152 and 163-165, fill the low spots in the lava, forming a broad courtyard covering more than 250 m². North of this, feature 161 may be another remnant enclosure. Only the northeast and southeast walls remain, and the large quantity of stone near the east entry to cave feature 158 raises the possibility of a corner there, which would make large, square enclosure with about 70-75 m². Distribution of midden throughout what would be the center of such a feature strengthens that interpretation, but the original feature may also have been open on the *makai* side. The small spur of an interior division wall resembles that of the largest structure at Kākapa Bay, another backward *E*-shape enclosure (see pg. 50).

East of this enclosure, a *pāhoehoe* ridge covers a relatively large, greater than 30 m² interior, lava tube, feature 159 (fig. 44). This site was previously recorded as site 50-10-18-10243 (Cordy 1986). Like every other lava tube in the project area with obvious evidence of Hawaiian occupation, this one has been totally looted. Midden and fragments of coral abraders indicate that a typical coastal habitation deposit was present. Habitation has also occurred recently, with water bottles, bedding, batteries, and other modern trash; the eastern entry has been walled off with metal bars and stacked stone. Feature 156, a few meters to the south, consists of an open sinkhole with a small segment of lava tube also containing midden.

On the western periphery of the site, three pits have been broken through the

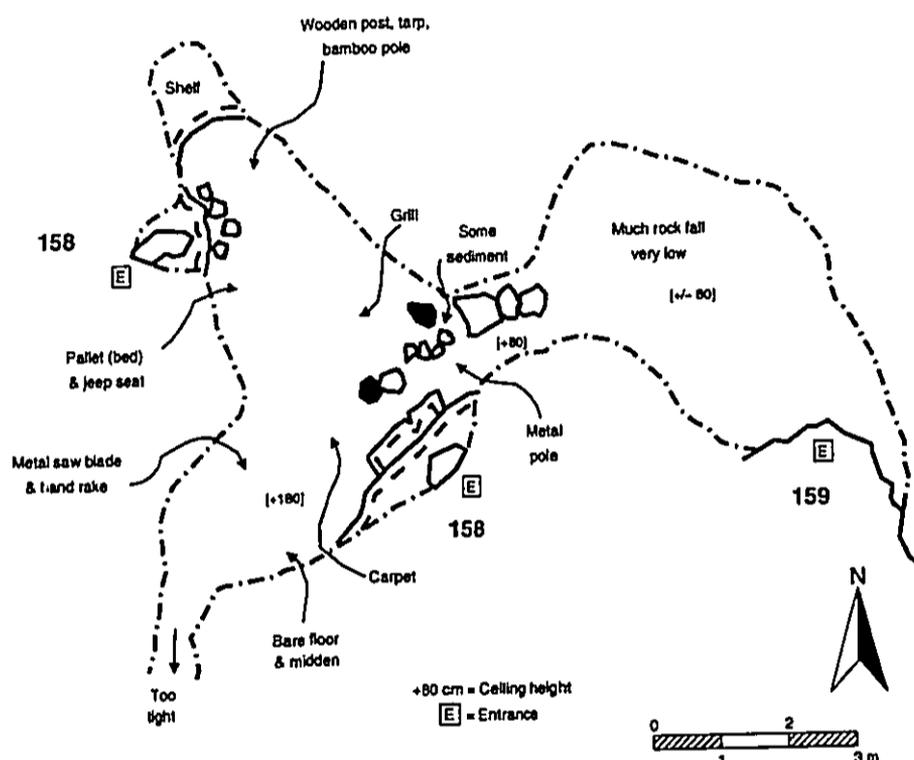


Figure 44. Features 158 and 159, site 50-10-18-23356. Tape and compass map drawn by A. Carpenter.

pāhoehoe crust. None exposes a passable lava tube or habitable shelter. The relatively large size of the pits indicates they may have been quarried to provide stone used in the other features.

In recent years, cluster G has suffered the depredations of truck traffic, habitation, excretion, and dumping. Less obviously, the site probably has been robbed of stone. Most days during fieldwork, rock wall builders could be observed in Awake'e *ahupua'a* taking material, and the presence of a road by feature remnants and the absence of tumbled rock on the site suggests that it has happened here as well. As well as can be determined, cluster G functioned as a habitation cluster, or *kauhale*. The relatively small number and large size of surface features here departs from the typical pattern, but the relatively large area of level surface and protected cave shelters presents an unusual environment where not much building is required.

Cluster H: Burial and Shrine Lava Tubes

Between the points where one spur of the bulldozed road terminates and the other turns to parallel the coastline, lava tubes and blisters have been utilized for purposes beyond the typical habitation. Although undulating in ridges and tumuli that exceed a meter in height, the overall terrain represents a break from the steeper slope *mauka*, and begins the bench that extends *makai* to cluster G.

Partially crushed by the bulldozed road, feature 180 consists of a lava tube extending 12.5 m with a passable space about 2 m wide and a total width of more than 4 m (fig. 45). Additional space may have existed beneath the road, which broke open the skylight through which the cave is now accessible. This end of the tube has some midden inside and out, as well as the ubiquitous modern deposits of broken beer bottles, human filth, and garbage. It appears to be a looted habitation area.

A couple of meters into the cave, two wall segments, features 180.1 and 180.2, appear to be remnants of a feature that sealed off the back of the cave. Behind this, human bones are scattered throughout the back part of the cave, where midden does not occur. The condition of both wall and bones indicate disturbance, and incompleteness of the skeleton suggests that some bones have been removed. The number of individuals was not determined, although it does not appear to have been large. A few water-worn basalt cobbles occur in the burial portion of the cave.

Near the end of the other road spur, Bobby Camara identified a rubble-filled lava blister, feature 181, as a shrine he had seen decades ago (fig. 46). Upon clearing out broken *pāhoehoe* rubble, the original interior surface was indeed shrine-like. Although not finely paved, a half-dozen water-worn 'alā stones occur here. None remain in an upright position, but all exceed 20 cm in length, and have the oblong shape and smooth surface associated with stones found in shrines elsewhere in the project area. One is tucked beneath an overhang on the northwest side of the blister, which has an exposed opening of slightly over 2 m². At 60 cm in length, one of the 'alā stones is about twice the size of any of the others. A meter to the east of the main feature, the edge of a natural lava ridge has been augmented with an alignment of *pāhoehoe* and water-worn cobbles.

Cluster I: Pit Complex with Lava Tube Habitation and Shrine

Located 300 m from the shore, just *mauka* of a large field of *pāhoehoe* pits, a cluster of caves and associated features straddles the inland boundary of the project area (vol. 2, map 21). The *pāhoehoe* pits, among which several large beach cobbles are found, include typical examples that break through the upper crust of lava into a shallow void and several that provide entrances to small lava tubes, some of which were used for storage. Feature 305, a collapsed lava tube in which the interior rubble has been pulled away in four places to make small openings into the tube, marks the *makai* edge of the cluster. The area of collapse is 3.8 m long and 3.2 m wide, and a few marine shells at the west end of the collapse, including cowrie, *pipipi*, and *Conus*, indicate a low level of habitation.

At the *mauka* end, several inhabited and utilized lava tubes and surface features indicate habitation and ritual activity. Both the *mauka* and *makai* boundaries more or

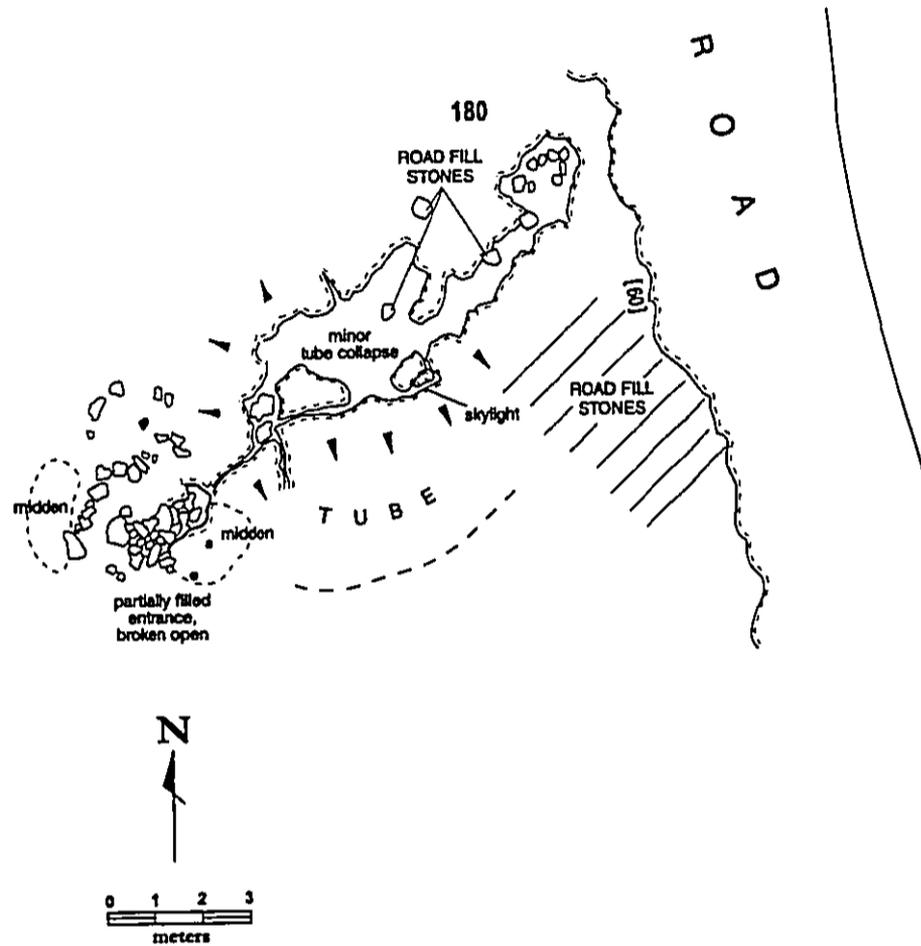


Figure 45. Cave feature 180, site 50-10-18-23356. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

less conform to the terrain, not venturing onto more level lava plains. Likewise, the other boundaries reflect the landform, not extending off the ridge in either direction.

The *pāhoehoe* pits here often break through rather thin roofs of shallow lava tubes, exposing a pit that is relatively deep and with substantial overhang on one or two ends. Features 286 and 287 are both very small, less than 0.5 m long, and unusual in being deeper than they are wide. Pits like these do not produce much material and appear to have been used for storage, rather than as quarries. Feature 298, a long narrow *pāhoehoe* pit, contains a piece of bamboo about 80 cm long under the overhang on the north end of the feature (fig. 47). Several of the pits in this cluster would have functioned well as storage for similar long items.

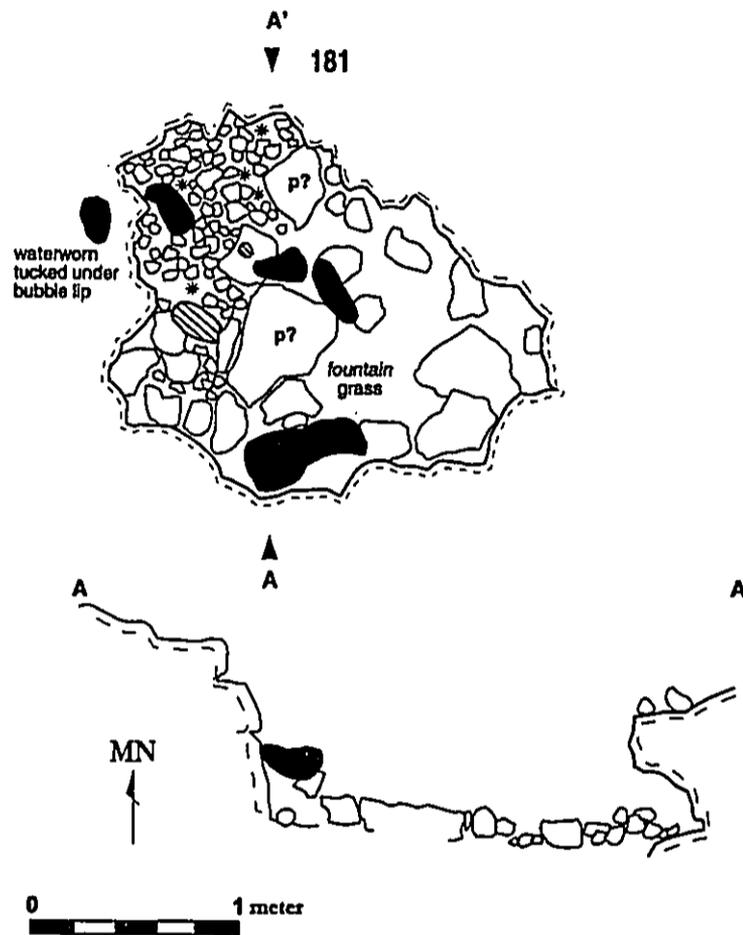


Figure 46. Plan and cross-section of shrine, site 50-10-18-23356, feature 181. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

The pits here appear to have been under construction when the cluster was abandoned, based on the relatively large number of waterworn cobble hammerstones left behind. One is found in *pāhoehoe* pit feature 299 and two others, features 290 (fig. 48) and 303 (fig. 49) were found on the surface

Above the pits, where terrain begins to level off, several sections of lava tube have been used for habitation and storage. The largest, feature 173, has a 5 m long roofed section, *mauka* of which an open air section extends nearly another 5 m. Both areas have marine midden and *kukui* shells. The *makai* entry, smaller but large enough for easy passage and for light to enter, lies behind feature 175, a partially collapsed enclosure constructed of upright *pāhoehoe* slabs and cobble fill. Another upright slab defines the cave entry, and *pāhoehoe* pavement within feature 175 and at the adjacent

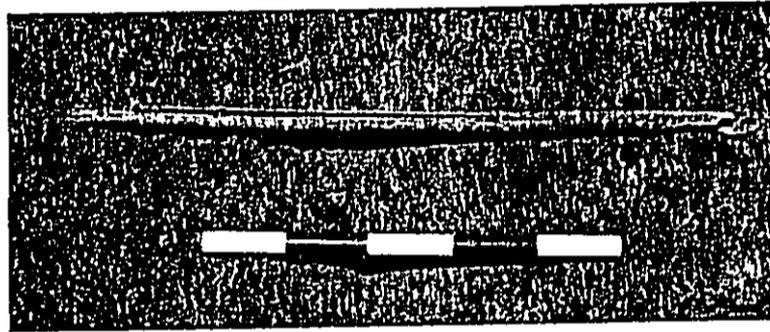


Figure 47. Bamboo from the interior of *pāhoehoe* pit feature 298, site 50-10-18-23356. The scale is marked in 10 cm increments.

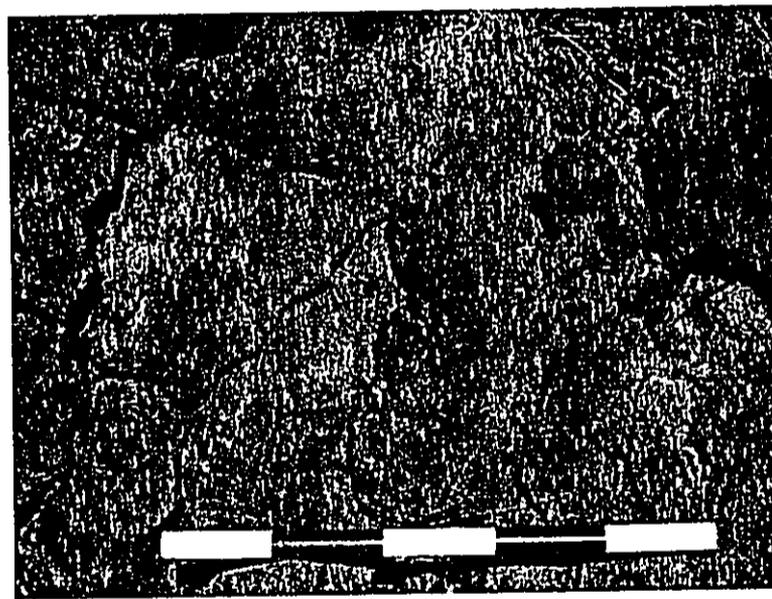


Figure 48. Water-worn cobble hammerstone, site 50-10-18-23356, feature 290. The scale is marked in 10 cm increments.

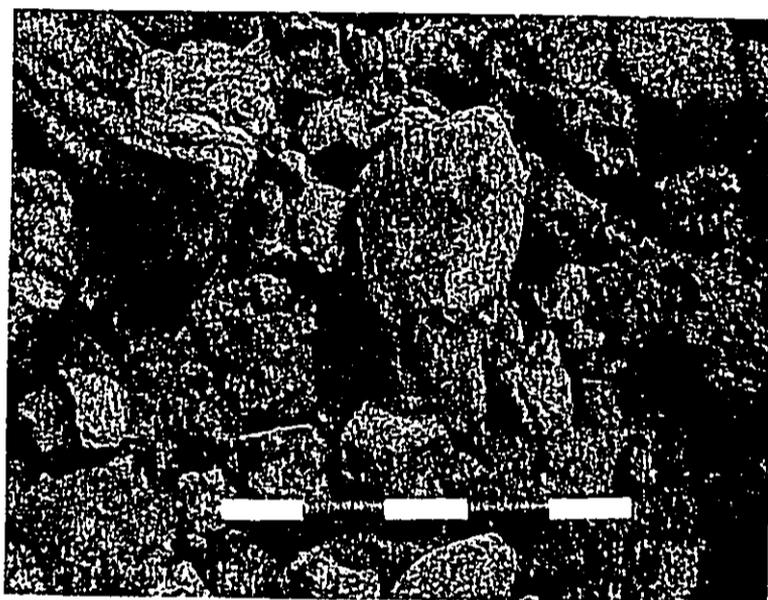


Figure 49. Water-Worn basalt cobble hammerstone, site 50-10-18-23356, feature 303. The scale is marked in 10 cm increments.

feature 175.1 covers the approach to it. Given the absence of branch coral or other indicators of shrine activity, as well as the unremarkable cave midden, the upright position of these slabs appears to be more a matter of construction expedience than of religious significance. A pavement, feature 176, on the cave roof and a juxtaposed wall remnant, feature 178, may have been part of a single structure, and in fact may have connected to feature 175 to enclose the *makai* cave entry, with feature 175.1 being the access path. Damage to these structures makes it impossible to make that determination.

About 3 m northeast of feature 175, a C-shape enclosure, feature 174, opens to the north, away from the other features. Upright slabs lining the interior of the back wall are carefully set, exposing the whitish underside of the stones (fig. 50), and reminiscent in style to feature 118 in cluster F (see pg. 109). Ends of both side walls curve to the west, and reach only half the height of the meter-high back wall. Between the western wall and feature 178, feature 174.3 consists of a small cave containing midden, but is too small for a person to fit inside and is designated a cupboard. Outside the opposite wall, the *pāhoehoe* surface has been pecked, but without rendering a bowl or petroglyph figure. Next to these, a worn path, feature 174.1, crosses the *pāhoehoe*, passing the back entry of feature 173 and fading out at feature 168.

Twenty meters *mauka* of feature 174, a section of lava tube, feature 171, just 60 cm high inside appears to have been used for storage. A cache of bamboo poles with a maximum diameter of 2.5 cm lies inside, but no midden was observed. A very small pit, about 30 cm in diameter, breaks through the *pāhoehoe* 5 m to the south, and the entire surface of the flow here is very fragmented, possibly due to quarrying for stone

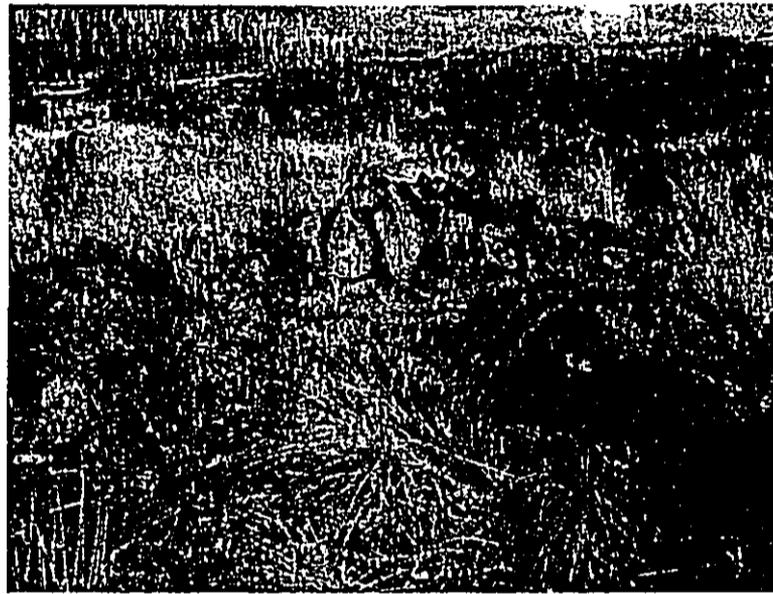


Figure 50. Enclosure, feature 174, site 50-10-18-23356, looking east. Note the whitish color of the upright *pāhoehoe* slabs at the back wall. The scale is marked in 10 cm increments.

used in constructing the surface features.

Makai of the trail connecting the north and south portions of the cluster, occasional small, less than 1 m² scatters of midden indicate use of the smooth, relatively level pahoehoe for habitation. A cave, feature 169, has an entry broken through on the *mauka* side, and its 1.1 m ceiling allows a couple of people to sit inside, but very sparse midden does not indicate heavy use. Nearer the trail, the only sizable pit in this habitation area has an interior wall of upright slabs, which along with its relatively high elevation and several pieces of branch coral outside suggest that it may be of some ritual significance.

The southern end of the trail fades out between feature 168, a small, stacked wall segment, and feature 167, a relatively large mound. A small patch of midden next to feature 168 suggests habitation, although relatively short-term. The mound, being larger, represents somewhat more labor investment. Located next to the trail, it could be a marker. Alternatively, it has sufficient volume to be a burial feature.

Continuing to the south, a low spot wedged between tumuli has been modified to create a shrine, feature 166 (fig. 51). Tucked beneath the surrounding landscape, the position is somewhat unusual, but the presence of branch coral and several large water-worn basalt stones, accompanied by the use of uprights in the construction certainly leads to that interpretation. One large stone that probably once stood upright at the site has two depressions resembling eyes, lending the *pōhaku* a human-like form (fig. 52). The effort involved in bringing the boulder here may exceed that put into construction

of any of the habitation features, which all consist of stone from the immediate vicinity.



Figure 51. Shrine, feature 166, site 50-10-18-23356, looking north. Note the several water-worn boulders and cobbles. The scale is marked in 10 cm increments.

Cluster I is larger than most, but the majority of its area consists of pits in the *pāhoehoe*. Within this, habitation appears focused within a 150 m² area around the largest lava tube, feature 17), although ancillary features and scattered midden indicate at least sporadic use of an area closer to 350 m². The few pits within the habitation area are either very small, or have construction within them, indicating activity different from the pits *makai*. Although separated by more than the 10 m threshold used to distinguish *kauhale* clusters at the coast, the north and south sections of cluster I are linked by a well-worn trail, and united in their isolation from anything else at this elevation. Several aspects suggest that habitation here was temporary. With perhaps only two surface habitation features and one cave, it would fall at the lower end of *kauhale* in terms of both area and number of features. Also, it is located at the uphill end of the *pāhoehoe* pit field, complicating ocean access; no trail was found connecting this directly to the ocean. Location above the pits instead suggests a closer relation to the activity of pit-bashing, rather than to “normal” habitation, which in this area occurs almost universally within 100 m of the shore.

That there exists a habitation and a shrine here suggests that making the pits was an activity somehow segregated from the everyday life—the distance between the pits and coastal habitations is trivial, meaning that a separate habitation is by no means necessary. It is conceivable that inhabitants of cluster I did not also live at the coast, but the *mauka* settlements of Kekaha are so far away as to make this interpretation a

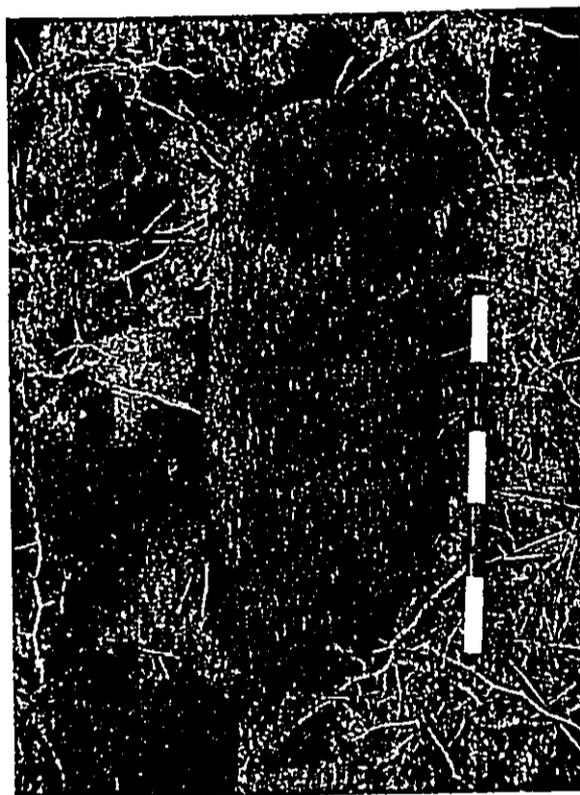


Figure 52. Water-Worn boulder at feature 166, site 50-10-18-23356. The indentations resembling eyes are near the top of the boulder. The scale is marked in 10 cm increments.

stretch. Although alternative explanations are possible, two known uses of bamboo poles involve fishing along the Kekaha coast (Kamakau 1976; Maly 1998) and for use in directing fishing canoes (Titcomb 1972:4), another indication that this location, with its reasonably good view of the bay, was used by coastal people on occasion. In that regard, it should be noted that habitation here would more likely be intermittent, or perhaps cyclical, rather than one or two temporary episodes.

Miscellaneous Features

The boundaries of site 50-10-18-23356 take in, in addition to the feature clusters described above, numerous small features that indicate a relatively great level of activity not directly associated with habitation. Most of these features are located in the large 'a' flow at the north end of the site in the vicinity of clusters A, B, and C (fig. 53). Pits and small shelters excavated at the base of large boulders are ubiquitous here. Most of these are too small to have held an adult human, or at least to have held one comfortably

or for any length of time, and provide deep shade for only a portion of the day. Also present are small platforms, some of which appear suited for temporary habitation. Others are roughly paved and might contain human burial remains. None were opened to inspect for the presence of bones, however. One human burial was discovered in a crack in a large boulder, which has also accumulated modern trash.

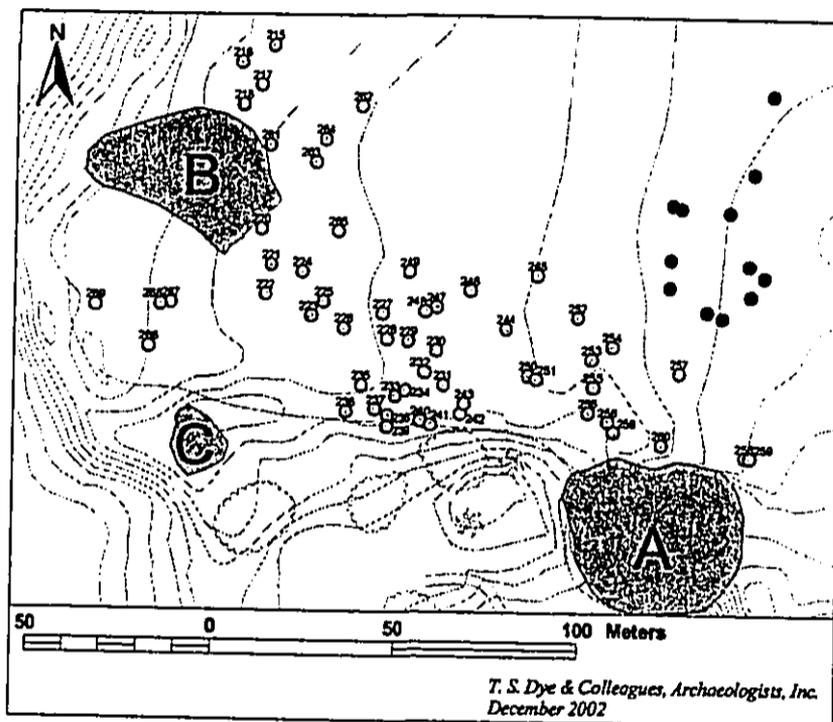


Figure 53. Outlying features on the large 'a'ā flow at the north end of site 50-10-18-23356. See figure 38 on page 93. The dark blue dots are features of trail site 50-10-18-23360.

Northeast of cluster B are eight features within the survey area. Similar features extend beyond these for an undetermined distance. Feature 215 is a small platform that fills the space between three large boulders. It is faced with 'a'ā cobbles and filled with small 'a'ā cobbles and pebbles (fig. 54). The platform is 1.9 m long, 1.3 m wide, and 0.6 m high. A single coral cobble is located on the platform, and an 'ōpihi shell is on the 'a'ā flow nearby. This platform likely supported a temporary habitation, but might also have been used for burial.

Feature 216 is a clearing 4.0 m long and 2.0 m wide paved with 'a'ā gravel and pebbles. Coral cobbles have been arranged on the clearing to form letters. Feature 217 is a small platform faced with 'a'ā cobbles and filled with 'a'ā gravel and pebbles,



Figure 54. Platform, feature 215, site 50-10-18-23356, looking west. The scale is marked in 10 cm increments.

forming a level, smooth surface (fig. 55). It is 1.8 m long, 1.0 m wide, and 0.3 m high. A coral cobble, probably derived from the beach berm deposit immediately *makai*, and two basalt cobble hammerstones are located just off the side of the platform.

Feature 218 is an 'a'ā cobble mound located south of an extensively worked, massive, boulder. The top of the boulder has been worked to expose reddish, interior lava over a large area. The mound is 2.0 m long, 1.3 m wide, and typically 0.5 m high. A small piece of branch coral is located on top of the mound.

Feature 261 is an overhang shelter located at the southwest end of a massive 'a'ā boulder (fig. 57). The shelter is formed by a pit 1.0 m long, 0.5 m wide, and about 50 cm deep. It extends under the boulder approximately 50 cm.

Feature 262 is an overhang shelter located at the north end of a massive 'a'ā boulder (fig. 58). The entrance to the shelter is partially walled with stacked 'a'ā cobbles and one or two small boulders. The shelter interior is 1.2 m long, 0.6 m deep, and 0.6 m high. Features 263 and 264 are 'a'ā pits. Feature 263 consists of two pits on either side of a massive 'a'ā boulder. The pit on the east side of the boulder is 1.3 m long, 0.9 m wide, and 0.7 m deep. It extends under the boulder about 50 cm. The pit on the west



Figure 55. Platform, feature 217, site 50-10-18-23356, looking west. Note the two cobble hammerstones. The scale is marked in 10 cm increments.

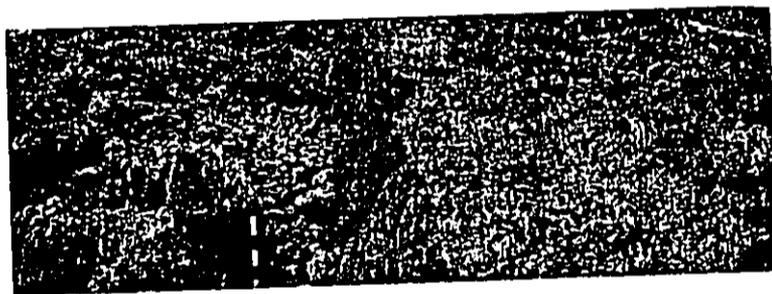


Figure 56. Mound, feature 218, site 50-10-18-23356, looking west. The feature is located behind the scale. Note the broad area of reddish, interior lava exposed on top of the massive boulder. The scale is marked in 10 cm increments.



Figure 57. Overhang shelter, feature 261, site 50-10-18-23356, looking northeast. The shelter is beneath the scale, which is marked in 10 cm increments.

side of the boulder is 1.3 m long, 1.0 m wide, and 0.5 m deep and also extends under the boulder about 50 cm. Feature 264 is excavated in 'a'ā cobbles and boulders about 1.5 m northwest of a massive boulder. It is 1.0 m in diameter and a maximum of 0.8 m deep.

The stretch of 'a'ā lava between cluster B and the anchialine pond contains the majority of the features. Feature 265 is an overhang shelter located under the south side of a massive 'a'ā boulder (fig. 59). It is 1.6 m long, 1.1 m deep, and 0.7 m high.

Feature 220 consists of three mounds located on top of a massive 'a'ā boulder. One of the mounds is constructed by placing four slabs of lava, each approximately 50 cm long, 50 cm wide, and 20 cm thick, on end, leaning against one another (fig. 60). The other two mounds are informally stacked to heights of approximately 40 cm. The top of the boulder has been extensively worked, resulting in a surface littered with cobbles and small boulders.

Feature 221 is an 'a'ā pit located at the base of a massive 'a'ā boulder (fig. 61). The pit is 0.4 m long, 0.4 m wide, and 0.8 m deep. It is partially protected by an upright slab boulder that leans against the side of the massive 'a'ā boulder. A water-worn

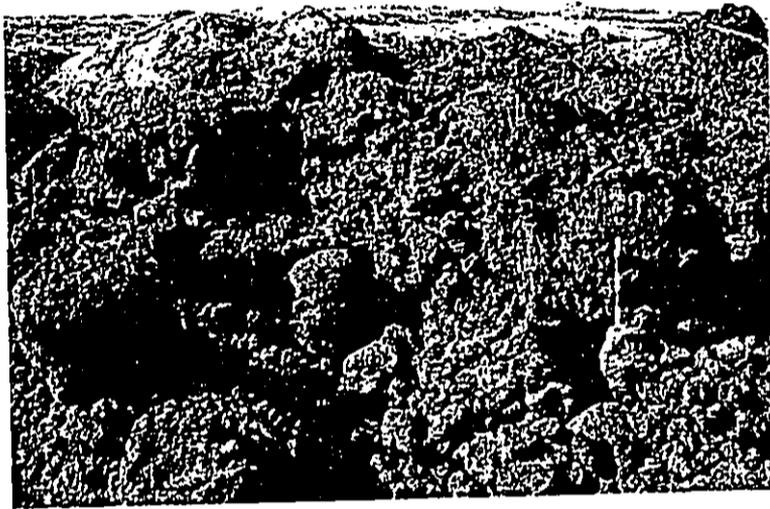


Figure 58. Overhang shelter, feature 262, site 50-10-18-23356, looking south to Pu'u Kuili. The scale is marked in 10 cm increments.

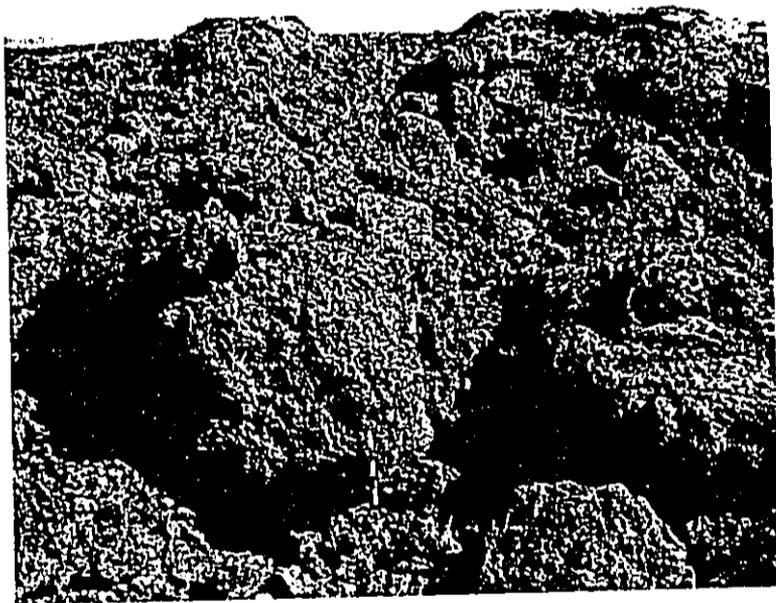


Figure 59. Overhang shelter, feature 265, site 50-10-18-23356, looking north. The scale is marked in 10 cm increments.

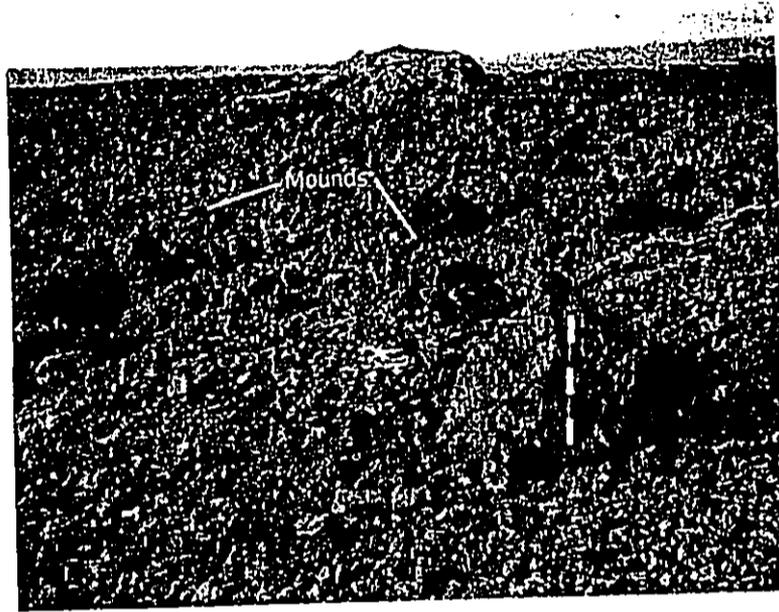


Figure 60. Mounds, feature 220, site 50-10-18-23356, looking north. The scale is at the mound constructed of lava slabs. Note the two other mounds in the background. The scale is marked in 10 cm increments.

basalt cobble is located at the edge of the pit.

Feature 222 is a wall of 'a'ā cobbles and small boulders stacked to a maximum of two courses (fig. 62). The wall is 1.7 m long and has a maximum height of 0.7 m. It is located in an area of fairly even 'a'ā pebbles that might be the remnants of a clearing.

Feature 223 is an enclosure constructed by making a clearing within a ring of 'a'ā boulders. The interior of the enclosure is 1.7 m long, 1.4 m wide, and the surrounding boulders stand to heights of 0.5–0.8 m. The interior of the enclosure is paved with 'a'ā cobbles. Also present are a coral cobble and a water-worn basalt cobble.

Feature 224 is a C-shape enclosure with stacked 'a'ā cobble and boulder walls up to five courses high (fig. 64). The interior of the enclosure is paved with 'a'ā pebbles. The enclosure measures 2.2 m across the opening, 1.3 m deep, and has a maximum wall height of 0.8 m.

Feature 225 is an overhang shelter 1.2 m long, 0.9 m wide, and 0.6 m high located at the base of a massive 'a'ā boulder (fig. 65). A low wall of informally stacked 'a'ā cobbles is located at the entrance to the shelter. The wall was likely constructed of the material removed from beneath the boulder when the shelter was created.

Feature 226 is a long, narrow overhang shelter built along the south side of a massive boulder (fig. 66). It measures 2.6 m long, 0.4 m wide, and 0.4 m high. The shelter was constructed by standing small boulders on end to form the outer wall, then placing boulders and cobbles on top of these to span the gap between the wall and the massive boulder.

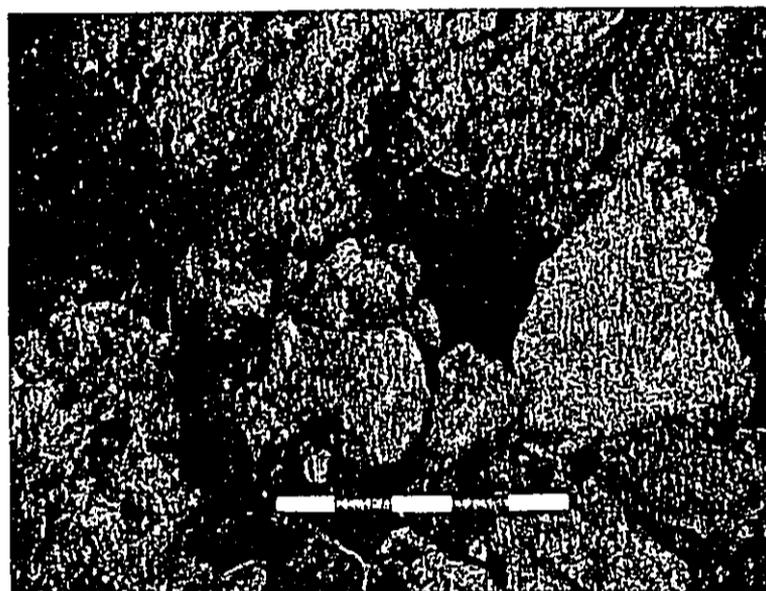


Figure 61. 'A 'ā pit, feature 221, site 50-10-18-23356. Note the water-worn basalt cobble above the scale. The scale is marked in 10 cm increments.

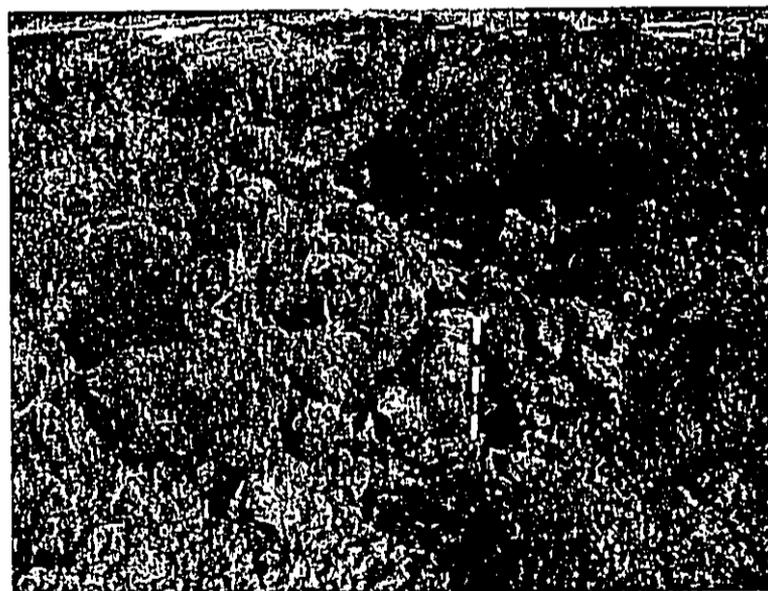


Figure 62. Wall, feature 222, site 50-10-18-23356, looking E. The scale is marked in 10 cm increments.



Figure 63. Enclosure, feature 223, site 50-10-18-23356, looking north. The scale is marked in 10 cm increments.

Feature 227 is an enclosure situated at the *mauka* side of a massive boulder (fig. 67). The walls of the enclosure are large boulders topped here and there with one or two courses of 'a'ā cobbles to a maximum interior height of 1.1 m. The interior is 5.5 m long and 2.2 m wide. It is paved with 'a'ā pebbles and gravel. *Leho* shells, echinoid remains, coral cobbles, and a small water-worn basalt boulder are also present.

Feature 228 is an overhang shelter at the *mauka* end of a massive 'a'ā boulder (fig. 68). The shelter has been excavated under the boulder. It is 1.5 m long, 1.3 m deep, and 0.6 m high. The entrance to the shelter is protected by 'a'ā cobbles, which have been stacked on either side.

Feature 229 is an 'a'ā pit 0.5 m in diameter and 0.9 m deep.

Feature 230 is an overhang shelter excavated under the *mauka* end of a large boulder (fig. 69). The entrance is partially walled with natural boulders, upon which 'a'ā cobbles have been placed. The shelter interior measures 1.3 m long, 1.2 m deep, and 0.5 m high.

Feature 231 is an 'a'ā pit 0.9 m in diameter and 0.3 m deep. The shallow pit appears to have been partially filled with 'a'ā cobbles.

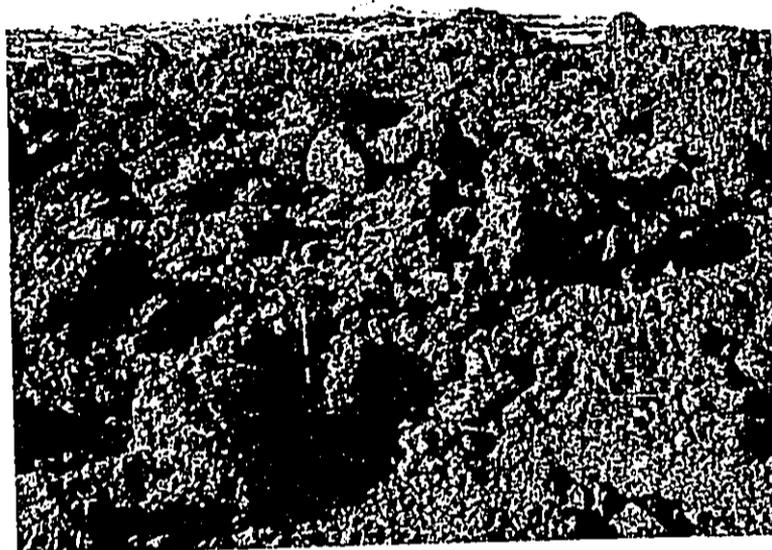


Figure 64. C-shape enclosure, feature 224, site 50-10-18-23356, looking south to Pu'u Kuili. The scale, set against an interior face of the enclosure wall, is marked in 10 cm increments.



Figure 65. Overhang shelter, feature 225, site 50-10-18-23356, looking northeast. The scale is marked in 10 cm increments.



Figure 66. Overhang shelter, feature 226, site 50-10-18-23356, looking northeast. The scale, which is standing in an opening through the roof of the shelter, is marked in 10 cm increments.

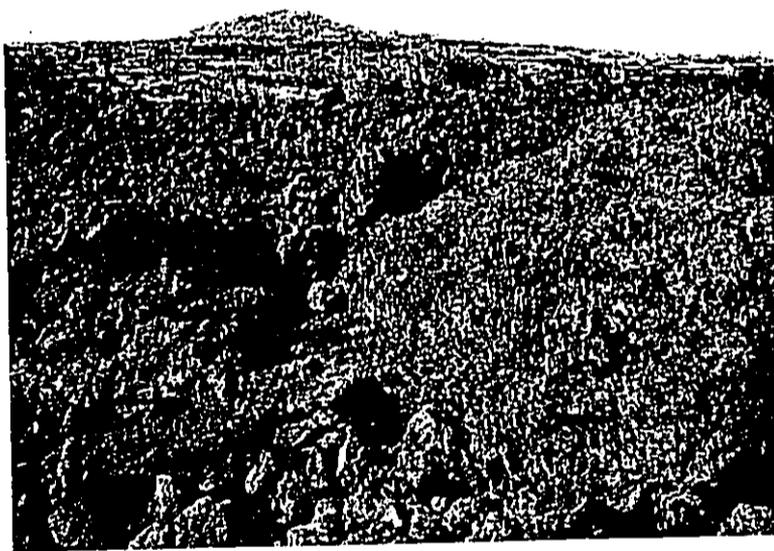


Figure 67. Enclosure, feature 227, site 50-10-18-23356, looking south. The scale, located at the far end of the enclosure, is marked in 10 cm increments.



Figure 68. Overhang shelter, feature 228, site 50-10-18-23356, looking west. The scale is marked in 10 cm increments.

Feature 232 is an overhang shelter at the southeast end of a large boulder (fig. 70). It is 0.6 m long, 0.6 m wide, and 0.6 m high.

Features 233-239 are 'a'ā pits, most of which were excavated next to massive 'a'ā boulders. Feature 233, located at the west side of a massive 'a'ā boulder, is 1.2 m long, 0.9 m wide, and 0.8 m deep. Feature 234, located on the east side of the same boulder as feature 233, is 0.6 m long, 0.4 m wide, and 0.5 m deep. Feature 235 consists of two 'a'ā pits, one on either side of a massive 'a'ā boulder. The eastern pit is 0.8 m long, 0.7 m wide, and 0.8 m deep. The western pit is 0.8 m long, 0.7 m wide, and 0.7 m deep, and contains a water-worn basalt cobble. Feature 236, located at the northwest end of a massive 'a'ā boulder, is 1.0 m in diameter and 1.0 m deep. Feature 237, located at the southeast end of a massive 'a'ā boulder, is 0.6 m long, 0.5 m wide, and 0.5 m deep. Feature 238 is not located next to a boulder. It measures 0.9 m long, 0.8 m wide, and 0.7 m deep. Feature 239 is located at the northwest end of a massive 'a'ā boulder. It measures 1.4 m long, 1.2 m wide, and 0.9 m deep.

Feature 240 is an overhang shelter located under a massive 'a'ā boulder (fig. 71). It is about 3.0 m long, 1.3 m deep, and 0.5 m high. Although the space inside the



Figure 69. Overhang shelter, feature 230, site 50-10-18-23356, looking west. The scale is marked in 10 cm increments.

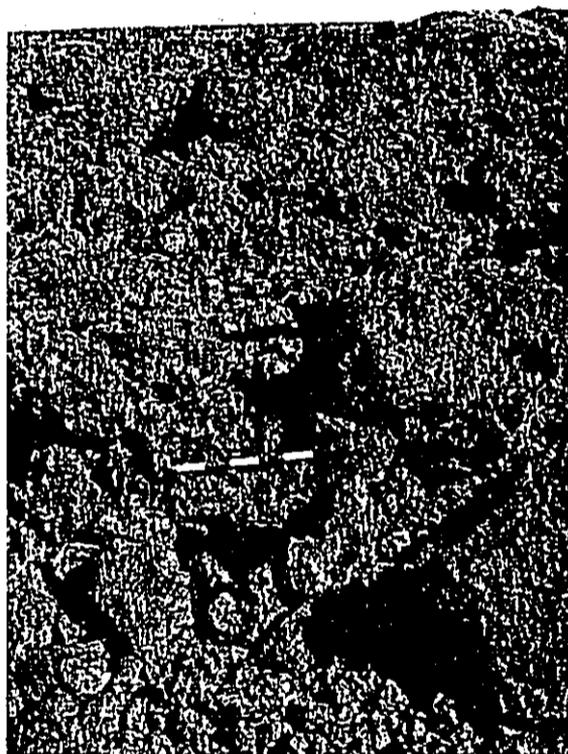


Figure 70. Overhang shelter, feature 232, site 50-10-18-23356, looking northwest. The scale, located above the shelter entrance, is marked in 10 cm increments.

shelter is large enough for an adult human, the opening is small and entry and exit are awkward and difficult.



Figure 71. Overhang shelter, feature 240, site 50-10-18-23356, looking south to Pu'u Kuili and the beach at Manini'ōwali Bay. The scale is marked in 10 cm increments.

Features 241-244 are 'a'ā pits. Feature 241, located on the east side of a massive 'a'ā boulder, measures 1.4 m long, 0.5 m wide, and 0.6 m deep. Feature 242 consists of two 'a'ā pits located along the north side of a massive 'a'ā boulder. The eastern, larger pit is 1.6 m long, 0.5 m wide, and 0.6 m deep. The western, smaller pit is 0.9 m long, 0.8 m wide, and 0.8 m deep. Feature 243 is located between three large 'a'ā boulders. It measures 1.1 m long, 0.6 m wide, and 0.9 m deep. Feature 244 is located at the south end of a massive 'a'ā boulder. It measures 0.6 m long, 0.4 m wide, and 0.6 m deep.

Feature 245 is an alignment of 'a'ā cobbles on top of a massive 'a'ā boulder (fig. 72). The boulder has been worked to break away the exterior lava crust in places. The alignment, about 1.3 m long, fills in gaps in a natural line of frothy, black 'a'ā lava that contrasts with the yellow brown lava exposed over the rest of the boulder top.

Features 246-249 are 'a'ā pits. Feature 246 consists of two 'a'ā pits, one on either

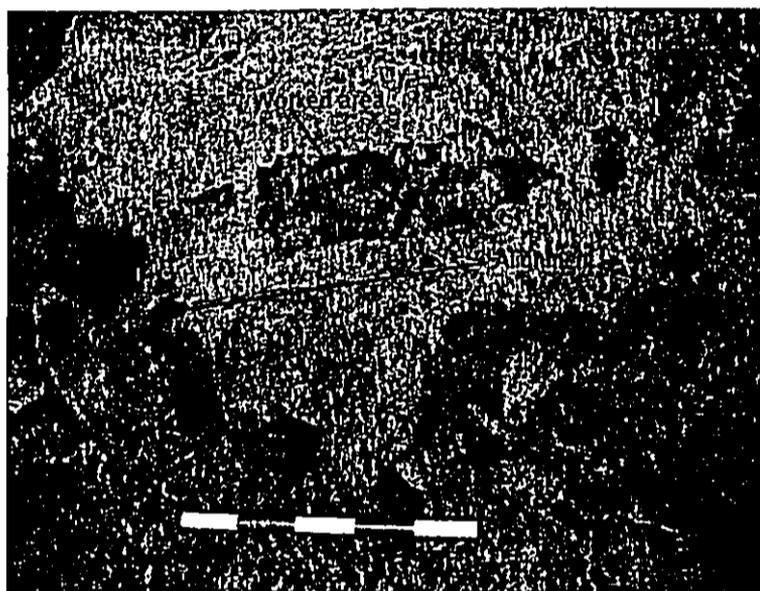


Figure 72. Cobble alignment, feature 245, site 50-10-18-23356, looking west. Note the worked area where the lava crust of the boulder has been broken. The scale is marked in 10 cm increments.

side of a massive 'a'ā boulder. The pit on the north side of the boulder is 0.5 m long, 0.5 m wide, and 0.3 m deep. The pit on the south side is 0.65 m in diameter and 0.3 m deep. It contains a coral cobble. Feature 247 measures 0.5 m in diameter and 0.5 m deep. It contains a small, water-worn, basalt cobble. Feature 248, located between two massive 'a'ā boulders, is 0.5 m long, 0.4 m wide, and 0.6 m deep. Feature 249 is 1.3 m long, 1.0 m wide, and 0.6 m deep. It is located in the space between three large 'a'ā boulders.

North of cluster A are 11 features closely associated with trail site 50-10-18-23360, which exits the 'a'ā lava near the anchialine pond below. Feature 250 is an 'a'ā pit with a small clearing west of it (fig. 73). The 'a'ā pit is 0.5 m in diameter and 0.3 m deep. The clearing is 1.4 m long and 1.0 m wide, and is paved with 'a'ā pebbles and small cobbles. Feature 251 is an 'a'ā pit located at the south end of a massive 'a'ā boulder, in the space between four boulders. The pit measures 0.45 m long, 0.3 m wide, and 0.6 m deep. Feature 252 is an overhang shelter constructed under the south end of a massive 'a'ā boulder (fig. 74). The shelter is 1.2 m long, 0.7 m wide, and 0.5 m high. Features 253 and 254 are 'a'ā pits. Feature 253 measures 0.8 m long, 0.7 m wide, and 0.6 m deep. Feature 254, located between three large 'a'ā boulders, is 0.5 m long, 0.4 m wide, and 0.4 m deep. Feature 255 is a small platform situated between three large 'a'ā boulders (fig. 75). The platform is faced on the west side with 'a'ā cobbles; the other three sides are defined by massive 'a'ā boulders. It is paved with small 'a'ā cobbles. The platform is 1.5 m long, 1.0 m wide, and 0.3 m high. Feature

256 is a wall that connects massive boulders at the edge of a bulldozed area (fig. 76). It is constructed of 'a'ā cobbles roughly stacked between and on top of massive boulders to a maximum free-standing height of 0.8 m. The wall is in poor condition, having been disturbed by bulldozing. Features 257–260 are 'a'ā pits. Feature 257, located at the east end of a massive 'a'ā boulder, is 1.1 m long, 0.6 m wide, and 0.3 m deep. Feature 258, located at the west end of a massive 'a'ā boulder, is 1.0 m in diameter and 0.7 m deep. Feature 259 is 0.5 m in diameter and 1.0 m deep. Feature 260 is 0.6 m in diameter and 0.3 m deep.



Figure 73. Clearing and 'a'ā pit, feature 250, site 50-10-18-23356, looking southeast. Note the location of the pit and the pebble paving in front of the scale. The scale is marked in 10 cm increments.

Between clusters B and C are four features. Feature 266 is an apparently incomplete set of human remains located in a partially covered crack under the north side of a massive 'a'ā boulder. The feature is close to the beach at Manini'ōwali Bay and is heavily littered with modern trash. The human bones were observed *in situ* and were not removed for more detailed observations and analyses. No determination was made on the age or ethnicity of the remains. Feature 267 is an 'a'ā pit located at and partially under the northwest end of a massive 'a'ā boulder. The pit is 1.1 m long, 1.0 m wide, and 0.4 m deep. It extends under the boulder approximately 60 cm. Feature 268 is an enclosure defined on its west end by a low wall of stacked 'a'ā cobbles and boulders and elsewhere by an 'a'ā outcrop that has been worked to expose gray interior lava rock. The informally-constructed wall reaches a maximum interior height of 0.5 m. The interior of the enclosure measures 2.5 m long and 1.7 m wide. It is paved with 'a'ā pebbles. A modern deposit of coral cobbles and an 'ōpihi shell is located on top



Figure 74. Overhang shelter, feature 252, site 50-10-18-23356, looking north. The scale is marked in 10 cm increments.

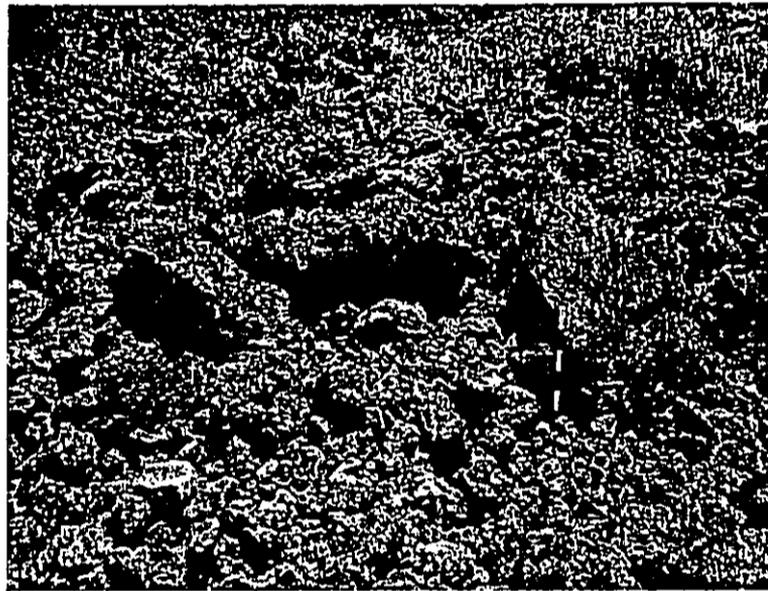


Figure 75. Platform, feature 255, site 50-10-18-23356, looking southeast. The scale is marked in 10 cm increments.

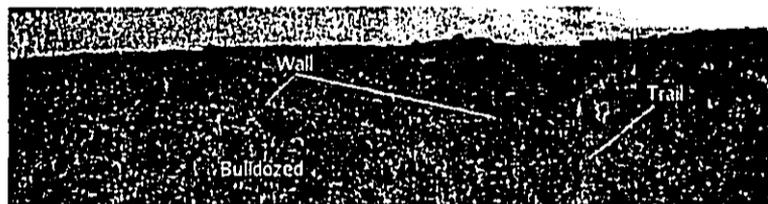


Figure 76. Wall feature 256, site 50-10-18-23356, panorama looking north. The scale is marked in 10 cm increments.

of the worked 'a'ā outcrop. Feature 269 is a small shelter under a large 'a'ā boulder that is partially walled with 'a'ā cobbles (fig. 78). The interior height of the wall is approximately 50 cm.

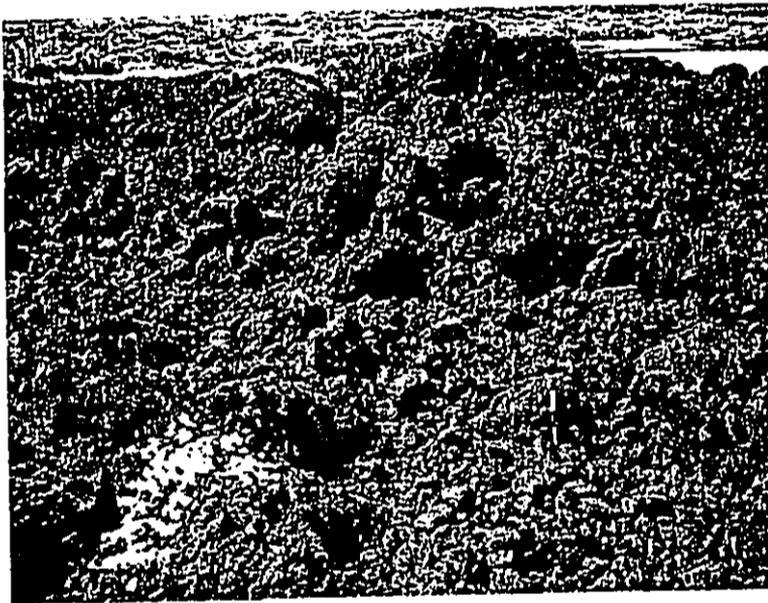


Figure 77. Enclosure, feature 268, site 50-10-18-23356, looking south to Pu'u Kuili. The scale is marked in 10 cm increments.

Outlying features on *pāhoehoe* lava are less densely distributed than they are on the 'a'ā flow at the north end of the site. Immediately south of the 'a'ā flow the terrain is a mixture of 'a'ā and *pāhoehoe* lava, with small tongues of 'a'ā lava overlying and higher than the *pāhoehoe* (fig. 79).

Four features were located on a small tongue of 'a'ā lava. Feature 270 is a shelter cave with a deposit of coral and 'alā cobbles near the entrance. The cave interior is relatively roomy and provides shade from the morning and mid-day sun. There are small, localized, less than 1 cm thick cultural deposits in the cave with many *pipipi* shells, along with some cowry and 'ōpihi. Features 271 and 272 are 'a'ā pits. Feature 271 is located in the same outcrop as feature 270. Feature 272 contains an 'alā cobble and a cowry shell. Feature 273 is a cluster of three 'a'ā pits, two of which are partially excavated beneath outcrops forming possible overhang shelters. The easternmost pit is 1.4 m long and 1.0 m wide; there is 60 cm between the overhang and the floor of the pit, upon which a cowry shell is found. The middle pit is the same size, but shallower, with only 40 cm between the overhang and the floor, which contains a *Drupa* shell. The westernmost pit is small, 0.5 m in diameter and 0.5 m deep.

Features 274-280 are located along the southern margin of the 'a'ā tongue. Feature 274 is an enclosed shelter about 2.0 m long and 2.0 m wide, located on *pāhoehoe* at the toe of an 'a'ā flow (fig. 82). A wall of stacked 'a'ā cobbles with a typical interior

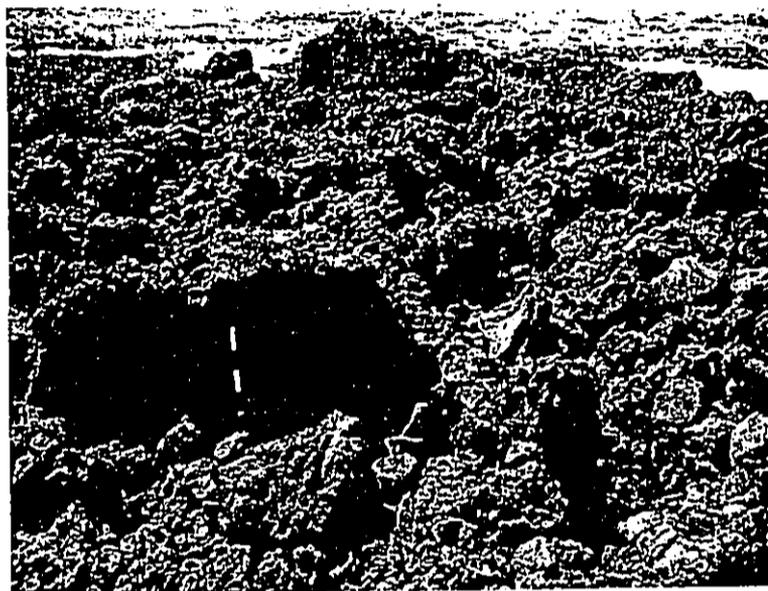


Figure 78. Partially walled shelter, feature 269, site 50-10-18-23356, looking southeast. The scale is marked in 10 cm increments.

height of 60 cm marks the northern end of the shelter, partially enclosing the area adjacent to a low, shallow overhang. *Pipipi* and cowry shells are found in the interior of the shelter. A small shell midden just outside the shelter to the west contains mostly cowrie. Features 275-280 are six small *ahu*, now much broken down, but forming a nearly straight line over a distance of 13 m. The typical *ahu* is about 60 cm in diameter and only 30 cm high and is constructed of 2-3 dozen 'a'ā cobbles and an occasional boulder.

Feature 281 is a water-worn basalt cobble hammerstone (fig. 83), apparently left some distance from where it had been used.

Feature 282 is an enclosed shelter located at the toe of a *pāhoehoe* flow (fig. 84). A short overhang with a flat *pāhoehoe* floor in front is partially enclosed on the north side by a crudely constructed wall faced with *pāhoehoe* boulders and large cobbles and filled with *pāhoehoe* cobbles (fig. 84).

Makai of the *ahu* features 275-280, is feature 322, an enclosed shelter built into a pocket of a *pāhoehoe* flow (fig. 86). A short, crudely stacked wall defines the enclosure's south end (fig. 87). Two water-worn cobbles are here, one inside the enclosure (fig. 88), and the other 3 m south (fig. 89). A short distance south, a third water-worn cobble, feature 283, might be associated with the enclosed shelter.

Farther south is a diffuse distribution of *pāhoehoe* pits, features 284, 314, 35, 323, and 324, and water-worn basalt cobble hammerstones, features 316 (fig. 90), 318 (fig. 91) and 319 (fig. 92).

The central feature here is feature 317, a lava tube shelter, the entrance to which is

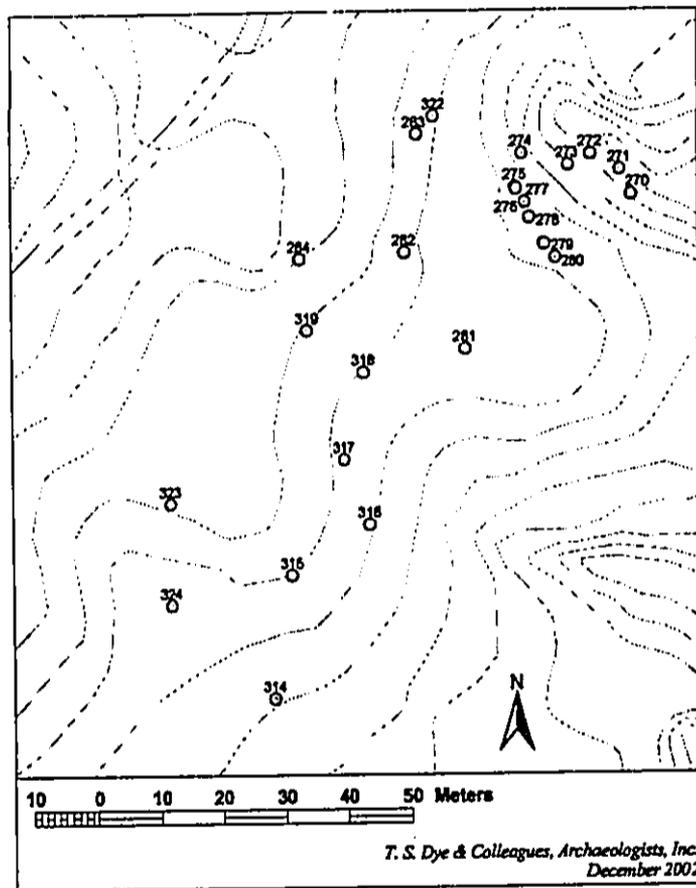


Figure 79. Outlying features on *pāhoehoe* at the north end of site 50-10-18-23356. See figure 38 on page 93.



Figure 80. Shelter cave, site 50-10-18-23356, feature 270, looking east. Note coral and basalt cobbles in foreground. The scale is marked in 10 cm increments.



Figure 81. 'A'a pits, site 50-10-18-23356, feature 273, looking west. The scale is marked in 10 cm increments.

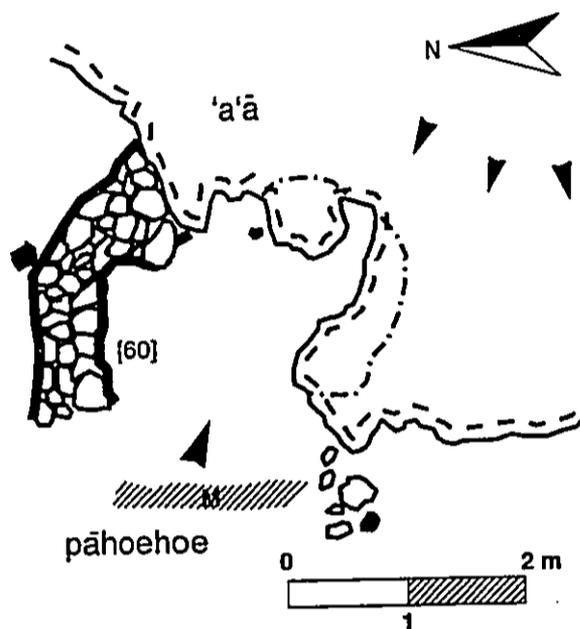


Figure 82. Plan map of feature 274, site 50-10-18-23356. Tape and compass map drawn by T. Dye. The legend is on page 39.

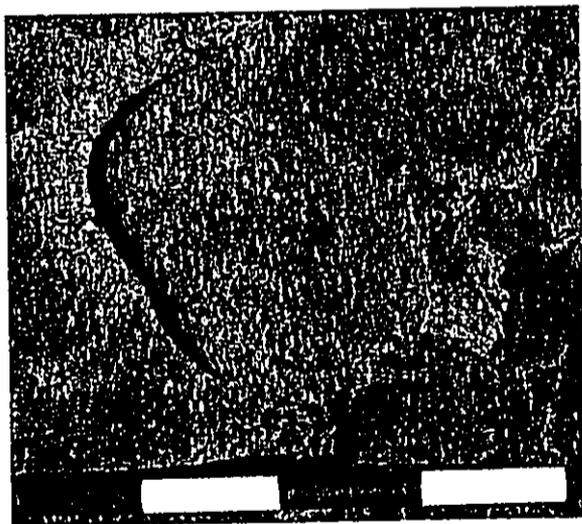


Figure 83. Water-worn basalt cobble hammerstone, feature 281, site 50-10-18-23356. The scale is marked in 10 cm increments.



Figure 84. Enclosed shelter, site 50-10-18-23356, feature 282, looking southeast. The scale, marked in 10 cm increments, is at the outer face of the wall.

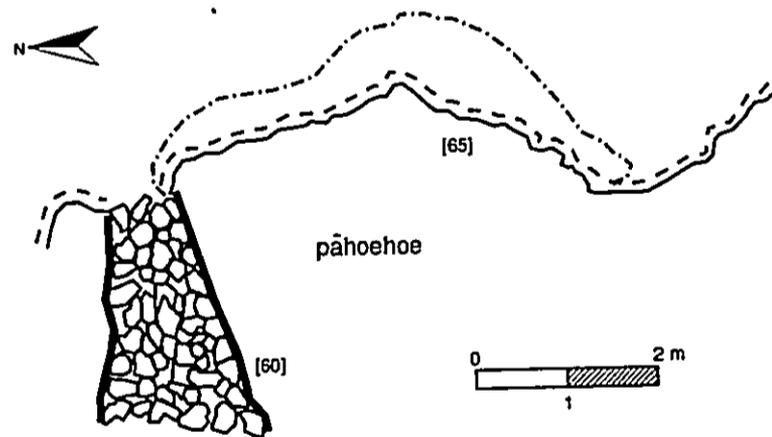


Figure 85. Plan map of feature 282, site 50-10-18-23356. Tape and compass map drawn by T. Dye. The legend is on page 39.

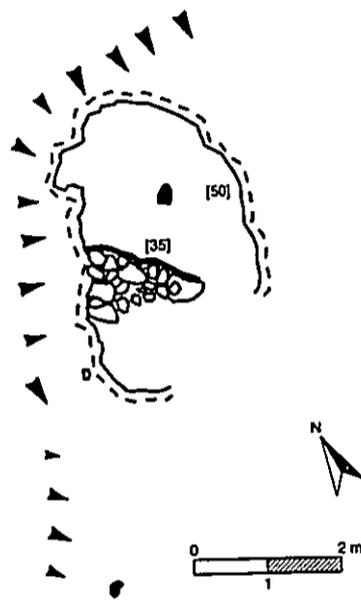


Figure 86. Plan map of feature 322, site 50-10-18-23356. Tape and compass map drawn by T. Dye. The legend is on page 39.

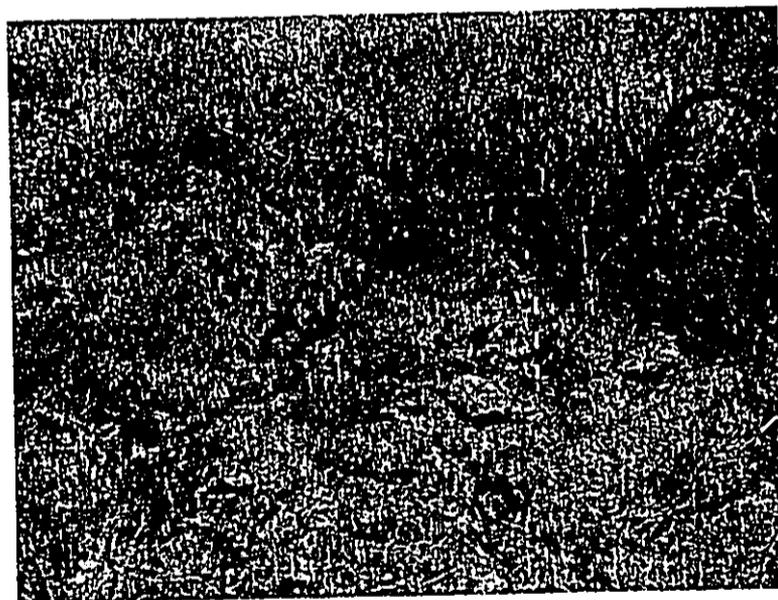


Figure 87. Enclosed shelter, site 50-10-18-23356, feature 322, looking northeast. The scale, which is standing near the middle of the wall, is marked in 10 cm increments.

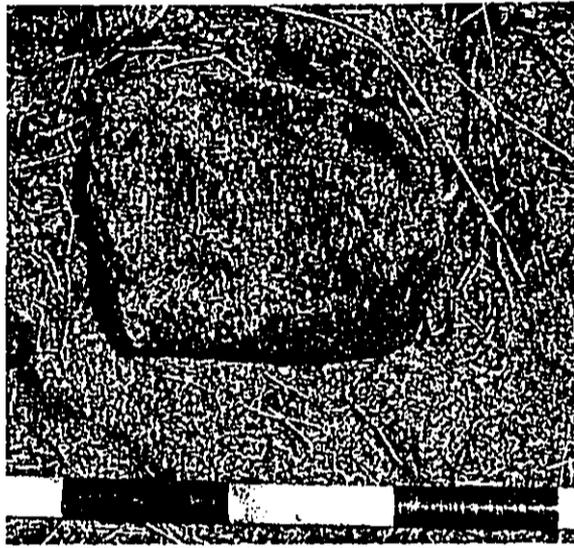


Figure 88. Water-worn basalt cobble hammerstone inside site 50-10-18-23356, feature 322. The scale is marked in 10 cm increments.



Figure 89. Water-worn basalt cobble hammerstone outside site 50-10-18-23356, feature 322. The scale is marked in 10 cm increments.

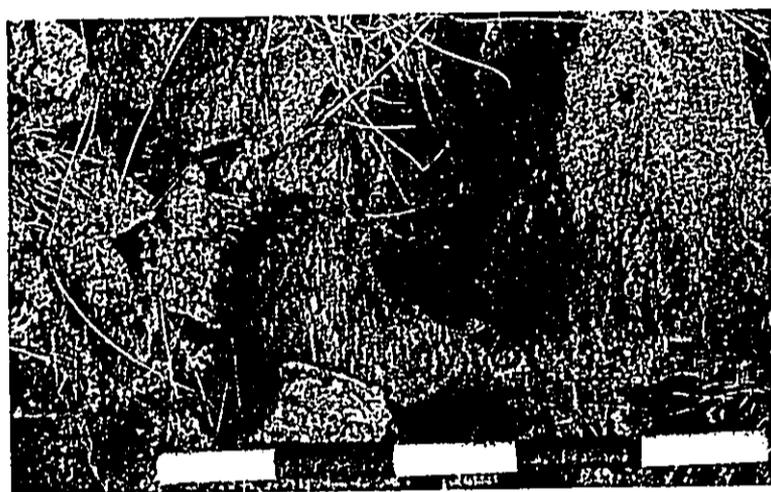


Figure 90. Water-worn basalt cobble hammerstone, site 50-10-18-23356 feature 316. The scale is marked in 10 cm increments.

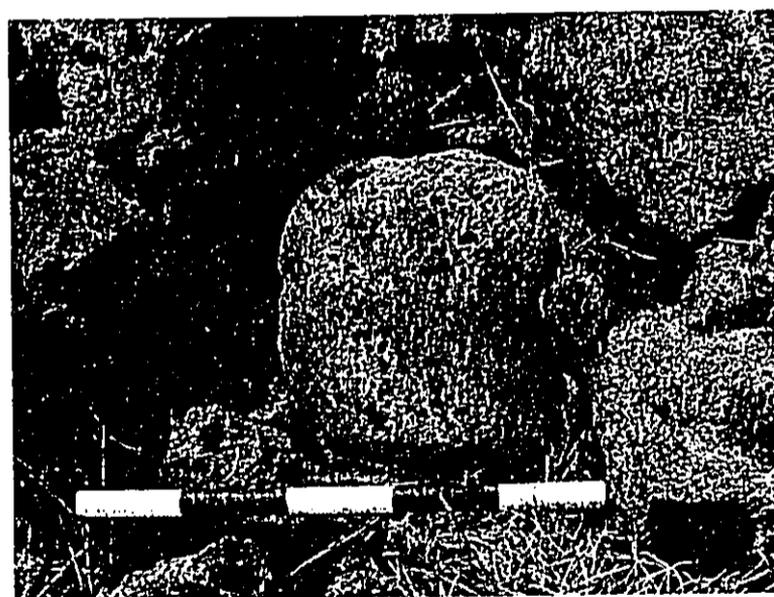


Figure 91. Water-worn basalt cobble hammerstone, site 50-10-18-23356, feature 318. The scale is marked in 10 cm increments.

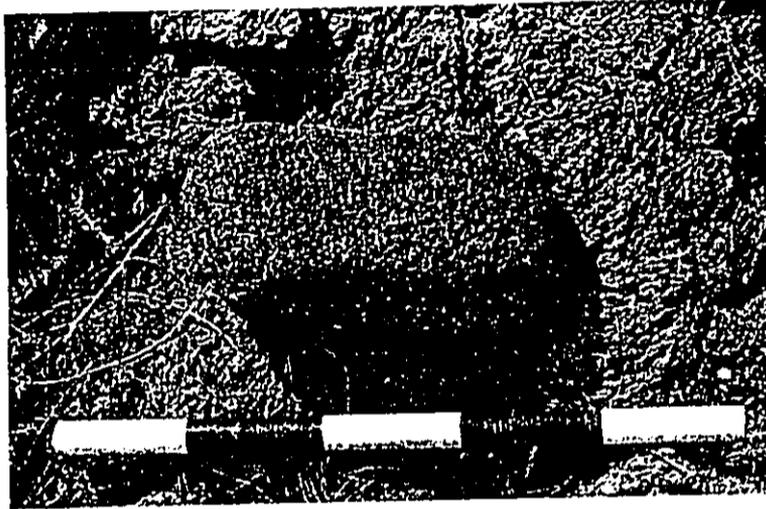


Figure 92. Water-worn basalt cobble hammerstone, site 50-10-18-23356, feature 319. The scale is marked in 10 cm increments.

through a collapsed area 2.1 m long and 1.8 m wide. Two water-worn basalt cobble hammerstones are on the *pāhoehoe* just outside the entrance and a reddish scoria lava abrader with olivine phenocrysts is about 5 m south of the opening. The tube has a maximum height of about a meter, and is typically lower, making movement inside, even on hands and knees, relatively difficult. The tube runs both north and south from the entrance. The 3 m long southern extension contains scant marine shell midden. The northern section is longer and contains more remains. Immediately inside the entrance are a cowry shell octopus lure and a water-worn basalt cobble hammerstone. About 3 m farther inside is another water-worn basalt cobble hammerstone and a deposit of bird bones, one of which might be worked into a pick. About 8 m from the entrance the tube turns west; this extension is barren of cultural materials.

At the south end of the site are outlying features proximal to and south of clusters F, G, H, and I (fig. 94). The *pāhoehoe* terrain here alternates between smooth and rough, jumbled sections. The rough, jumbled *pāhoehoe* is very difficult to traverse and it appears to have been generally avoided in traditional Hawaiian times. The features in this part of the site are found almost exclusively on relatively smooth stretches of *pāhoehoe*.

Just outside the boundaries of cluster I are four features. The largest of these is feature 313, a slightly modified shelter cave that lacks midden or other cultural material (fig. 95). The shelter cave is quite large, 3.3 m long, 1.7 m wide, and 1.0 m high. Just inside the entrance is a narrow access to a smaller, deeper lava tube, which also lacks cultural material. Features 311 and 312 are *pāhoehoe* pits, both of which contain water-worn basalt cobble hammerstones. Feature 312 is located at the worked toe of a *pāhoehoe* flow. Feature 306 is a water-worn basalt cobble hammerstone, from which large flakes have been removed through use (fig. 96).

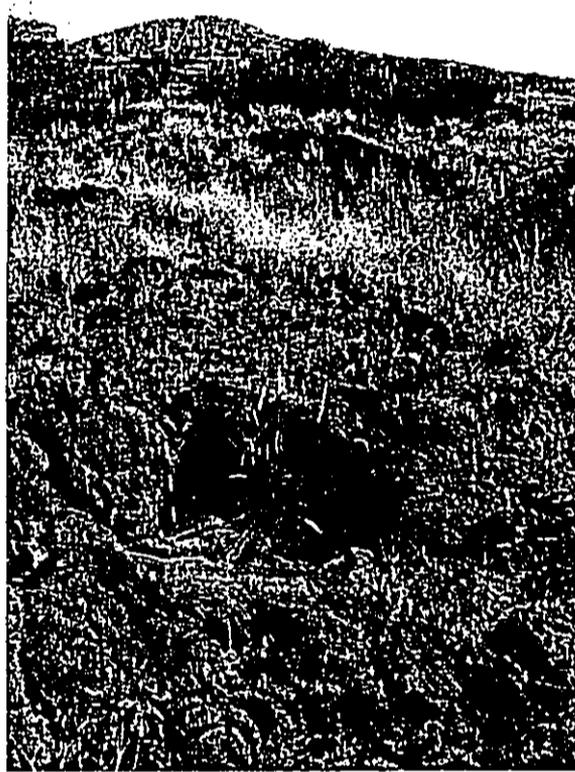


Figure 93. Lava tube shelter, site 50-10-18-23356, feature 317, looking south to Pu'u Kuili. The scale is marked in 10 cm increments.

Immediately *mauka* of the four-wheel drive road to the north end of Manini'ōwali Bay are four small features. Near the bend in the road, feature 321 is a low, elongate mound of stacked *pāhoehoe* slab cobbles and a boulder. It probably once stood higher than its current height of 30 cm. A waterworn basalt cobble hammerstone, feature 320, is located just south of the mound. Farther up the road, as it descends the last slope toward the coast, are two *pāhoehoe* pits, features 182 and 325.

South of clusters F, G, and H and located on the same coastal terrace are ten features. At the *mauka* end of the terrace, feature 331 is a small shelter under the toe of a lava flow, too small to shelter an adult. This feature appears to be analogous to the '*a'a*' pits excavated at the base of a large boulder. *Makai* of the shelter are two *pāhoehoe* pits, features 189 and 190, and a water-worn basalt hammerstone, feature 188. Feature 332 is an *ahu* built of *pāhoehoe* slabs on top of a tumulus (fig. 97). It appears to be relatively modern and stands 70 cm above the tumulus. A water-worn basalt cobble hammerstone is on the surface adjacent to the tumulus (fig. 98). Feature 333 is a small *pāhoehoe* pit, outside of which are a water-worn basalt boulder and cobble (fig. 99). Feature 334 is a *pāhoehoe* pit excavated at the toe of a flow, creating a shelter 2.0 m

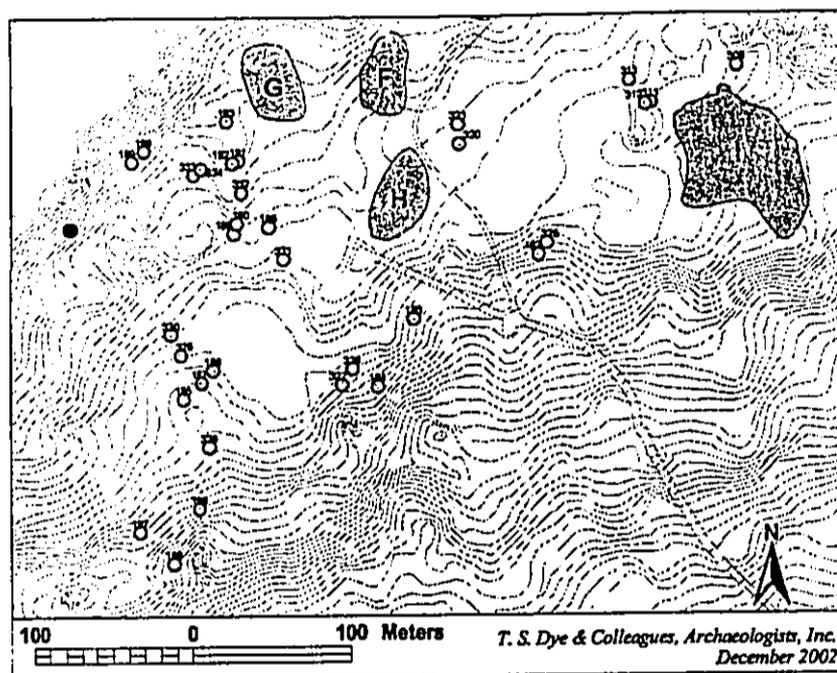


Figure 94. Outlying features at the south end of site 50-10-18-23356

long, 1.0 m wide, and 0.7 m high (fig. 100). Just north of here are two 'a'ā pits, features 191 and 192, the latter excavated into a very dense vein of bluish lava. *Makai* of the 'a'ā pits is a water-worn basalt cobble hammerstone, feature 193, with some marine shell midden scattered over the surface.

On the slopes above these features are 13 other small features. The four features nearest the road are all pits; features 183, 184, and 327 are 'a'ā pits, and feature 326 is a *pāhoehoe* pit located at the base of a tumulus.

At the southern end, running up the slope are a series of *pāhoehoe* pits, including features 185, 196-198, 329, and 330. Feature 329 is mostly filled with cobbles, including one water-worn basalt. Feature 328, a water-worn basalt cobble hammerstone broken at one end (fig. 101), is located nearby. Feature 186 is a long crack in a piece of up-thrust *pāhoehoe* that shows signs of quarrying, with the broken blocks removed from the crack and deposited outside. Feature 187 is a small mound of rocks whose four-course height is only knee high.



Figure 95. Shelter cave, site 50-10-18-23356, feature 313, looking southwest. The flat boulder below the scale marks the entrance to the lower lava tube. The overhang shelter is at the right side of the photograph. The scale is marked in 10 cm increments.

Summary

Wider and shallower than Kākapa, Manini'ōwali Bay presents a long, low coastline with less concentrated habitation. Clusters A, C, and perhaps B at the northern end of the bay illustrate the apparent preference for 'a'ā for habitation, this being the most densely settled area, and that with the largest number of features. Although it sits on *pāhoehoe*, cluster D represents the penchant for edges, being at the edge of sandy beach and *pāhoehoe* flow. It and habitation clusters E-G to the south show that habitation on *pāhoehoe* takes advantage of the particular attributes of the lava type: availability of lava tubes and blister shelters, blocks and slabs broken from the bedrock that provide good building material, and natural ridges and tumuli that can sometimes be turned into habitation areas with minimal modification.

Because of the nature of the natural surface here, outlying activity areas can be hard to discern, since, for example, a pathway only appears after innumerable feet have trod across it, wearing into the lava. Ancillary features do exist, however, and formal differences between features here and those on the 'a'ā appear to relate more to the type of building material available and the natural landforms than to a distinct strategy. *Kauhale* each have their own ocean access, and enclosures, C-shape enclosures, and platforms still form the main architectural features. Where 'a'ā has size-sorted clearings, *pāhoehoe* has fill—both result in versions of floors. Buffers between household clusters here tend to be wider than at Kākapa, but this may have more to do with

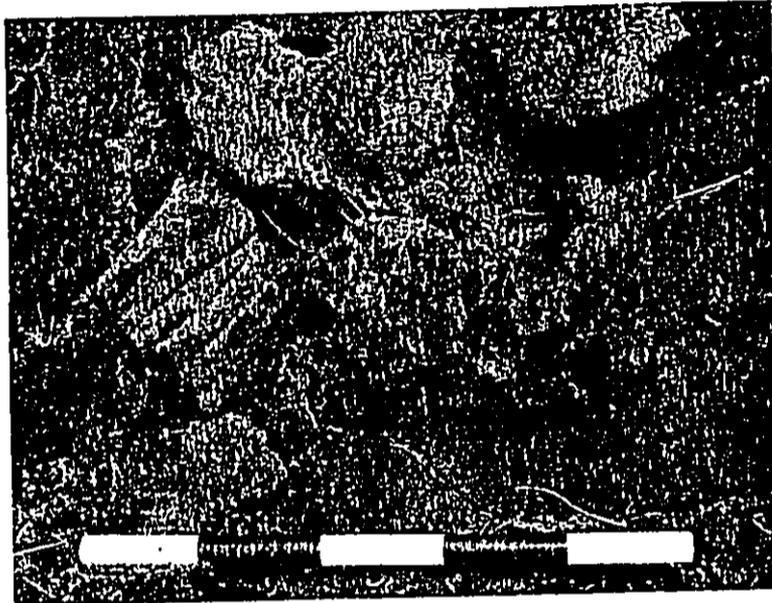


Figure 96. Water-worn basalt cobble hammerstone, site 50-10-18-23356, feature 306. Note the large flake scars. The scale is marked in 10 cm increments.



Figure 97. Ahu, site 50-10-18-23356, feature 332, looking north. The scale is marked in 10 cm increments.

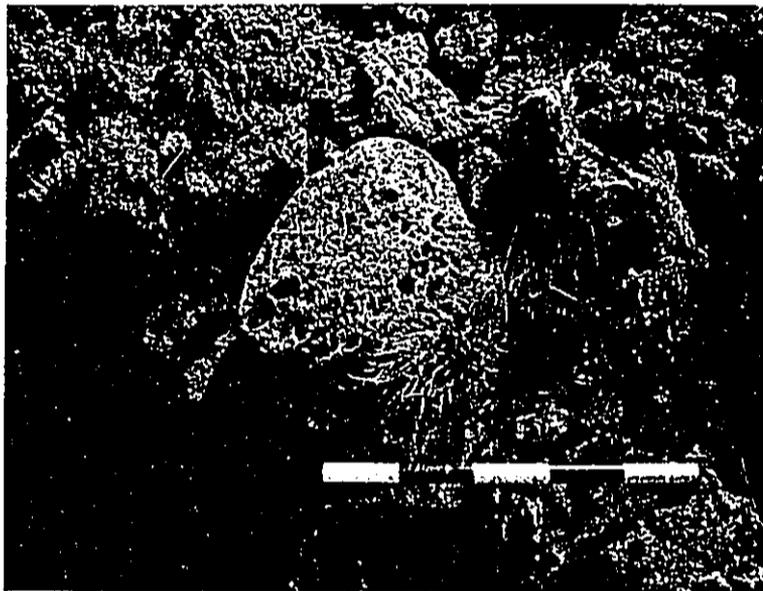


Figure 98. Water-worn basalt cobble hammerstone adjacent to tumulus, site 50-10-18-23356, feature 332. The scale is marked in 10 cm increments.

suitable building sites—habitable tubes and access for canoes being less densely distributed than modifiable 'a'a—than with a different approach to settlement. Aside from the absence of a large *heiau*, the major differences in religious features also seem to reflect the landscape; large boulders with red interiors do not occur on the *pāhoehoe*, and shrines do still have water-worn 'alā stones.



Figure 99. *Pāhoehoe* pit, site 50-10-18-23356, feature 333. The water-worn basalt rocks are above the scale, which is marked in 10 cm increments, and the pit is below and to the left.

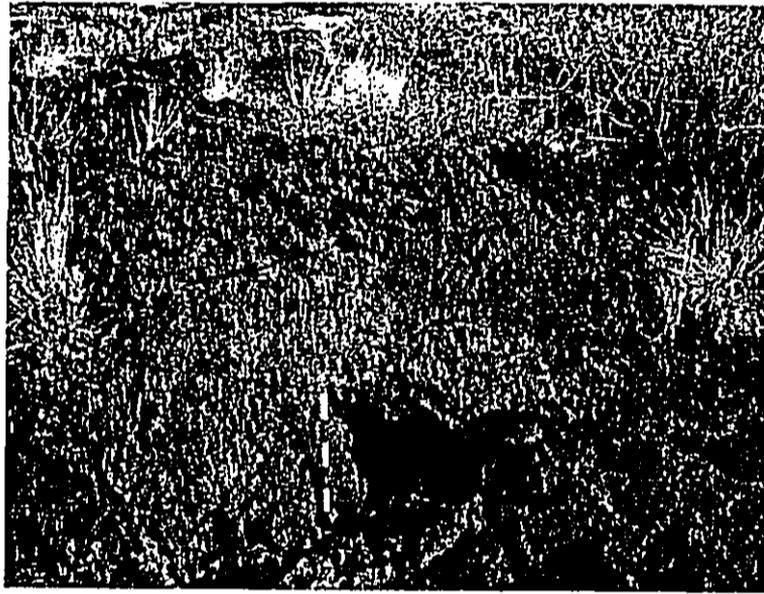


Figure 100. *Pāhoehoe* pit, site 50-10-18-23356 feature 334, looking east. The scale is marked in 10 cm increments.



Figure 101. Water-worn basalt cobble hammerstone, site 50-10-18-23356, feature 328. The scale is marked in 10 cm increments.

Punaloa Point Site 50-10-18-23357

At the southwestern end of Manini'ōwali Bay, Punaloa Point juts out in a shape that resembles Papiha Point to the north, but with a much steeper slope. Habitations occur in the immediate coastal zone where occasional level terrain allows, with pits, lava tube shelters, and other features extending *mauka*, beyond the project area (fig. 102). In general, features at Punaloa Point exhibit a lesser degree of development than can be found in either direction along the coast. The pit complexes include quarries that provided building material for coastal habitations, but may also represent other functions, or perhaps quarrying that served a broader area.

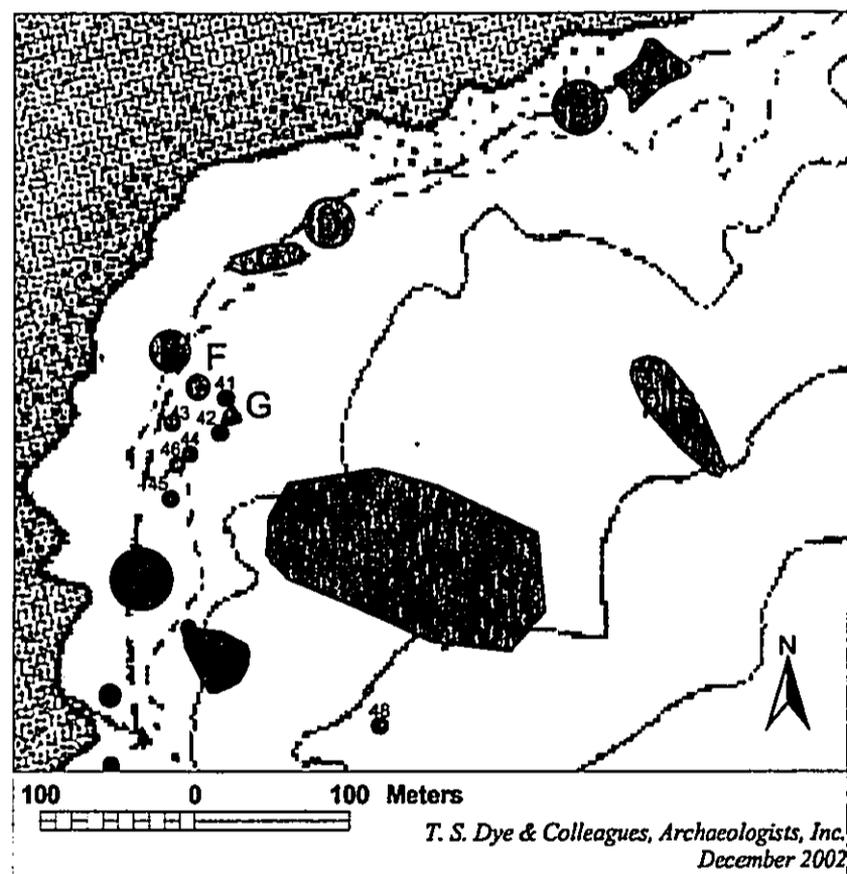


Figure 102. Feature clusters and outlying features of site 50-10-18-23357.

Cluster A: North Punaloa *Kauhale*

This cluster of small features has been impacted by wave activity that has damaged some walls and perhaps buried portions of the site. In addition, campers have dismantled some walls and built windbreak shelters. The coastal *alaloa* trail and a branch heading *mauka* run through the cluster, which is immediately fronted by the beach. With relatively few features and no large surface structures, this type of area is typically interpreted as a temporary habitation, but the well-worn trail crossing the *pāhoehoe* to *mauka* features, as well as the labor invested in quarrying stone from the flow both indicate that cluster A represents something more than a temporary occupation. Because the project area does not include complete coverage of the landscape *mauka* of this, it is possible that additional features may be associated.

The largest feature of cluster A, feature 4, actually lacks any above-ground structural element, and instead consists of a level, stained area of the cobble beach (vol. 2, map 24). This rough pavement measures about 10 m by 6 m, although the interior edge cuts short of a rectangle, and the *makai* edge has been blurred by storm wash. Nonetheless, dirty grayish brown coral here stands in stark contrast to more recently deposited cobbles, and a relatively high proportion of non-water-worn basalt distinguishes this as an anthropogenic landscape. Defining the *mauka* edge of feature 4 are two short sections of terrace facing that define opposite sides of the *alaloa* trail where it traverses a swale. *Mauka* of the longer, 3.5 m, segment, the low ground contains jumbled cobbles and small boulders, but has a line of water-worn boulders, including one salt pan, suggesting that the depression may have been formally faced prior to wave damage. The other edges lack any hint of structural elements, but thorough clearing of the loose stone could potentially reveal embedded foundation stones if they exist.

anthropogenic

Sitting on a *pāhoehoe* shelf above and *mauka* of the swale, feature 5 consists of a C-shape enclosure whose *makai* opening has been partially closed off by a section of wall that appears to be a later addition. Cobbles fill a crack in the *pāhoehoe* fronting the feature, resulting in an exterior *lānai* wrapping around the northeast and northwest sides, whose 17 m² area greatly exceeds the 3.5 m² interior area of the enclosure. Only a small section of the exterior wall facing remains intact, but the interior remains in good condition, perhaps an indication that the feature was maintained after its regular occupation ended or that the interior was maintained by campers who used it, but did not invest time in maintaining the entire structure. Based on the intact portions, the wall originally had interior and exterior stacked facings, with cobble-filled core; the pattern of collapse indicates something other than wave action, being worst on the *mauka* side.

East of the C-shape enclosure, a wall, feature 2, begins at the edge of the *pāhoehoe* and extends about 5 m *mauka*, where it terminates in a mound. Feature 3, a rough mound of *pāhoehoe* and water-worn stone 2 m *makai* of the wall may originally have been a part of the wall. Regardless of whether it ever extended *makai*, feature 2 consists of a simple wall, not enclosing any space, and not associated with a pavement of other structure. As such, it seems to function more to divide the residential complex of cluster A from the undeveloped landscape to the north.

Continuing southwest along the coast, features 6 and 7 show additional coastal activity. Currently an L-shaped wall, feature 6 has been recently rebuilt to function as a camping shelter. At the base of the wall parallel to the shore, however, deeply embed-

ded boulders appear to be a much older foundation. Unfortunately, the size or shape of the earlier feature cannot be determined, although the location and orientation mirrors that of rectangular enclosures and platforms that line the coast. Feature 7 incorporates a *pāhoehoe* shelf as one wall, and has another stacked section that forms half an enclosure. Wave-deposited cobbles obscure the *makai* edge, making it difficult to determine whether this was a C-shape or complete enclosure. Being superimposed on the feature, the modern cobble beach appears to be higher than it would have been during occupation.

Outside and east of feature 7, a path worn into the *pāhoehoe* branches *mauka* from the coastal trail. About 15 m behind feature 7 is another C-shape enclosure, feature 8, and a complex of pits that lie outside the project area. Unlike so many *pāhoehoe* pits encountered during this survey, these have a clear function: quarrying building material. The blocky, 20 cm thick chunks broken out of the pits occur in feature 8, as well as augmenting water-worn stone and the thin plates of coastal *pāhoehoe* used in the shoreline features.

About 10 m *mauka* of feature 2, a lava blister overhang, feature 1, has been modified. Only about half of the 2.2 m² of floor area is sheltered. In the southern extreme, another shallow overhang may have functioned as a cupboard, but would not shelter a human. Sparse midden and a scoriaceous lava saw inside, as well as the stacked wall defining one edge attest to cultural use, but the precise function of this feature remains unknown. Feature 1 extends a maximum of 1.8 m below the surrounding surface, with a maximum interior height of 1.2 m.

At first glance, cluster A appears to be a couple of C-shape enclosures and not much more. Features 4, 6 and 7, however, strongly indicate that a more substantial coastal complex once existed, and has been masked by years of high surf and tsunami. Although the features do not have some of the attributes commonly associated with permanent habitation, some characteristics suggest at least repeated occupation. A branch of the coastal trail, site 50-10-18-23360, worn into the *pāhoehoe* surface, especially in this location, not connected to the *mauka-makai* trails used historically by shod donkeys and horses, demonstrates long-term use. Investment of labor in quarrying blocks from the *pāhoehoe* flow, when beach rock or loose coastal *pāhoehoe* was available, likewise shows a level of commitment to occupation here that would not fit with short-term use. Careful delineation of the coastal trail behind feature 4 indicates that the pavement was not common ground that could be freely traversed, perhaps because a wooden structure existed there. Likewise, feature 2, a wall apparently delineating the cluster boundary, indicates a formalized approach to settlement space inconsistent with an interpretation of temporary habitation. Differences between cluster A and more substantially built, larger features occurring elsewhere in the project area may signal the difference between a "permanent" habitation and one used repeatedly by fishermen or travelers, but that would not be the only plausible conclusion, and it instead may represent a different period or a different function.

Cluster B: North Punaloa *Kauhale*

Just down the coast, about 15 m from cluster A, this group of features resembles the former, although fewer structures occur along the coast. Additional features occur

mauka of cluster B, outside of the project area.

Like Cluster A, the single largest feature, feature 9.1, is actually an area of quarried *pāhoehoe* blocks and grayish brown coral, in this case covering over 80 m² (fig. 103). Not quite as level as feature 4, this may be the remnant of a platform or walled structure. The dirty coral covers the ground between the current beach berm and a *pāhoehoe* shelf behind.

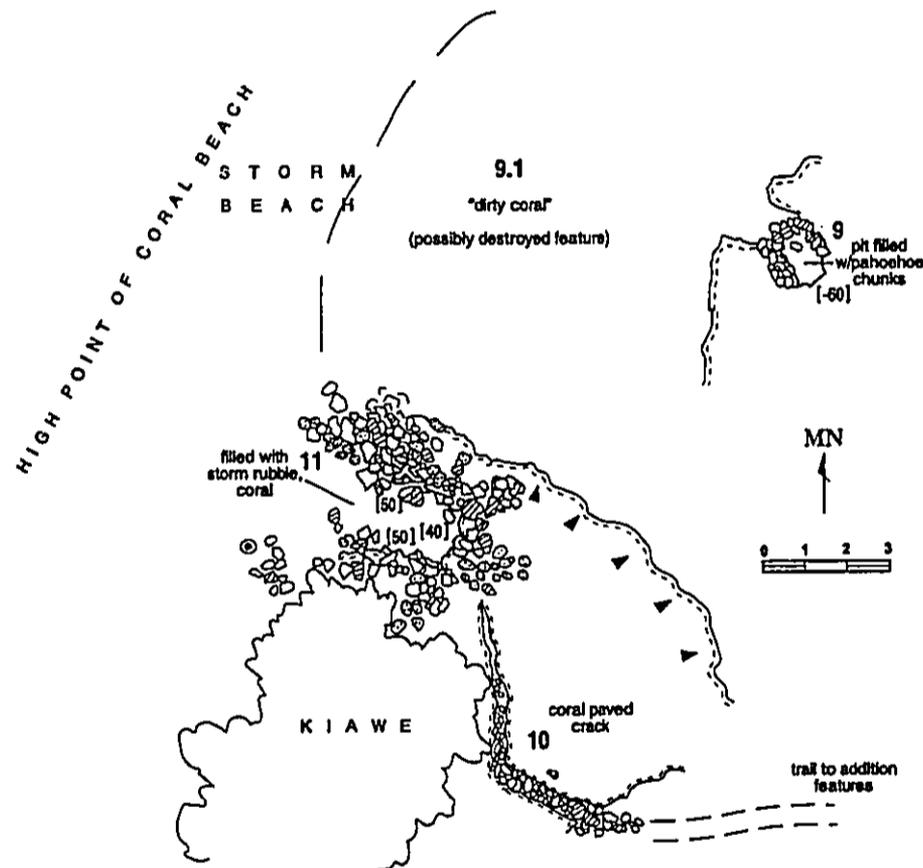


Figure 103. Plan map of cluster B, site 50-10-18-23357. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

At the eastern edge of the cluster, feature 9 consists of a pit broken into the edge of the *pāhoehoe*. The *makai* edge appears to be lined with stacked stone, although the feature is filled with cobbles, making the interior hard to see. Ten meters to the southwest, feature 11 is a C-shape enclosure in poor condition, having been battered by winter surf and/or tsunami. Some midden occurs here, but not in great quantity. At the northeast corner, stone has been stacked into a cairn, probably recently. Behind the

enclosure, a *pāhoehoe* dome marks the beginning of a trail heading *mauka* to another cairn, some lava tube shelters, a U-shape enclosure, and other features, all outside of the survey area. A crack in the dome has been filled with coral cobbles, feature 10, apparently just to avoid having an open crack, although it may also signal the beginning of a branch of the coastal trail.

Cluster B closely resembles cluster A in its setting and the feature types represented. It most likely represents a similar level of habitation. Although they have been presented separately here due to a gap of more than 10 meters, they could conceivably have been a contiguous cluster in the past, with wave damage and deposition obscuring intervening features. However, redundancy of small feature forms, and perhaps more importantly, of separate trails *mauka*, suggest that the clusters were perceived as distinct, and that the buffer between them is real. Both sit just behind the shore on a bench of land stretching as much as 100 m behind the waterline before slope increases. A ridge to the northeast separates them from Manini'ōwali Bay, and another to the southwest separates them from the other Punaloa Point clusters. Although the current information does not demonstrate that clusters A and B were contemporaneous occupations, it is unlikely that one would have been invisible to later settlers, and the imperative to build at separate sites apparently held true regardless of contemporaneity.

Cluster C: Punaloa *Kauhale*

Straddling the coastal *alaloa* trail, separated from clusters A and B by a small ridge to the north, these features represent a mixture of ancient and modern habitation. Like the previous clusters, this one occupies a sandy area behind a cobble beach along a shoreline facing north-northwest to the ocean.

Feature 15 has been mostly obliterated apparently due to looting that left one pit in the floor, and involved wholesale dismantling of the southern half of the feature (vol. 2, map 27). A sketch map drawn by Cordy, and labeled site 50-Ha-D21-51, indicates that the feature used to be a narrow, open-ended enclosure about 7.5 m long and 2.5 m wide, with an adjoining platform to the south with a surface about 5 m². In part, the damage to the southern half of the feature results from the fact that the feature consists of an augmented lava formation, with much of it probably no more than one course of stone high in its original condition. The north and east walls, seemingly in their original condition, stand about 50 cm high, and are of double-faced, core-filled construction. The western, *makai* side appears to have been a terrace alignment, perhaps never enclosed. The floor in the northern portion is bare, smooth *pāhoehoe*, while the deteriorated remainder is now covered with pebbles and cobbles of *pāhoehoe* and beach rock.

Feature 17, at the opposite end of the cluster, has been modified relatively recently, with a camping windbreak on the northeast and a cairn on the southwest. Like feature 15, its original form seems to reflect local microterrain; unlike feature 15, this appears to have been built into a low spot, surrounded by higher *pāhoehoe* on all but the *makai* sides.

Feature 19, the largest in the cluster, measures 16 m in length, and has an interior area approaching 50 m². The open *makai* side and oblong form suggest that this feature housed canoes. The southeastern arm of the features is in poor condition, apparently

due to wave damage, based on the appearance of the beach and direction of tumble. Whether intact deposits remain within the feature is unknown, since the original surface is either disturbed or covered by the wave activity. The fact that the northeastern side is relatively undamaged, and is beneath a thick growth of *kiawe*, indicated that the damage may be relatively recent, since that species has been expanding here in living memory. In addition to the wave damage, the practice of campers taking stones to build other features has undoubtedly contributed to the poor condition.

Recent features are abundant here, including wall segments, campfire rings, trail modifications, and mounds. The only other feature that appears to be original to the Hawaiian occupation is feature 17, a deeply embedded boulder alignment mauka of the canoe shed. Although only a remnant, the feature appears to have been a square or rectangular feature measuring about 3.2 m on the *mauka-makai* axis.

Because the project in this area of the coast includes only the trail and a buffer corridor, some features farther inland have not been recorded in detail, and others may remain to be discovered. Following the line of feature 19's north wall, for example, a mound or wall remnant occurs atop an outcrop about 23 m behind the *mauka* wall of that feature. Although no clear path to or past it was found, this may be a trail marker. Twenty-five meters *mauka* of the *alaloa*, and slightly farther than that south of feature 15, there is a collapsed C-shape enclosure in poor condition. Distribution of features inland of the main cluster, rather than spread along the coast, mimics the pattern of clusters A and B.

Cluster C clearly indicates the presence of a relatively substantial residential component. Although what remains are only portions of four original features, more may have been present in the past. Additionally, the sizes of features 15 and 19 are relatively large for this part of the coast. Presence of sandy surfaces and smooth *pāhoehoe*, paired with proximity to the beach and the coast trail, make this an attractive location for settlement. Unfortunately, these same attributes, as well as the fact that the cluster is away from the heavy day-use area of the bay, have made it an attractive location for more recent campers, who have remade the features. Combined with looting and wave damage, recent temporary occupation has contributed to the deterioration of the original features.

Cluster D: Punaloa *Kauhale*

A feature remnant recorded by Cordy as a temporary structure, Bishop Museum site 50-Ha-D21-52, anchors this coastal cluster and is now labeled feature 49 (fig. 104). Based on the architectural remains and a sketch map made by Cordy, which show a single above-ground feature just *mauka* of the *alaloa* trail, the interpretation as temporary habitation is quite plausible. As in clusters A and B, however, a trail leading *mauka* across the *pāhoehoe* and several quarry pits indicate rather heavy use. Because the area inland of this lies beyond the survey areas of this project or of Cordy, the reason for a worn trail and the degree of habitation that may be associated is not known, and the possibility of additional features cannot be discounted.

Feature 49 now appears to be a remnant of its former self, the only intact portions forming a C-shape enclosure open to the *mauka* side. A few stones aligned farther past the "opening" of this feature, however, indicate that the feature once was an enclosure

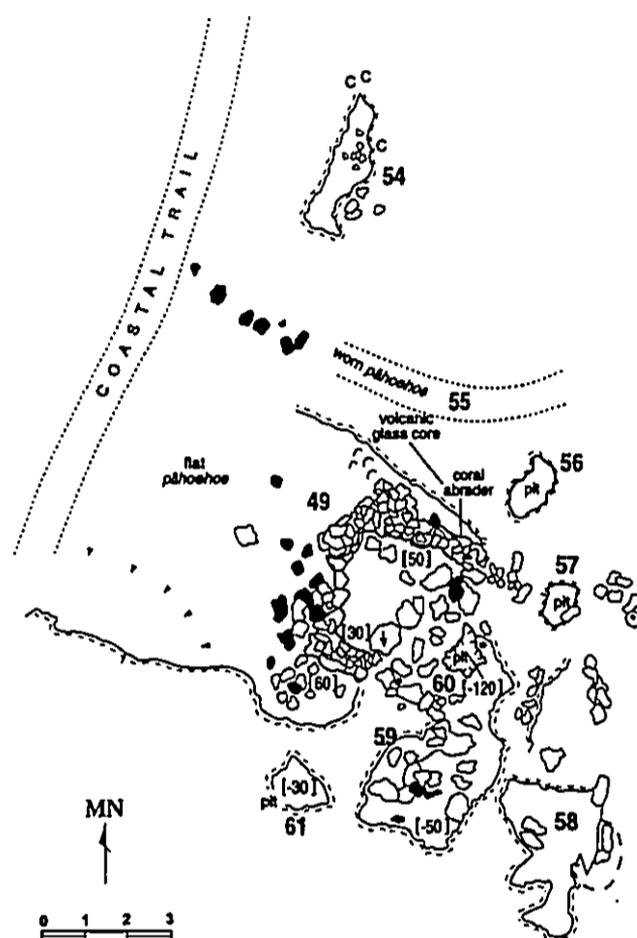


Figure 104. Cluster D, site 50-10-18-23357. Tape and compass map drawn by M. Maigret. The legend is on page 39.

with an interior area of about 8–10 m². Shell midden occurs inside, and a coral abrader and volcanic glass core lie on the surface outside the northern wall. Rather than the usual wave damage or collapse from neglect, the cause of damage to this feature appears to have been people taking rock away. The enclosure and surrounding pits appear to be missing a substantial quantity of stone.

Surrounding the enclosure, Features 56–61 comprise a series of pits broken into the pahoehoe. Four pits, features 56, 57, 60, and 61 measure a meter or less in open area, although Feature 60, at 120 cm, is quite deep. Features 58 and 59 cover much larger areas, 4.5 and 8 m², and a relatively large amount of stone has been removed from them. However, the volume probably would not have exceeded that used in a structure the size of feature 49, assuming it was an enclosure as large as is thought. Farther to

the north, feature 54 is median-sized pit about 2.5 m² from which *pāhoehoe* has been removed.

Besides the pits, another indication of substantial use of the site is a trail that branches *mauka* of the primary coastal trail. Like the branches in clusters A and B, this trail is worn into the *pāhoehoe* surface. This one also has an embedded stepping stone pavement on the *makai* section. As mentioned previously, features *mauka* of the cluster were not recorded during this project, and therefore the nature of occupation here is not known.

Cluster E: Large Habitation or *Heiau*

At the back of the beach, roughly halfway across Punaloa Point, a large structure parallels the beach. This occurs where the survey area is just the coastal trail and buffer, and though a quick examination failed to reveal additional features *mauka*, thorough survey could find more. Rectangular in shape, the structure includes attributes of enclosures and platforms. Behind the main structure, a relatively large area of level *pāhoehoe* has been modified where needed to provide a large floor.

Walls define the north and south ends of the main structure, feature 65, which has a surface area of at least 150 m², the precise figure being hard to determine because the *makai* edge has been obliterated or buried by wave deposits (fig. 105). At the northern end, the feature's *mauka* edge is a platform about 40 cm high. Outside to the north, feature 68 consists of a pavement surrounded by an alignment and ridge farther north. On the *mauka* side, a large area of flat *pāhoehoe* with some coral and cobble fill in low spots, feature 71, extends 15 m back, terminating in natural *pāhoehoe* rises, one of which has a mound on top. The latter is outside the project area, and it is unclear whether it marks the back of this complex, or perhaps the beginning of a trail heading *mauka*.

At the southern end, the side wall extends farther back, with a perpendicular back wall, feature 67, about 15 m *mauka* of the front. *Makai* of this wall and outside the main feature is a circular alignment, feature 66, nearly 2 m in diameter, in which nearly half of the stones are small, water-worn boulders. North of this and blending into the back of the main structure, a roughly paved area comprises feature 70. Inside feature 65, a small platform, feature 69, rises 10–20 cm above the remaining surface in the southwest corner.

The function of this complex could be habitation, but the large size, rectangular shape, and substantial construction indicate that it could be a *heiau*. The level areas, features 70 and 71, behind the main structure, being surrounded by *pāhoehoe* ridges and the back wall of the feature, are segregated from the surrounding areas up and down the coast, an attribute sometimes associated with *heiau*, and do not appear to have midden deposits or other indications of the level of habitation that would be expected with such a feature. No ethnographic or previous archaeological evidence exists specifically identifying the structure as a *heiau*, however. Indeed, it has somehow escaped any recording at all. The size and rectangular shape resembles structures in Kaho'iawa and Awake'e, and it may be that this form represents a style of habitation common to this coast.



Figure 105. Cluster E, site 50-10-18-23357. Tape and compass map drawn by M. Maigret. The legend is on page 39.

Regardless of the particular functional interpretation, cluster E appears to be the *makai* end of a series of features, including clusters F-H, extending mauka along a shallow gulch, including pit complexes, scant evidence of habitation and mounds marking trails and possibly boundaries. Cluster E represents the southernmost of the major coastal features in the ahupua'a of Manini'ōwali.

Cluster F: Quarry Zone Shelter

Located inland of cluster E in mid-Punaloa, lava tube feature 37 has a few traces of habitation, more outside than in (fig. 106). Stone walls on the surface appear to be simple windbreaks. Hammerstones inside the lava tube demonstrate human presence there, but substantial habitation does not appear to have occurred.

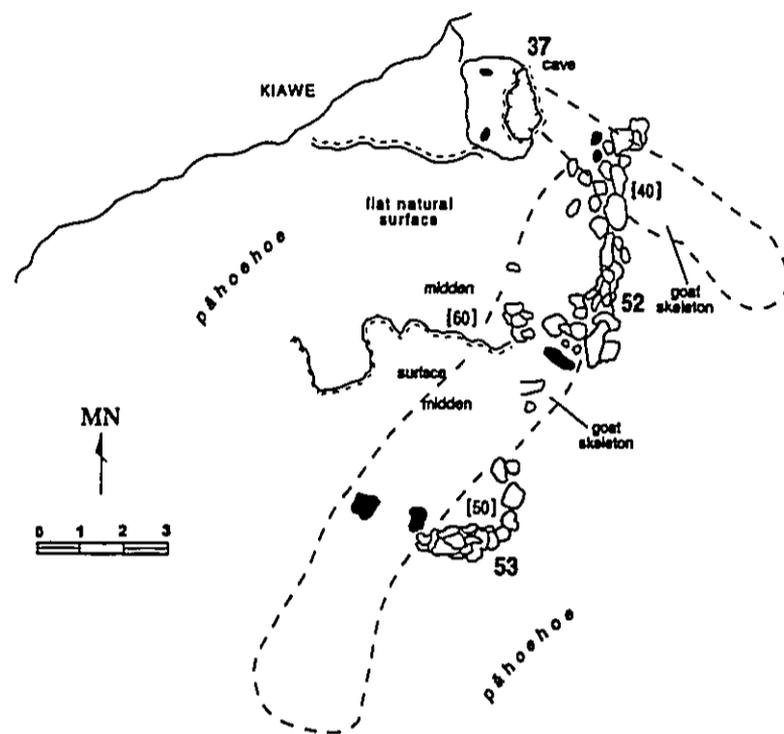


Figure 106. Cluster F, site 50-10-18-23357. Tape and compass map drawn by M. Maigret. The legend is on page 39.

The ceiling of feature 37, the lava tube, rarely reaches a meter in height, and even then only at a narrow peak. The interior area approaches 35 m² distributed among two branches, but little midden occurs away from the daylight and twilight zone near the skylight entry broken into the tube. Several large water-worn cobbles inside the tube indicate that it may have been more important as a place to store quarrying tools, rather than a habitation.

Although not tremendously abundant, marine midden occurs in greater quantity on the surface. Features 52 and 53, short sections of wall, provide some protection from ocean winds.

If cluster E in fact represents a *heiau*, this could be an associated habitation, although the midden and hammerstones present, as well as the absence of artifacts with ritual associations, suggest that it more likely functioned as a shelter or storage area. The lava tube may represent a resting area for people making the *pāhoehoe* pits found in this area of Punaloa. Like cluster G, it may be part of a dispersed group of habitation

features, some of which lie north of the Punaloa survey area.

Cluster G: Quarry and Temporary Habitation

This cluster, located about 15 m *mauka* of cluster F, but *makai* of the ridge that rises to feature 47 (see pg. 168), sits at the edge of the Punaloa survey area. To the north, outside the project area, a broad *pāhoehoe* tumulus has modifications and midden indicating a habitation, and this cluster may actually be an outlier of that feature. The features cluster on and around a portion of the *pāhoehoe* 1–2 m above the surrounding landscape. Other than a wall, all of the features are mounds or pits. In addition, scattered blocks of *pāhoehoe* and broken edges of the flow signal the overall function of this area: a quarry for blocks of *pāhoehoe* used in building features.

Features 38 and 39, both mounds, sit high on the flow, and without the current growth of *kiawe*, would be visible for some distance (fig. 107). Unfortunately, these forms fit with several interpretations, the most likely being trail or boundary markers. Because their alignment lies about 45° off of the typical *mauka-makai* orientation of boundaries, that interpretation would seem less likely, if the features are in fact related to each other. Taken as trail markers, they may be related to outlying feature 73, located about 20 m to the southeast, but no worn path is visible. Alternatively, the mounds could be stockpiled quarry material, but the lack of any size or material type sorting would seem to argue against the intentional gathering of this material. No clear indications of age were observed, but the surrounding features indicate that they are prehistoric.

Between the mounds, an L-shaped wall, feature 50, defines the northeast and southeast edges of a level section of *pāhoehoe* covering approximately 25 m². Some midden occurs on the surface, but in small enough quantity to counter interpretation of this as a substantial occupation. Also, the *pāhoehoe* does not afford a place to set house posts.

Pits, features 40 and 51, and numerous broken blocks of *pāhoehoe* demonstrate a pattern of breaking the flow margins throughout the immediate vicinity. Only one water-worn hammerstone cobble was observed, but both the scarred flow edges and the numerous blocks and slabs spread around show that the lower edges of the *pāhoehoe* ridge were repeatedly hammered to break free 20–25 cm thick blocks of stone. Several hammerstones found in cluster F may be the tools used here. In addition to the thick blocks, thin plates or slabs of *pāhoehoe* have been hammered loose from the relatively flat upper surface of the ridge.

To the north of cluster G, a lava bubble with modified edges and more abundant midden on the surface indicates habitation of much longer duration than feature 50 demonstrates. This cluster fits into a larger pattern of *pāhoehoe* quarry activity characteristic of Punaloa *mauka*. Without quantification of the volume of stone missing from pits and lying loose on the ground, the amount of quarry activity in general and of stone removed from sites cannot be accurately judged. Thus it remains unknown whether the *pāhoehoe* quarries served just the need for construction along the immediate coast, or if they had a larger regional purpose.

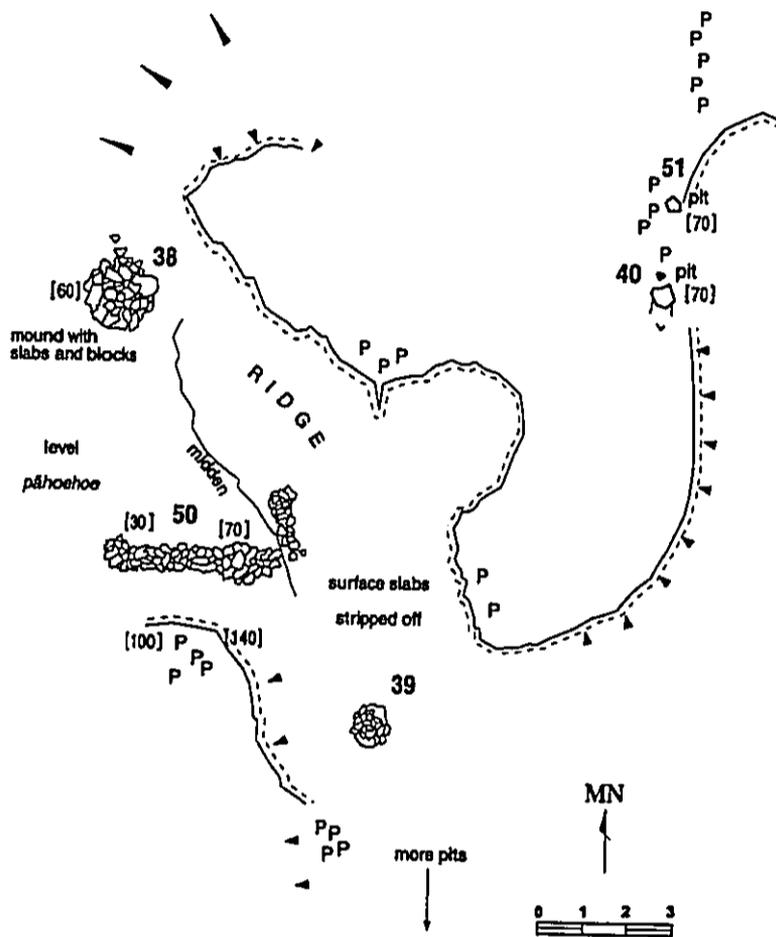


Figure 107. Cluster G, site 50-10-18-23357. Tape and compass map drawn by M. Major. The legend is on page 39.

Cluster H: Punaloa Quarry Zone

In northern Punaloa, the nature of the *mauka* patterns remains less well known due to the project area constraints, but survey of access road corridors *mauka* of middle Punaloa provides additional data regarding land use behind the coastal zone. As mentioned above, Punaloa exhibits a pattern in which habitation clusters along the coast signal the presence of pit complexes in the *pāhoehoe*, sometimes accessed by well-worn trails. Cluster H includes abundant evidence of pits, battered flow margins, temporary habitation, and mounds that together appear to indicate widespread quarrying of *pāhoehoe* blocks. How widespread remains uncertain, since the access road surveys consist of limited corridors, but the features recorded here represent only a small fraction of the overall area.

Before continuing, it should be noted that although this area is called a "quarry," all of the connotations of that interpretation do not necessarily apply. Clearly, stone was loosened from the pristine lava flows in Punaloa *mauka*. Especially in areas close to above-ground features, some *pāhoehoe* blocks and slabs were used in feature construction. Whether stone was removed from the area, and whether the intent of dislodging *pāhoehoe* blocks was to obtain building material remains to be demonstrated. Widespread battering of minor blisters and tumulus margins indicates that the goal was not to expose habitable tubes, and because the tubes do not appear to congregate around habitation clusters, trails, or water sources, pit-based agriculture does not seem to be the goal.

Features here include the typical *pāhoehoe* pits ranging in area from under a meter to over 4 m². Perhaps more commonly, the lower margins of *pāhoehoe* ridges and tumuli have been battered. In both cases, the objective appears to have been procurement of stone slabs and blocks. The flows in this area yield stone typically 20 cm thick, with the chunks found strewn, and occasionally piled, near the holes rarely exceeding 50 cm in length. This size range resembles that found in structures made of *pāhoehoe* throughout Manini'ōwali, indicating that the activity represented here is quarrying for building material. Alternative explanations exist, and no attempt to compare systematically quantities of stone loosened from flows and remaining on site was done to prove that stone was removed.

Other than pits and battered margins, features within the quarry zone include mounds, cave shelters, and a C-shape enclosure. At least two mounds, features 33 and 34, mark a trail. Given its location and orientation, this trail may be part of a larger trail from Manini'ōwali Bay to Kaho'iawa Bay. Oral history provided by Arthur Mahi indicates that trails "from one place to another" occurred inland (Maly 1998:106), and the location of Site 50-10-18-23360 provides archaeological corroboration of a bay-to-bay trail in a similar placement. Other mounds either mark trails that lack a worn surface path, or could function as boundary markers, or perhaps some other purpose. Feature 47, a single coral upright, may be a trail and a boundary marker. It sits prominently on a ridge that seems to be the southern end of the quarry zone, at the top of a small tube that offers an excellent trail surface very similar to that described in cluster F of site 50-10-18-23356 (see pg. 72).

The lava tube shelters observed within the quarry zone, including some outside the project corridor, share some attributes. First, the nature of flows here has determined the overall size and shape, with few sections having passages more than 1 m high or 3 m wide. Also related to flow morphology, but perhaps more related to cultural practice, tubes with evidence of habitation, for example features 26 and 48 (fig. 108), tend to occur at about 90 feet in elevation. More extensive, close-interval survey of areas *mauka* would be required for confirmation, but within the surveyed area, this elevation seems to correspond with the *mauka* edge of the quarry zone, in a pattern similar to site 50-10-18-23356, cluster I (see pg. 113). Other than entry pits broken through the *pāhoehoe*, modifications to the tubes do not occur. As with the cave, feature 37, near the coast, midden does not seem much more abundant inside than the sparse scatters occurring on flat *pāhoehoe* above, an indication of casual use, rather than long-term habitation or patterned disposal. Water-worn basalt used to hammer the *pāhoehoe* is the only artifact type present. With little evidence of intensive or even sustained use,

these features fit the category of "temporary habitation" much better than the coastal features. Their main function may simply have been to provide shade.

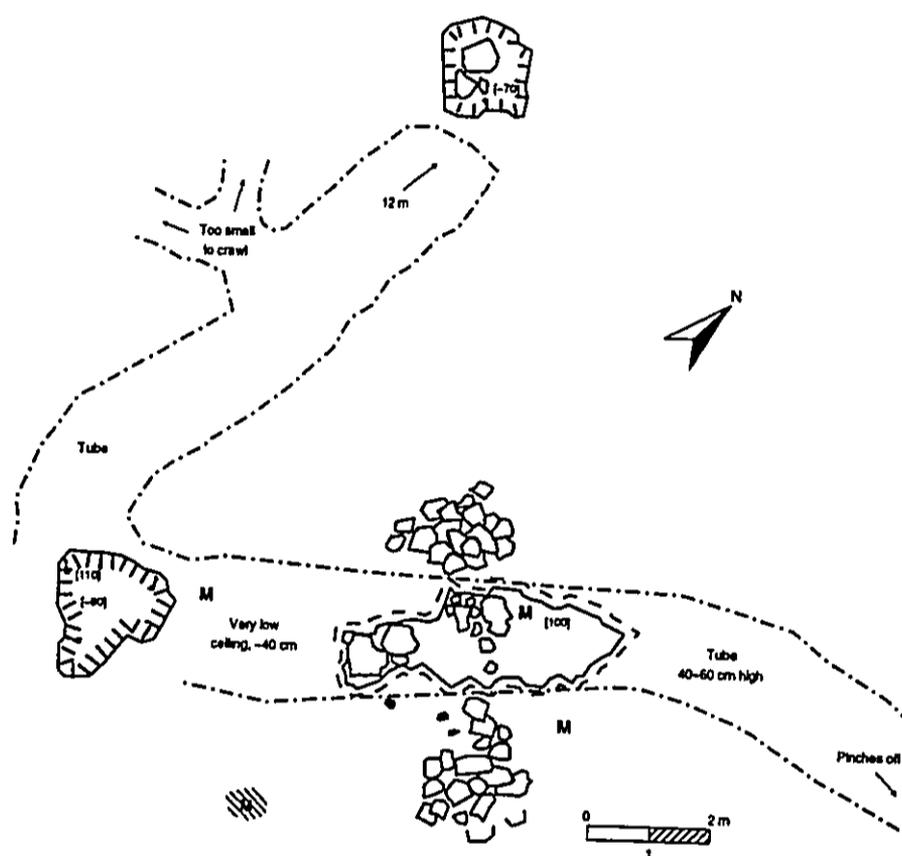


Figure 108. Plan map of cave feature 48, site 50-10-18-23357. Tape and compass map drawn by M. Major. See figure 8 on page 39 for legend.

Although it lies outside the project area, a C-shape enclosure, feature 29, within the quarry zone merits note. The construction incorporates upright slabs of *pāhoehoe* similar in form and placement to features interpreted as possible shrines in site 50-10-18-23356, clusters F (see pg. 107) and I (see pg. 113). Farther *mauka*, a concentration of pits reveals stone with a white patina on one side and shiny bubble on the other, similar to the stone used in clusters F and I. The existence of particular colors and textures amid the larger area, and the fact that this locale was more intensively quarried than others, suggests that cultural preferences guided at least some quarry activity.

Additional Coastal Features

Between cluster E and the *ahupua'a* of Awake'e, relatively few features occur. This scarceness further emphasizes the importance of that cluster, and of the quarry zone, since the Punaloa survey area expanded from trail corridor to broad area just south of the former, and thus would have encountered features behind the immediate coastline. The true location of the Manini'ōwali-Awake'e boundary, north of the boundary indicated on the USGS maps (see pg. 172) south of cluster E suggests that there may have been a buffer zone between *ahupua'a*, an area in which few features occurred.

Those features recorded in this area suggest marginality. The features closest to the coast, features 43 and 44, a pit and adjacent mound of stone from it, reflect what was probably a single episode of quarry activity. About 20 m to the southeast, feature 73 consists of a mound, possibly marking a trail to cluster G. On the next low *pāhoehoe* rise to the southwest, about 9 m away from feature 73, a very small collapsed blister has a collapsed, slab-roofed cupboard at one end and a faced pit at the other, features 62 and 63, respectively. A few meters farther, feature 64 consists of a naturally flat *pāhoehoe* surface upon which an irregular rectangular arrangement of stones lies on a north-south axis; the western wall exhibits upright slabs nearly 50 cm tall, while the others consist of similar material broken down to smaller size. Inside, the ropy, black *pāhoehoe* surface remains in its natural state, whereas outside it has been beaten. A 4 m long by 2.5 m wide platform located about 15 m south of feature 64 has a depression at the back, and stands out on the landscape; its size and form would be consistent either with a significant boundary or a burial platform, since it lacks the more finished surface, coastal location, or ancillary features associated with most habitation features in the region.

Punaloa Summary

Although the *pāhoehoe* lava jutting out to form Punaloa Point does not obviously differ from that behind Manini'ōwali Bay to the northeast, the emphasis of human activity here seemingly rests on the stone. Behind a very narrow littoral band of settlements, pits dot the landscape. Although margins of tumuli and ridges seem to have been the most commonly battered areas, they by no means represent the only terrain used. The purpose of all the pit-bashing appears to have been to dislodge blocks and slabs of *pāhoehoe*. In addition to the 20–25 cm thick material generally obtained from the interior slopes, thin plates of *pāhoehoe* from the more level, near-coast zone were targeted. At least one location seems to have been targeted on the basis of a particular appearance of stone that was possibly used in sites farther north in Manini'ōwali. Although the degree has not been quantified, field observations indicate that stone was removed from many pits. Clearly, some of the material made its way into the coastal features, but it may also be possible that some *pāhoehoe* quarried here was used at other locations as well, perhaps taken away from Punaloa by canoe.

The coastal features generally resemble what would be termed temporary habitations, since they most often consist of C-shape enclosures and other relatively small structures. Certainly, the level of labor and design sophistication invested in the coastal habitations of Punaloa does not appear to match that observed at the residential com-

plexes surrounding the bays of this project area, much less the even more substantial habitations elsewhere in Kona district.

Some aspects of the archaeological record, however, provide reasons that modern interpreters should not be so quick to dismiss the features as unimportant and only temporary in nature. For example, several of the coastal clusters have well worn trails leading *mauka*. None of these appears to connect with the major trails, sites 50-10-18-5337, -16059, or -1193, that have been used historically for horse and donkey travel, meaning that the path was worn into the *pāhoehoe* by bare feet or sandals made from leaves, a feat taking untold years of repeated travel. Similarly, with the availability of beach stone, easily modified swales, and occasional habitable tube shelters, the extent of quarrying to provide stone used in making structures proves to be something of a surprise. There seems to be a disproportionately high degree of labor invested in "temporary" C-shape enclosures and walls.

Arrangement of settlement space also suggests a more formal approach to the cultural landscape than would be expected for temporary camp sites. Clusters A and B, for example, include features located *mauka* of the beachfront, although ample room exists for spreading out along the coastal band, and they share the same flat area between ridges. Given the absence of physical impediments to spreading out along the shore, this suggests intentional buffers between one cluster and another. In turn, that phenomenon may be read as a trace more of a long-term recognition of particular territories than of temporary use followed by abandonment, or even of camping by non-residents using the coastal trail for travel around the island. Likewise, the presence of a trail heading *mauka* from each coastal settlement indicates an importance attached to *mauka* access for each cluster.

Reflecting this theme, clusters E-G and part of H indicate a land use pattern extending inland along a low gulch, the closest that this landscape offers to the prototypical Hawaiian valley settlement pattern. In a landscape where no protected bay is present to provide an ideal canoe landing, independent access to *mauka* stone sources appears to be the analog to beach access as a defining factor for independent *kauhale*. These trails, the buffers between habitation clusters, and the presence of associated features and pits behind the shoreline all fit with the ubiquitous Hawaiian settlement pattern of dividing land into *mauka-makai* strips. It would not be surprising at all to find that the *mauka* quarry pits have been divided into territories, perhaps terminating in the *mauka* tube shelters.

The paucity of features in Punaloa also represents something of a deception. First and foremost, it should be recognized that the survey area here primarily consists of a coastal strip along the *alaloa* trail, and that additional features are known to exist in association with the coast, but outside of the recorded area. More subtly, the *pāhoehoe* landscape provides landforms that do not require a great degree of modification to be habitable. Caves, obviously, represent one such form. But several areas also show that level *pāhoehoe*, particularly when occurring atop a ridge or tumulus, provides the natural equivalent of a platform. Distribution of midden, use of cobbles to fill cracks, and occasional stacking to complete natural "platforms" all serve to indicate that natural features were in fact used for habitation. Similarly, the "dirty" coral cobbles and angular *pāhoehoe* occurring on the beachfront at clusters A and B suggest that substantial pavements, or perhaps even ruined structures were an important element of

coastal clusters, adding area that exceeded the small walled features that remain as the more obvious clues. Finally, the ocean itself has undoubtedly reclaimed some of the settled space in relatively exposed Punaloa Point, covering features in storm deposits, toppling walls, or sweeping away midden.

These arguments are not intended to imply that Punaloa Point features represent a permanent village, or that settlement there occurred on the same scale as at the bays. Instead, the goal is to show that despite the rather meager arrays of obvious features, human use of Punaloa appears to have been an important component of the overall settlement pattern of Kekaha. This seems to rest most squarely on the presence of *pāhoehoe* flows of relatively uniform thickness that could be broken free from the land and used in constructing features. Rather than a quarry in the modern sense—a place where intensive exploitation of a natural resource results in massive alteration of the landscape—this activity seems to be dispersed over space, and perhaps over time. With so many pits, and so much stone left behind at the source, it seems more likely that quarryers focused on obtaining a nice slab, or several good blocks of stone from each pit—that the behavior was a very targeted procurement of a particular type or shape of stone. The habitations along the *makai* and *mauka* margins of the quarry pits indicate that people stayed long enough to rest, or even spend a few days. Use of some of the quarried stone in the local C-shape enclosures and walls provides a partial reason for the quarry pits, but does not explain the entire phenomenon, particularly the pits not located in the immediate vicinity of the features.

Kaho'iawa Bay Site 50-10-18-23358

South of Punaloa Point, the Kaho'iawa portion of Awake'e *ahupua'a* offers a very narrow coastal strip backed by the cinder-covered slope of Pu'u Kuili. Despite the shoreline cliffs and limited *mauka* extent of level land, a series of relatively substantial habitations lines the shore (fig. 109). To a large degree, this probably reflects the fact that Kaho'iawa Bay offers a rather sheltered bay.

Cluster A: North Awake'e Boundary and Habitation of Natural Features

On the USGS Makalawena quadrangle map, the northern edge of Awake'e *ahupua'a* cuts through Kaho'iawa Bay about a quarter of the way down from Punaloa Point, so that the boundary line enters the ocean at the back of the bay. Interestingly, this portion of the boundary clearly shows up as a dogleg departure from the boundary *mauka* of Pu'u Kuili. During the survey, however, substantial cairns were found farther to the north, in a line with the *mauka ahupua'a* boundary, which if correctly interpreted as boundary markers would place all of Kaho'iawa Bay within Awake'e *ahupua'a*. Feature 13, presumably more recent, has a 0.75 in. metal pipe hammered into bedrock at its base. Ten meters away at a bearing of 164°, feature 14 is a similar, high-stacked cairn on lower ground. Farther southeast, another cairn, feature 12, marks the upslope edge of several midden deposits and lava tube features with evidence of precontact habitation and modern use (fig. 110). Well *mauka* of these, feature 53 is another cairn

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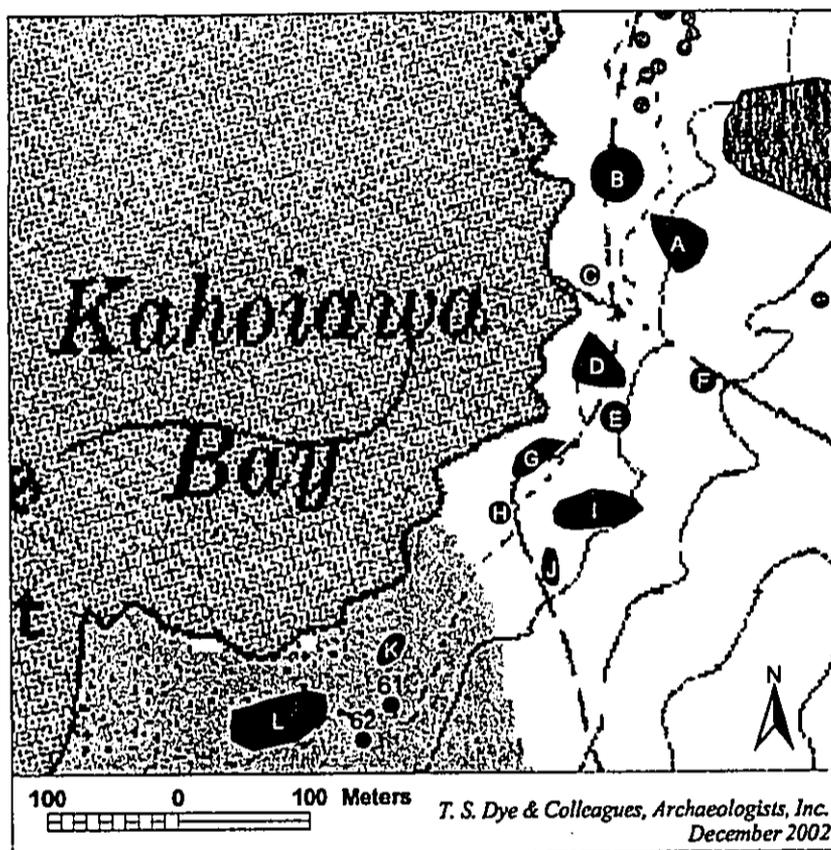


Figure 109. Feature clusters and outlying features of site 50-10-18-23358.

located on a ridge, next to which "BDY" has been painted in white. Although most or all of these features could be relatively modern, the fact that they more closely follow a ridge—the sort of natural formation reported as *ahupua'a* boundaries in *kama'āina* testimonies of the 1870s—suggest that they represent the true boundary. Another ridge with white uprights, site 50-10-18-23357, feature 47, and a platform near the coast, site 50-10-18-23357, feature 45, occur parallel to this boundary, but even farther, about 35-45 m, north.

Interestingly, the features located between cluster E of site 50-10-18-23357 and cluster A of site 50-10-18-23358 almost all appear to be markers, mostly mounds, but also including the coral upright and platform. The number of features suggests some fluidity of the boundary over time, and the absence of other forms indicates that this area is indeed a boundary with an uninhabited buffer. Location of the ridge, coral

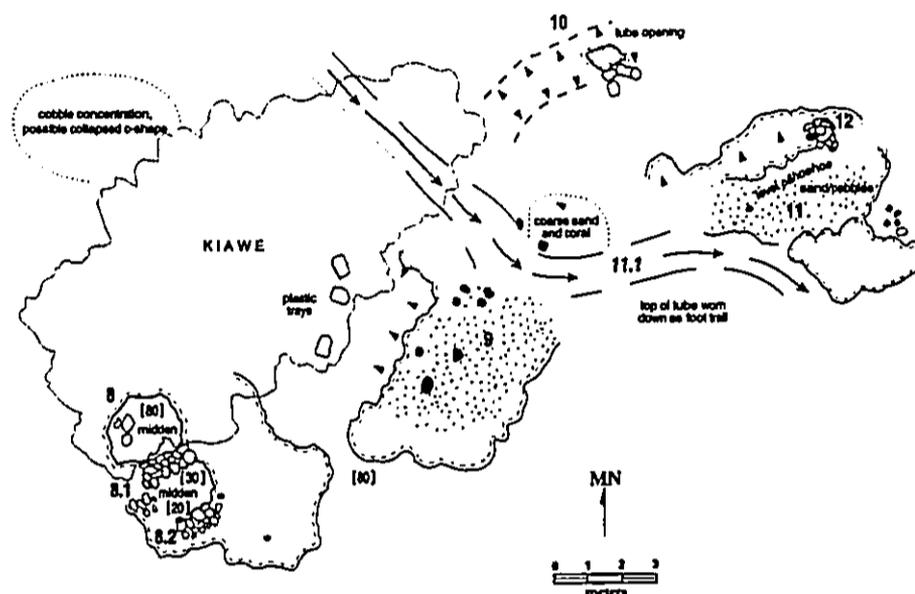


Figure 110. Portion of cluster A, site 50-10-18-23358. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

upright, and platform in the middle of this zone, with smaller mounds toward the periphery, suggests that the mounds may have marked the buffer, while the landform and platform marked the dividing line. If alternatively, the multiple features represent the passage of time, then the boundary has drifted southward over time, to the point where the modern USGS map depicts Manini'ōwali *ahupua'a* encroaching into Kaho'iawa Bay, previously the domain of Awake'e *ahupua'a*.

South of the boundary features 13 and 14, a cluster of features appears to be a habitation cluster. Adjacent to feature 12, feature 11 consists of a level *pāhoehoe* surface covered with sand, coral pebbles, and midden. In addition to these traces of habitation, several pieces of branch coral indicate possible religious significance, although there is no structure present. About 6 m to the southwest, a similarly level *pāhoehoe* area, feature 9, also has midden, sand, and coral pebbles, as well as several water-worn basalt cobbles. Each of these natural "platforms" offers close to 10 m² of habitable area, although there are no walls or postholes to demonstrate the presence of an above-ground feature.

A small lava tube meandering along the slope and passing between features 9 and 11 has an upper surface about 1 m wide and 1 m above the surrounding lower ground. Like the lava tube through cluster F of site 50-10-18-23356, its upper surface is worn from use as a trail, and like many of the trails in site 50-10-18-23357, it connects the coastal trail to *mauka pāhoehoe* quarry pits. No entry into this lava tube was located, but the exterior size suggests that it would not be of habitable size anyway. Just east of

feature 9, this lava tube intersects with another, where a pit, feature 10, reveals that the 50 cm high interior contains a few coral cobbles and a small quantity of midden. Given the size, it appears that feature 10 represents a disposal pit, rather than a habitation entry.

Down slope, just over 5 m east of feature 9, a larger pit, feature 8, provides access to a larger lava blister with abundant evidence of habitation. With a skylight opening more than 7 m² in area and a habitable interior area about twice that and high enough to sit in, feature 8 provides ample shelter for several people. Midden inside and out attests to habitation, and, unfortunately, to the looting endemic to this coastline. A terrace, feature 8.2, defines the south edge of the opening, and a short wall, feature 8.1, divides the shelter in two, roughly bisecting the opening, but making the northern interior much larger.

Cluster A resembles coastal clusters at Punaloa Point in that few constructed features are present, but natural landforms have been used for habitation, and in the presence of a well worn trail leading *mauka* of the habitation to a pit zone. Modern activity, including looting, trash disposal by campers, and probably marijuana cultivation have all left their mark in these features to a greater degree than was observed to the north. In large measure, this reflects the closer proximity of cluster A to a road, since the beachfront here has been used as an access for four-wheel drive vehicles.

Cluster B: North Kaho'iawa *Kauhale* Remnant

Makai of cluster A, this group of features occupies the beachfront on a small cove of northern Kaho'iawa Bay. Although the bay as a whole covers the entire shoreline in front of Pu'u Kuili, this is one of the few places with a break in the cliffs and a cobble beach, making canoe landing a bit easier. Unfortunately, it has also made modern vehicular access easier and this has resulted in damage to whatever features are here. At present, cluster B consists of remnant features in the low-lying *pāhoehoe* behind the beach and recent campfire rings on the beach itself. The entire area is covered with modern garbage and the lower *mauka* features, in particular, have been used as toilets and dumping areas.

Four features on the beach represent recent activity (fig. 111). Features 2-4 are all stone ring fireplaces, averaging 1.4 m in diameter. Feature 5, although more substantially built with a stone base, is also a recent fireplace. The very close proximity of these fireplaces indicates that they do not represent contemporaneous occupations by separate groups, but rather a pattern of successive groups each electing to build a new fireplace feature. Stone used in the construction of these features includes beach rock as well as some clearly taken from older features, with proximity indicating that all of it derived from the archaeological structures.

Nearly parallel to the beach, feature 1 currently consists of a stone terrace whose face descends in the *mauka* direction. However, it may have been part of a larger enclosure or platform occupying the level cobble beach, now disturbed by modern camping. Both ends have collapsed, and the feature only stands 1-2 stones higher than the ground behind it, but the remaining 11 m length indicates that it would have been a medium to large structure, probably exceeding 40 m² in area.

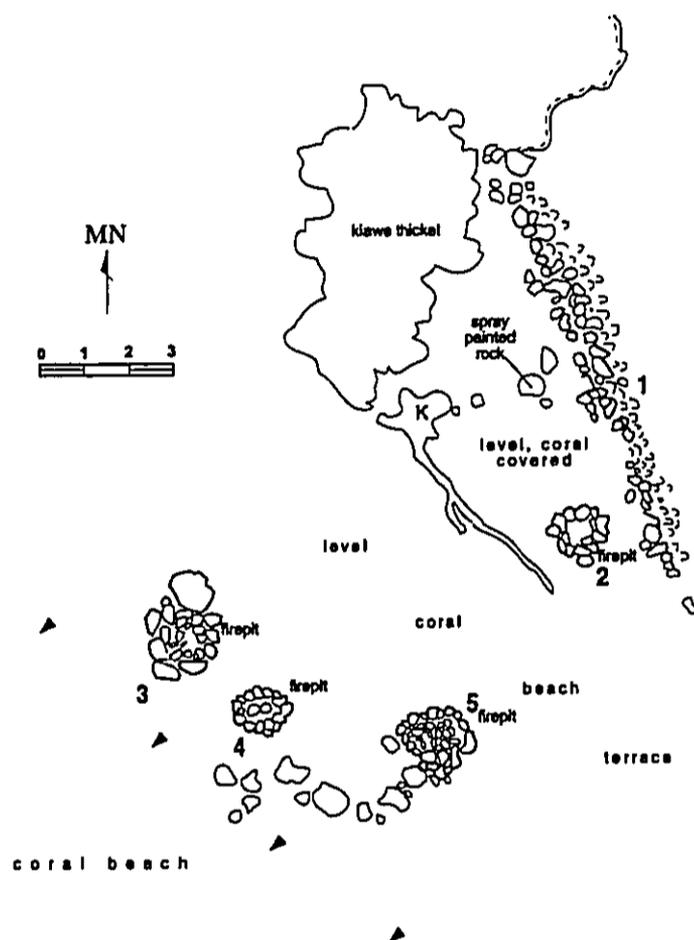


Figure 111. Makai portion of cluster B, site 50-10-18-23358. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

About 15 m east of feature 1, an enclosure remnant, feature 6, sits directly on the *pāhoehoe* flow behind and below the cobble beach berm (fig. 112). With only the eastern half in recognizable condition, the original shape may have been either a complete enclosure or a C-shape. In either case, interior area would have been about 5 m². Another 6 m to the east, feature 7 consists of a deep C-shape enclosure, sometimes called a U-shape enclosure, with substantial walls and a 8.5 m² interior covered with *pāhoehoe* chunks. On the south side, the wall is free-standing, with double-faced, core-filled construction; elsewhere, the wall abuts a *pāhoehoe* ledge and is faced only on the interior. On the northern edge, outside the end of the C-shape opening, two narrow terrace facings, features 7.1 and 7.2, form shelves a meter or less in depth, and 2-2.5 m long. Their function is not completely clear, perhaps just an augmentation of the

finished habitation space, storage, or steps up to the level of the surrounding *pāhoehoe*.

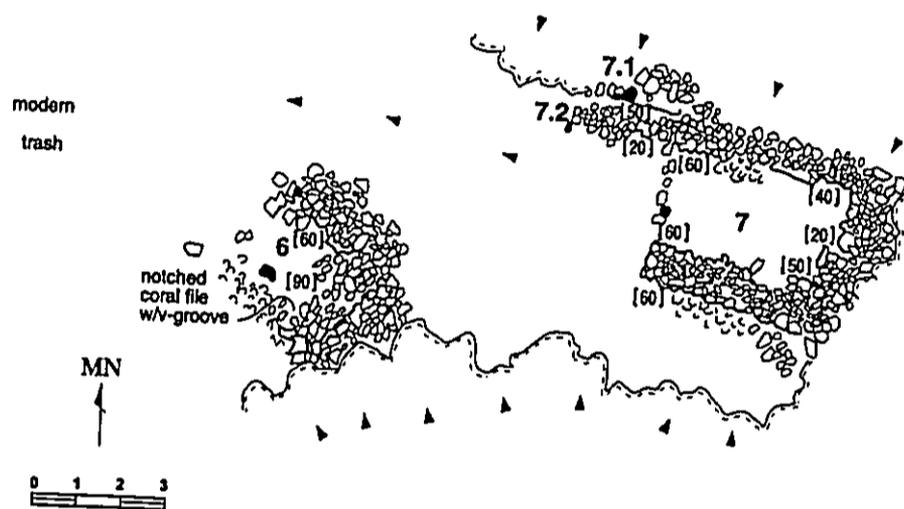


Figure 112. *Mauka* portion of cluster B, site 50-10-18-23358. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

Although not assigned a feature number, another 8.5 m² area of rather level, clear *pāhoehoe* immediately *makai* of feature 7 may have been used as a habitation space; the space is "enclosed" by the wall of feature 7 and the surrounding natural *pāhoehoe* ledge. Being relatively deep from opening to back wall, both this space and feature 7 fall somewhere in between the typical forms of habitation C-shape enclosures and canoe sheds, and it is possible that the protected location behind the beach was chosen for the latter, with habitation occurring on the higher ground, which would be more exposed to cooling breezes, but also to waves.

Modern camping, unfortunately, has obscured some traces of earlier occupation in this small beach at Kaho'iawa. The advantageous natural environment, with good ocean access and along the coastal trail, apparently made it attractive enough for Hawaiians to have built what appear to be permanent features. Just north of the modern boundary between Awake'e and Manini'ōwali *ahupua'a*, it probably was squarely within Awake'e in the past, or perhaps an *'ili* or other land unit between Pu'u Kuili and Kaho'iawa Bay. That fishermen continue to use this place suggests that the ocean resources here are valued; they might have been even more so in the past. A noticeable attribute of the area is that birds frequenting the anchialine pools to the south and north are directed into a relatively narrow flight path here by the steep terrain *mauka*, a pattern of movement that Hawaiians no doubt noticed, and perhaps exploited. Pu'u Kuili itself offers excellent vantage points for watching schooling fish, and the notch of Kaho'iawa Bay may have provided an opportunity for surrounding them.

Cluster C: Enclosure with Surrounding Wall

Located inside a thick patch of *kiawe* along the coast of northern Kaho'iawa Bay, an oblong enclosure, feature 18, has an additional wall, feature 19, wrapping around the *makai* and north sides. Although not previously recorded, the construction and location suggest that this represents precontact Hawaiian habitation, rather than a recent camping shelter. With no additional features nearby, this structure does not fit the normal conception of a habitation compound, and could be a small *heiau*, or perhaps a variant form of habitation.

With nearly 120 m² of interior area, the main enclosure is sizable (fig. 113). Walls have tumbled some, particularly on the *makai* side, where waves and large *kiawe* branches have caused damage. The interior surface lies beneath a tangle of branches and leaf litter, and therefore cannot be clearly seen, but the northern half seems to be rougher than the south. At the far southern end of the interior, two slab lined pits, features 20 and 21, extend beneath floor level. The amount of loose stone in this area suggests that they have been disturbed, and there may have been roofs originally.

A break in the *makai* wall a few meters from the southern end leads into an ante-room of sorts, feature 19. An outer wall extends out from the main wall just south of the doorway, and wraps around the enclosure on the *makai* and northern sides, creating a 3–4 m wide outer room that has pebble and cobble pavement, becoming rougher from south to north. The northern part of this wall becomes less substantial, grading from stacked stone to a boulder alignment before fading away. Although the wall serves the purely utilitarian function of protecting the main enclosure from wave damage, there may be additional significance to it. Other features along the project area coastline, including similarly sized enclosures, lack the outer wall, which would be unusual if it provided real protection. Alternative functions, such as protection from attack from the ocean or formally defining an area not accessible to passers-by on the coast, should be considered.

In the absence of any subsurface data that could inform on function, this complex enclosure cannot be conclusively interpreted. The size would be consistent with a large house or perhaps a *heiau*. A rough, but relatively level, field of boulders and cobbles to the south could be the heavily damaged remains of additional features, but otherwise this seems to be the sole structure in the immediate vicinity. It could, however, represent a communal feature used by people inhabiting clusters B and D, being on the point between those two. The jeep road a few meters *mauka* does not seem to have obliterated any features there, indicating that it does not represent the *makai* remnant of a *kauhale*. If this structure represents a distinct household, it does not fit well with common archaeological conceptions of *kauhale*, since it is larger than expected for low status or temporary habitations, but lacks the suite of ancillary features expected of a sizable primary habitation.

Cluster D: Kaho'iawa Beach Cliff *Kauhale*

Previously recorded as part of Site 103 (Reinecke 1930), and later as sites T-156 through T-159 (Donham 1987), some of this site has been battered by high surf, and possibly damaged by vehicles parking by the shore. At the core of the site are two en-

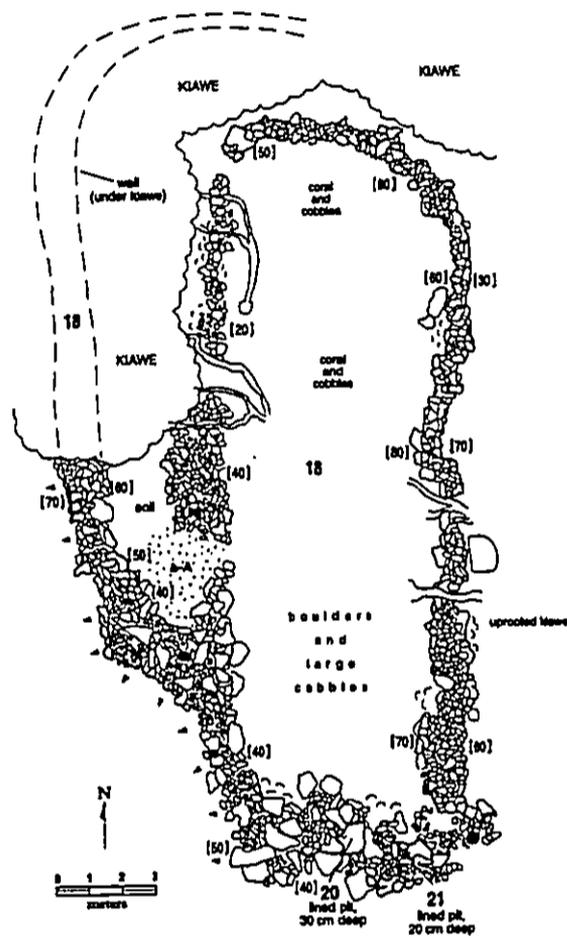


Figure 113. Cluster C, site 50-10-18-23358. Tape and compass map drawn by M. Major. The legend is on page 39.

closures, or possibly enclosed terraces, on cliffs protruding into the bay; although they are about 30 m apart, they have been included in the same cluster because of a trail linking them, and the fact that only one has convenient access to the ocean. Additional features, one heavily damaged when the jeep road cut through it, occur *mauka* of the enclosures. With the exception of the destroyed feature, this discussion will use newly assigned feature numbers; correlations are available in appendix A.

Even during Donham's 1986 survey, the feature designated T-159 was in such poor condition that the size and form could not be accurately determined. She estimated that the 64 m² of interior area remaining represented about half of the original size, and that the feature had been an enclosed habitation. Since that time, the thin soil deposit and wall remnants have been obliterated, although the location is apparent from her

description and scattered midden and stone on the cliff. Debris left by fishermen, noted by Donham (1987), continues to have accumulated, and appearances suggest that at least part of the damage to the feature has been a result of vehicles driving out to the point.

About 30 m to the south, across an indentation in the coastline, Features 22–25 have fared better, and appear much as Donham (1987) described them. Feature 22, although the makai edge near the cliff has been washed away, consists of an enclosure that may have had a terrace on the front edge, and whose interior area measures between 30–35 m². Some midden can still be seen inside, but the deposit is thin, and no internal features appear to be present. About 7 m *mauka* of the back wall, a C-shape enclosure, feature 23, opens *makai*, and shares essentially the same orientation as the larger feature. Extending out from the northeast corner, feature 24 consists of a 1.0 m deep cavity constructed of stacked stone, and presumably used for storage. Although the C-shape enclosure adds about 4 m² of interior area, a large area of midden, feature 25, occurs without any clear differentiation inside and well beyond the feature, covering what Donham (1987) estimated to be nearly 200 m². Some gravel pavement appears in this area, and a possible cobble alignment defines the northern edge, but the deposit lacks a clear form; nevertheless, feature 25 represents a large, level area whose midden and lithic accumulation indicates general habitation activity.

Between and inland of T-159 and feature 23, feature 47 is a C-shape enclosure just below the modern jeep road, and feature 48 is a small terrace platform 6 m to the northeast. The C-shape enclosure, unlike most, opens in the *mauka* direction, 80°, and offers about 3.5 m² of interior area covered with soil. The wall provides shelter from afternoon winds, and the presence of soil indicates a possible agricultural function. Extending out from the slope on three sides, feature 48 has a stone surface about 3 m² in area, and although clearly a cultural feature, does not represent a large enough area for much activity, or a significant labor input. Together, these features seem to represent outlying, ancillary features, rather than part of the core habitation.

On the *mauka* side of the jeep road, south of feature 48 and inland of Features 22–25, a structure recorded by Donham (1987) as T-156 has been reduced to rubble. Although more than 10 m from the other features, it is included within this cluster for ease of discussion. Based on Donham's descriptions, it was 3.2 m long and up to 5.8 m wide, but she could not determine the function or original form. Because the wall lies just 3 m from the jeep road, it could be possible that the feature represents road clearing, accounting for the rough form. Presence of water-worn basalt and coral stones, however, indicates that even if this is the case, an older feature probably occurred here.

More dispersed than clusters on nearby sections of the coast, cluster D may consist of two households linked by a trail, or perhaps a less dense version of the *kauhale*. With the nearby slope of Pu'u Kuili making *mauka* expansion problematic, and an intervening indentation on the coastline making close proximity impossible, the distance between T-159 and features 22–25 could simply be the only settlement pattern available in this landscape. Although features 47, 48, and possibly 56 represent outlying features, with clusters E and F perhaps demonstrating associated activity *mauka* (see pgs. 181 and 181), the core of activity appears to be strongly oriented toward the coast, with relatively large, rectangular features located there. This resembles the dominant patterns indicated by features throughout Kaho'iawa.

Cluster E: Peripheral Habitation Features

A small enclosure originally included within site 103 (Reinecke 1930), and described later as site T-154 (Donham 1987) has additional features located during the current survey. Shell midden and volcanic glass flakes suggest habitation-related activity, but the size, construction, and location of the features indicates that they may be ancillary features located on the margin of cluster D, rather than a distinct household.

Feature 49, the enclosure, has no openings and a soil and midden covered interior surface measuring 2.4 m² in area. This size, though consistent with C-shape enclosures found in habitations during the project, is small for a complete enclosure, and non-habitation functions such as an animal pen cannot be dismissed, and may be indicated by the up to 1.0 m high interior facing. Presence of volcanic glass and midden could represent either a specialized habitation activity, such as food processing, but could just as easily represent disposal activity having nothing to do with the original feature.

About 10 m to the north, opposite a small ravine, features 50-52 represent modification of a useful natural landform. The largest one, feature 52, consists of a natural terrace whose 28.5 m² level surface is strewn with midden, sand, and water-worn basalt and coral pebbles. Near the middle of Kaho'iawa Bay, this north-south oriented feature provides a good view of the habitations and the water below. A very roughly piled, discontinuous wall segment, feature 51, defines the northern end of the terrace. At the downhill end of the wall, feature 50 consists of a mound piled 70 cm high, perhaps marking the location of the terrace to people approaching from below.

Cultural materials deposited in feature 49 and on feature 52 demonstrate human presence on the slope overlooking cluster D. The relative sparseness of the deposit suggests that the features do not represent primary habitation areas, and they more likely exist as outlying features related to cluster D than as a distinct *kauhale*. Precise functions cannot be determined on the basis of forms or the scant cultural materials, although the form of feature 49 suggests an animal pen as a reasonable possibility for that enclosure. Distance of these features from the larger structures and denser deposits on the coast appear to reflect terrain, being on a relatively level area with the intervening ground sloping more steeply, rather than a cultural imperative.

Cluster F: Possible Agricultural Features

This cluster, located nearly 80 feet above sea level on the lower flank of Pu'u Kuili, has been previously recorded as site 103 (Reinecke 1930) and site T-160 (Donham 1987). Differences between the current condition and previous descriptions indicate that the process of modifications post-dating the initial construction have continued in modern times. Two small features down slope and *makai* of this main structure bear no obvious signs of modern construction, but may be relatively recent blinds for marijuana cultivation.

The main feature now consists of two corners, feature 40 on the northwest and feature 41 on the southeast, each resembling a C-shape enclosure (fig. 114). Donham described similar components, but oriented differently so that they formed northeast and southwest corners of a feature whose long axis lay at right angles to the current one, which is oriented at approximately 105°. Given the landform, it seems possible

that the previous directions were reversed, although neither component exactly matches the previous description, indicating that some reconstruction has occurred. In any case, the current components incorporate the surrounding landscape, with outcrops helping define the north, west, and part of the south edges of the enclosure, and a slope down to the west and southwest marking the exterior. Inside, a soil deposit of orange, decayed *pāhoehoe* covers the interior surface.

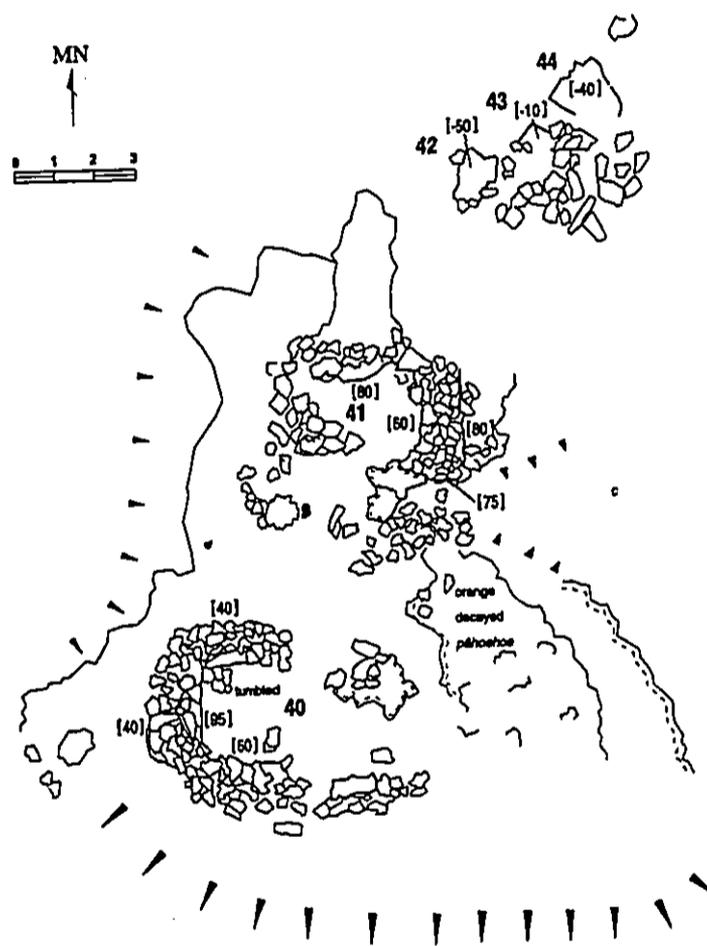


Figure 114. Portion of cluster F, site 50-10-18-23358, features 40-44. Tape and compass map drawn by M. Maigret. The legend is on page 39.

Outside the eastern edge of the feature, three pits, features 42-44, in the *pāhoehoe* could be quarries from which stone for wall construction was procured. Each is 10-50 cm deep, and 0.7-1.5 m in diameter. Loose *pāhoehoe* blocks lie on the southwest side of the pits, so if quarried, not all of the stone was used.

Down slope from the western edge of the main structure, two small features may

be of recent construction. Feature 45, an enclosure 1.6 m long and partially roofed with thin *pāhoehoe* slabs, lacks any side opening typical of roofed "cupboard" features, instead having narrow skylight openings. The other, feature 46, consisting of two thin slabs propped upright to form a V-shape opening into the base of the slope. Each of these features may have functioned to camouflage marijuana plants.

The previous interpretations of this site center on habitation, or possibly an animal pen (Reinecke 1930). Neither during the initial reports nor during the current investigation were any indications of midden or habitation-related artifacts discovered, and absence of any looter back-dirt piles suggests that they never were present. Although some sediment is present, it does not appear sufficient to obscure a buried deposit. The location, well uphill of any habitations, seems illogical for an animal pen, although that possibility cannot be eliminated.

Instead, it seems likely that the modern features provide a hint at the original function: agriculture. Unlike much of the slope of Pu'u Kuili, where plantings on the slopes could conceivably occur, but would not have left traces unless terraces were built, this relatively level area provides the opportunity to see features. The pits, possibly quarried but by no means providing stone that was mostly taken away, could be agricultural cultivation features. Likewise, walls could have functioned to retain the scarce resource of soil and to act as windbreaks, and orientation of the overall feature would have been southward, maximizing solar exposure. In modern times, the main structure and other features down the slope may have been altered to function as blinds or camouflage, to hide valuable crops. Lack of plastic pots suggests that, if this were the case, the cultivation probably occurred more than a decade or two ago, when such artifacts came to be the ubiquitous trace of outdoor marijuana cultivation.

Cluster G: Kaho'iawa *Kauhale* and Remnants

This cluster appears to include features of site 103 (Reinecke 1930) and sites T-149, T-151, and T-155 (Donham 1987), comprising a cluster of coastal habitation features. The largest, originally recorded as T-149 (Donham 1987:70), lies between the jeep road and the shore, and consists of a terrace roughly parallel to both. The 11.5 m long retaining wall, feature 27, may have been two or more meters longer originally, since the south end appears to have been disturbed by modern activity (fig. 115). Behind the facing, 4–5 m of level soil surface provides a habitable area of more than 50 m², and nearly level terrain immediately behind this more than doubles the area that could be used, if not roofed. South of the terrace facing, a midden scatter, feature 28, covers about 50 m² of a natural outcrop bench between feature 27 and the road, and includes marine shell and lithic artifacts. These materials, although not noted in the original site description, confirm the initial interpretation of the site as a habitation. South of the terrace facing, a "rubble pile extends to within 3.5 m of the road" (Donham 1987:70), a description corresponding to the current midden distribution, instead of the terrace, which is more than 12 m from the road, indicating that further erosion has occurred, and that the midden may have been under the floor of a much larger terrace.

About 8 m northeast of feature 27, feature 57 consists of a square C-shape enclosure, adjacent to the jeep road and full of trash. Although this appears to be the correct location for T-151 (Donham 1987:71), she described a C-shape enclosure remnant with

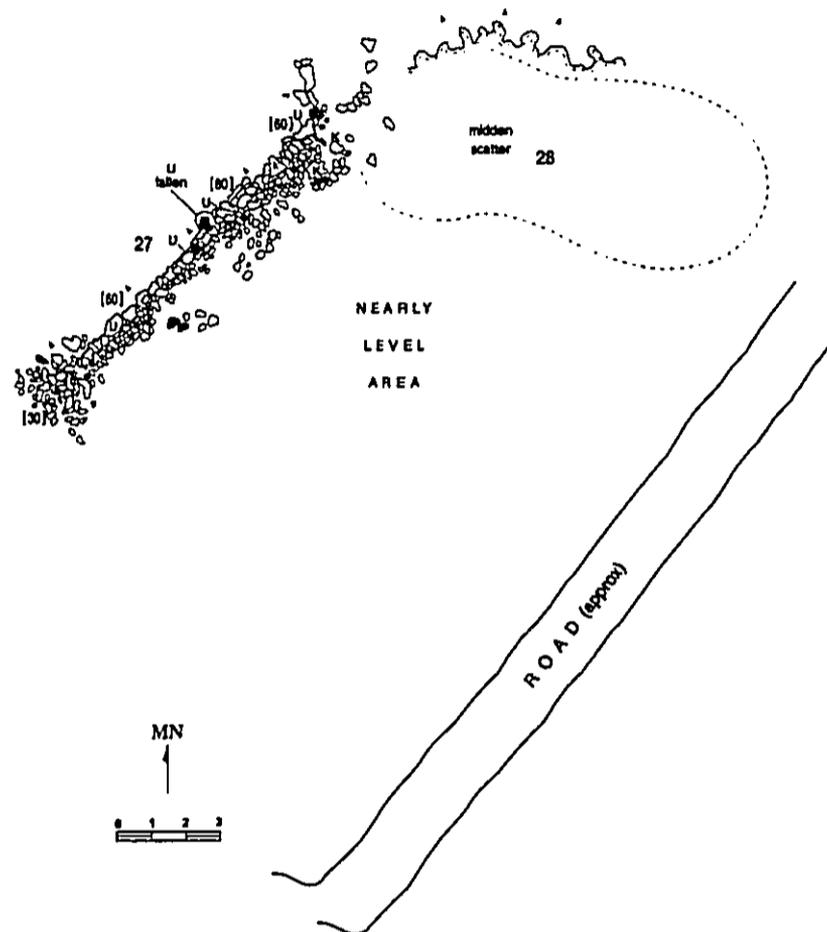


Figure 115. Cluster G, site 50-10-18-23358. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

only about one-third of the wall intact. The well-stacked walls and sharp exterior corners of this feature post-date the 1986 fieldwork, and modern garbage visible beneath some stones indicates it is probably less than a decade old. Filled with garbage, it has apparently been rebuilt as a trash receptacle. Except for the very square shape, however, the size, dry masonry construction, and orientation open *makai* all resemble older C-shape enclosures.

Inland of this, and only 4 m from the jeep road, another C-shape enclosure, feature 26, was originally recorded as T-155 by Donham (1987), who considered it a part of site 103 (Reinecke 1930). Rectangular, 3.3 m long by 2 m wide, rather than square in plan, this structure nonetheless shares the squared corner attribute of feature 57. This trait, proximity to the road, and presence of cans and bottles inside led Donham to

suspect that feature 26 was built historically. An additional clue, perhaps, can be seen in midden that contains only cowry and 'ōpihi, and therefore has less diversity than the shell midden deposits typical at older sites along this coast.

The location of features 27 and 28 by the coast certainly fits the pattern expected of households in Kaho'iawa, as does the feature form. Basalt and volcanic glass flakes amongst the shell midden suggest behaviors included stone tool use, possibly with tool-making as well, and along with the size of the feature indicate that the terrace represents sustained occupation. The only nearby features probably postdate this habitation, and it therefore does not fit the typical understanding of a household cluster, but it probably represents a residential unit. It is possible that additional feature components have been destroyed by the jeep road, or perhaps lie undetected beneath the organic horizon that blankets. Features 26 and 57 show that this area continues to draw human activity today, although as a rubbish dump, parking area, and shoreline access area for fishermen. The last function probably outweighs the existence of previous features in terms of persistent use of this area, since the main feature 26 now sits beneath thick, thorny vegetation.

Cluster H: Outlying or Temporary Habitation

These two features, recorded by (Donham 1987) as site T-150 and, in her opinion, comprising the southernmost section of site 103 (Reinecke 1930), are the collapsed remnants of a platform and C-shape enclosure. They seem to be habitation features, but being relatively small and located more *mauka* than usual, it could be possible that they were outliers of a more substantial household. Features 27 and 28 in cluster G, for example, are about 28 m to the northeast at a point where access to the water is somewhat easier. However, without a connecting trail, the distance exceeds that defined here for clusters, and the possibility that these features represent a distinct habitation cannot be disproved. One alternative interpretation is that these features represent a distinct, perhaps temporary, habitation.

Currently a mound, feature 30 appears to be a collapsed platform. Measuring about 4.0 m long by 2.8 m wide, the platform would have been smaller and probably about 50 cm high in its original condition. Several water-worn cobbles and boulders occur in the feature, which otherwise consists of the rough cinder boulders typical of the slopes below Pu'u Kuili.

Feature 29 remains in fair condition on the north end, and appears to have been a C-shape enclosure open toward the ocean. The intact wall stands about 50–70 cm high, and consists of stacked stone about a half meter wide. From the midpoint south, condition deteriorates, with a collapsed wall of smaller stone. The back wall includes several water-worn boulders, and the front is delineated by an alignment of subangular boulders. The interior area appears to have been closer to 2 m² than the 2.8 m² recorded by Donham, although subsequent collapse may have occurred, obscuring the original size.

Consisting of two small features, cluster H does not fit the pattern of household clusters in Kaho'iawa and southern Punaloa, where larger, rectangular structures immediately behind the coast dominate. Conceivably, these features represent outliers associated with cluster G habitation, but the distance, which is not, in this case, man-

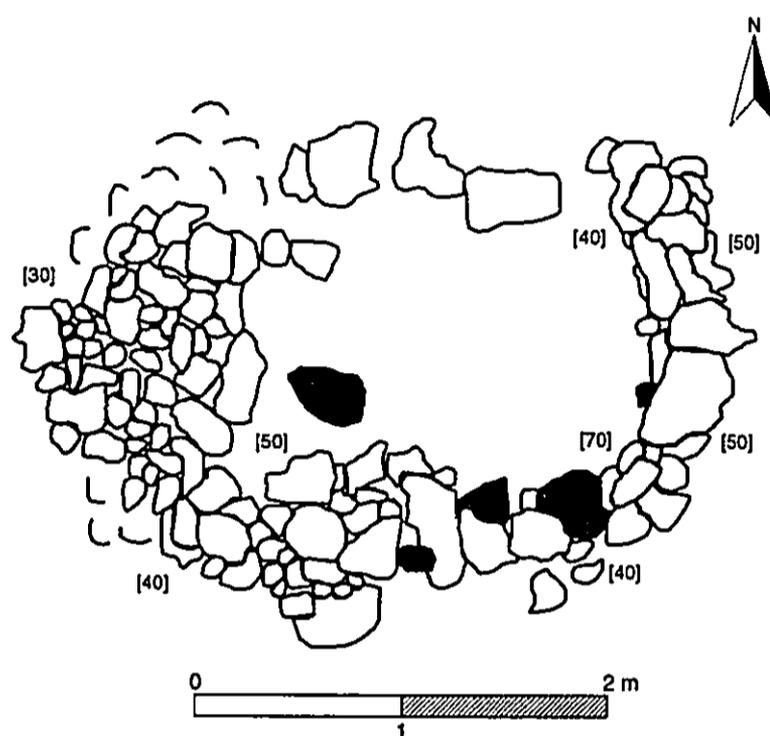


Figure 116. Feature 29, site 50-10-18-23358. Tape and compass map drawn by M. Major.

dated by intervening unsuitable terrain, seems too great. It should be noted, however, that the best route for a trail between clusters G and H has been disturbed by the jeep road, and a trail may have existed. Because they lie *mauka* of a section of coast where access to the water is relatively rough, the features do not seem to occupy an attractive location for long-term occupation, and therefore may be better interpreted as temporary resting areas or habitations for people traveling along the coast, or visitors from inland areas.

Cluster I: Kuili Slope Mounds

Initially recorded as Site T-152 (Donham 1987:72), two mounds, features 54 and 55, sit on a relatively level bench of land behind the bay on the lower slope of Pu'u Kuili. Averaging 1.5 m in diameter, these mounds exhibit what appear to be dismantled facings, and may be small burial platforms that have been looted. Site T-153 (Donham 1987:72), outside the project area, seems to be a part of the same overall cluster; some faced mounds in that site have been interpreted as burials on the basis of form and possible historic identification (Donham 1987:74).

This cluster, and indeed much of the slope between it, T-153, and cluster J, has

scattered water-worn basalt and coral cobbles and pebbles on the surface. The function of these pebbles remains uncertain, although they do show that people were present. Being on the *mauka* margins of the relatively well-occupied northern part of Kaho'iawa Bay, burial mounds would be consistent with typical Hawaiian settlement patterns. Alternatively, mounds could be markers for a trail up Pu'u Kuili, a scenario that cannot be demonstrated by the current project area, which hugs the coastline.

Cluster J: *Kilo I'a* Terrace

Located 10 m north of the jeep road from Pu'u Kuili down to Kaho'iawa Bay, this small complex includes two small terraces on the slope overlooking the bay. The upper terrace, feature 15, uses slabs of local stone to create a face 50 cm high and more than 5 m long, but is of simple construction and represents relatively low labor input. The terrace takes advantage of a naturally level area extending more than 6 m behind the face, where a few coral pebbles signal human presence, although not necessarily a sustained one. Immediately down slope, feature 16 represents something between a *mauka*-oriented C-shape enclosure and a small terrace, just 2 m across. A few stones on either side extend toward the ends of feature 15, forming a discontinuous enclosure. At the eastern end of feature 16, a highly decayed helmet conch shell sits in a niche among the stones.

helmet conch

Below feature 16, the slope becomes steeper, dropping away toward the shoreline. The placement of these features on the landscape and the presence of a conch shell provide tantalizing evidence of a very specific function for these features, a *kilo i'a*, or lookout point for fishermen. Such sites are known through ethnographic information, and the salient attributes—a view of the bay, use of conch shells for signaling canoes with nets—apply to this site.

kilo i'a

Feature 17, located about 18 m northeast of the terraces, does not strictly fit within cluster J, but is reported here for convenience. It consists of just a half dozen stones stacked 2-3 high, forming a small mound that is slightly hollow, but does not have enough stone nearby to indicate that it was intended to be a cupboard. Its location, between clusters J and I, suggests that it may have been a trail marker, although the loose cinder slope does not have a remaining trail corridor to prove it.

Cluster K: South Kaho'iawa Bay Habitation

Although located 18 m apart, these features have been included in the same cluster because of an intervening sandy area that appears likely to have buried deposits. The features were initially recorded as sites T-145 and T-146 (Donham 1987:69-70), and appear to be part of a pattern in which areas between permanent households were used for temporary activity areas, either as outliers of the main *kauhale*, or perhaps by non-residents using the coastal trail or coming from *mauka* areas to do some fishing.

At the northern end, just behind a sandy beach, feature 31 consists of a *pāhoehoe* rise that has been augmented with basalt and coral cobble fill to maximize level area, and is essentially a platform. Because of two areas where coral cobbles rise a bit higher than the *pāhoehoe* on the northern side, where the entire edge of the features is faced with relatively large boulders, Donham considered the possibility that this could be a

shrine, but she also noted that abundant modern litter and a campfire ring could mean that the feature is recent (Donham 1987:69). For the most part, the water-worn coral and basalt cobbles used as fill simply serve to level out the top of the outcrop. The absence of a raised back wall, branch coral, or other clear indications of a shrine make that interpretation less likely, but an upright observed in 2002 would seem to support such a conclusion. The age remains undetermined. Regardless of the chronological period, however, it would appear that the feature probably represents temporary habitation by fishermen or people traveling along the coastal trail. Although not defined by stepping stones in this area, the *alaloa* route must be along the flat, sandy area just inshore of the cobble beach here.

Feature 32, a modern fire ring on the beach 7 m south of feature 31, shows that people continue to stop along the coastal trail, and suggests that this area, level with a sandy surface, persists as an attractive campsite.

Initially recorded as a wall remnant, additional clearing and inspection reveals that a wall, feature 33, 18 m to the south of feature 31 connects to a natural formation such that a long *U*- or *C*-shape enclosure results (fig. 117). Oriented to 325°, the northeastern wall has a vertically stacked interior facing, but has tumbled on the outside. Condition of the wall deteriorates toward the *mauka* end, where an alignment described by Donham appears to be the scattered remains of a continuing wall; at this point, the *pāhoehoe* substrate rises to a higher level, forming a natural south wall which has a few stones atop it, parallel to the north wall. The outcrop veers more northerly, so that the front opening of the feature is narrower than the back wall, but still wide enough for easy access to an exterior *pāhoehoe* shelf and the cobble beach 8 m *makai*. The interior space measures about 11.5 m².

Although long and relatively narrow in shape, this feature more likely represents a habitation than a canoe shed. In part, this interpretation rests on the absence of other nearby features, since canoe sheds rarely occur in isolation. Also, the better landing spots occur in northern Kaho'iawa Bay and near the southern point, where larger, more developed feature complexes occur.

This cluster of features illustrates a marginally developed portion of the overall settlement pattern. With a sandy area and some *pāhoehoe* formations that lend themselves to construction of traditional structures with relatively minor labor input, this portion of the coast certainly saw use in ancient times, and has been used by modern campers as well. Located between the larger complexes at the northern and southern ends of Kaho'iawa Bay, this area of the coast apparently served as an outlier where people spent some time, but never built large, permanent households. These marginal features tend to be spread out along the coast, rather than developed *mauka* as is the case at larger clusters, hinting that distinct territories never were defined here. Besides suggesting that this small stretch of coast was considered less optimal for settlement, the narrow coastal band here indicates that population pressure here never mounted to the point that the entire coast was inhabited at any one time.

Cluster L: Kaho'iawa Point Complex

Previously recorded as site 50-Ha-D20-13 by Lloyd Soehren and site T-140 (Donham 1987:63), this represents a habitation complex at the southern end of Kaho'iawa Bay;

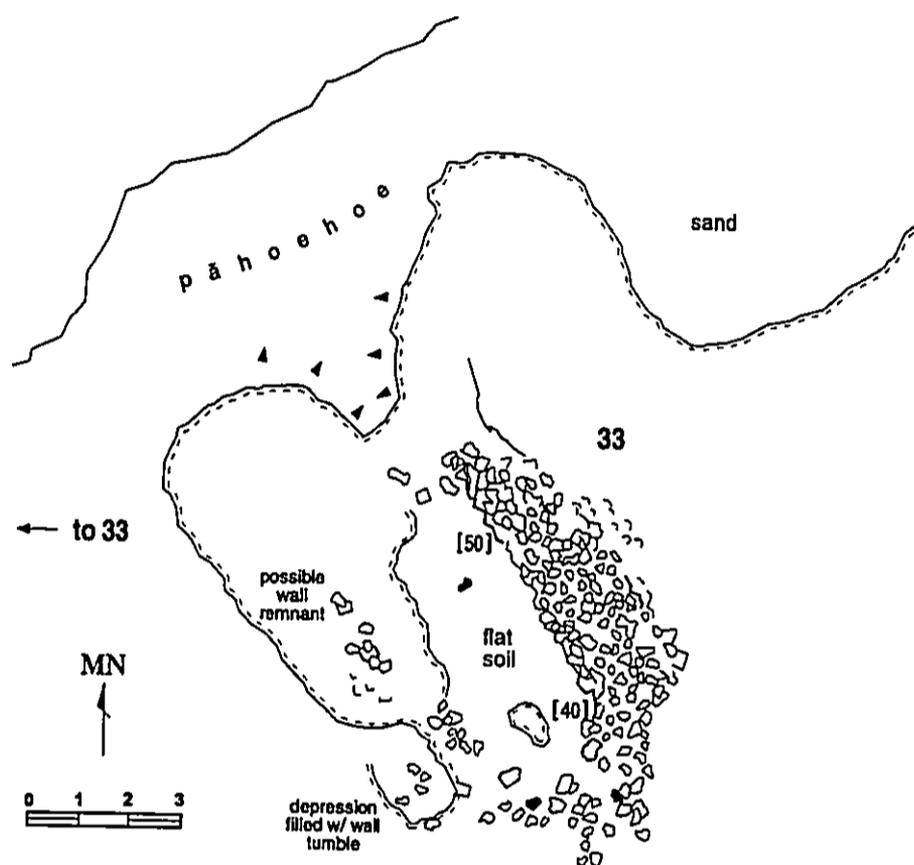


Figure 117. Feature 33, site 50-10-18-23358. Tape and compass map drawn by M. Maigret. The legend is on page 39.

features A and M in the original record, both located near the coast, are included here.

Feature 34 appears to be the C-shape enclosure feature A depicted in a photograph (Donham 1987:64, fig. 16), although it differs from the feature described in the text (fig. 118). Donham describes a C-shape enclosure measuring 5.3 by 4.3 m, but even when the two components observed in 2002 are combined, they fall short of those dimensions, and their floors are not covered with boulders as described. Although an error in the 1987 report cannot be discounted, the fact that modern campers clearly use this area, illustrated by the fact that they have constructed a formal trail *mauka* from this to a pit toilet, suggests that stones here have been reconfigured. Currently, a well-formed C-shape enclosure with about a 1.5 m² interior, feature 34, and a more deteriorated C-shape enclosure remnant, feature 35, occur in this location. Both are open to the sea, and together they parallel the coast. In the southwest wall of feature 35, two niches appear to be cupboards: feature 36 inside and feature 37 outside. Donham

did not mention these features, perhaps hidden beneath collapsed stone or dense *kiawe* at the time, but the presence of shells and an urchin spine file in feature 36 indicates that it is not modern. This, in turn, indicates that feature 35 represents part of the original feature. The boxy shape of feature 34 would be consistent with modern site alterations found in cluster G to the north.

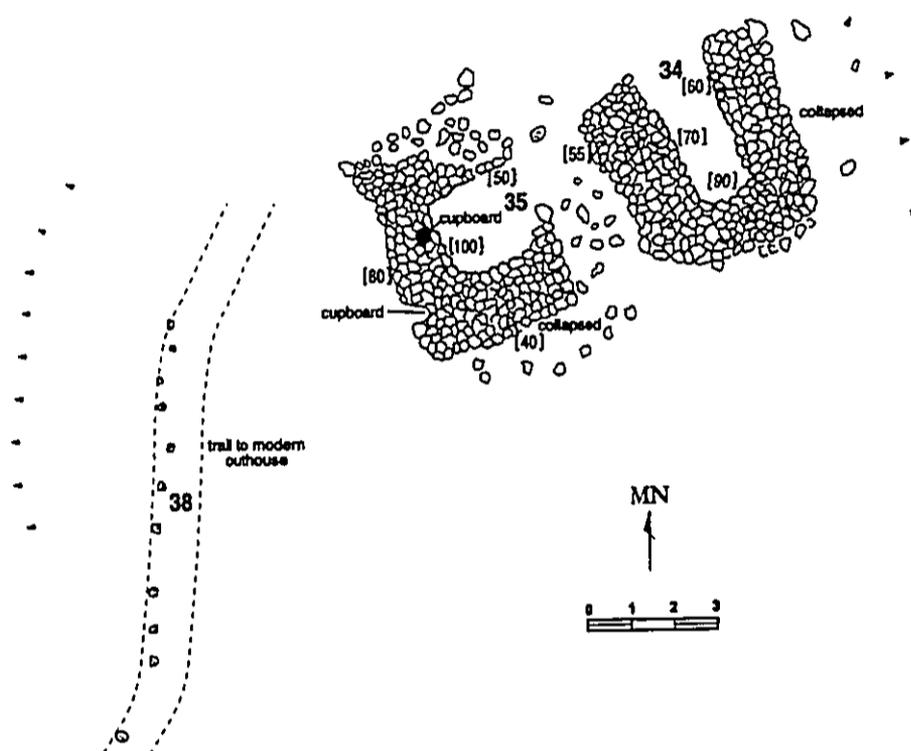


Figure 118. Cluster L, site 50-10-18-23358. Tape and compass map drawn by M. Yent and T. Palermo. The legend is on page 39.

At the south corner of feature 35, trail feature 38 branches off the *alaloa* to a modern outhouse located *mauka* of some *kiawe* trees. About 17 m long, this trail exhibits the modern technique of very frequent coral cobble markers along the edge.

Feature 39 appears to be intact, and is a boxy C-shape enclosure located about 60 m east of feature 35; it also opens to the sea. The interior area of 12.4 m² and overall appearance match the description of site T-140, feature M (Donham 1987:66), and as Donham noted, this is likely the *kāhua* reported by Soehren. Some water-worn coral occurs on the interior floor, and an alignment of large cobbles defines the front edge of the opening. Some midden is present, and this being the most substantial above-ground feature of this area, it has been interpreted as the primary habitation feature.

Not all of the features in the complex fall within the project area boundary, and

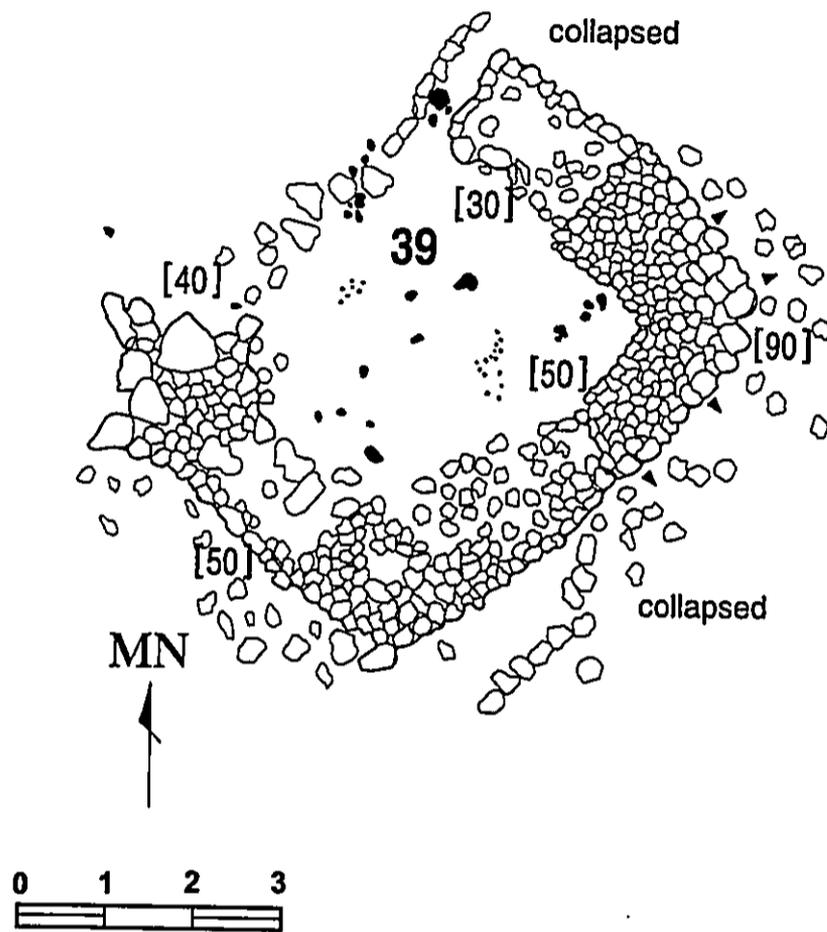


Figure 119. Feature 39, site 50-10-18-23358. Tape and compass map drawn by T. Palermo and M. Yent. The legend is on page 39.

therefore the record of this cluster depicts a less developed complex than truly exists. Donham recorded 13 features, including four partial enclosures, three cave shelters, five cairns, and a terrace (Donham 1987:63). There is also some sandy beach that could have subsurface traces of habitation, and this cluster is linked to others outside the project area by a well-worn trail. Although the current study did not investigate whether pit complexes existed inland of the project area here, the resemblance between this cluster and those on the northern part of Punaloa Point suggests that there might be. The *mauka* spread of features, the presence of cave shelters intentionally broken open, and the presence of an old trail heading farther *mauka* all indicate that this cluster, if not inhabited on a continuous permanent basis, at least experienced repeated occupations over a long period, including by modern campers.

Miscellaneous Features

Two pits, features 61 and 62, were discovered *mauka* of clusters K and L, at the south end of site 50-10-18-23358. The *pāhoehoe* is uneven here and the pits were constructed by removing and rearranging loose cobbles, rather than breaking through the crust of a smooth flow. Feature 61 is lined with cobbles and a small boulder or two to a depth of 60 cm, with an opening about 50 cm in diameter.

Kaho'iawa Summary

Feature clusters at Kaho'iawa, along with cluster E at site 50-10-18-23357, represent something of a departure from those found to the north, with several clusters consisting of a single large enclosure or terrace enclosure. Clusters C and G clearly fit this pattern, and the major elements of cluster D appear to be two such features, with the addition of C-shape enclosures that may be later additions. Cluster G, likewise, appears to be one major feature and associated midden, with ancillary features being more recent additions. Proximity to the coast, rectangular shape, size more than 10 m long, and consolidation of the household into one structure are the hallmarks of settlement here, contrasting with *kauhale* at Manini'ōwali and Kūki'o, where clusters of several small structures dominate, and rectangular structures tend to be smaller.

Outlying features do exist at Kaho'iawa, and may represent a variant of multi-structure *kauhale* in which elements are dispersed more widely. However, the *mauka* features in site 50-10-18-23358 have fewer traces of habitation, such as cupboards, midden, and pavement, and appear to represent functions such as burial, agriculture, and fishing, rather than domestic activities. Certainly these relate to households, but it would appear that sleeping and the preparation and consumption, rather than production, of food occurred in or immediately outside of the large structures.

Modern use of the sites has resulted in severe impacts, and only those structures shrouded in thorny vegetation, or located well above the jeep road seem to be in good condition. While recognizing the negative effects of modern fishing and marijuana cultivation, we should not lose sight of the fact that these behaviors also reflect on the persistence of fishing and agriculture at this site. That modern people have built one or more C-shape enclosures, even if they now serve only as garbage receptacles, also speaks to the continuity of certain architectural techniques and forms.

Awake'e Bay Site 50-10-18-23359

At the south end of Awake'e Bay is a small pocket beach that represents the first good canoe landing south of Kaho'iawa Bay. Behind the beach to the south is a massive 'a'a lava flow that stands above the *pāhoehoe* to the north. Archaeological features cluster at the interface of the two lava flows, extending back from the beach a relatively great distance in a departure from the usual coastal focus of settlement in Kekaha (Donham 1987). The survey area took in only the *makai* portion of this settlement, which is described as nine clusters, A-I, which follow the temporary site numbering scheme used by Donham (fig. 120).

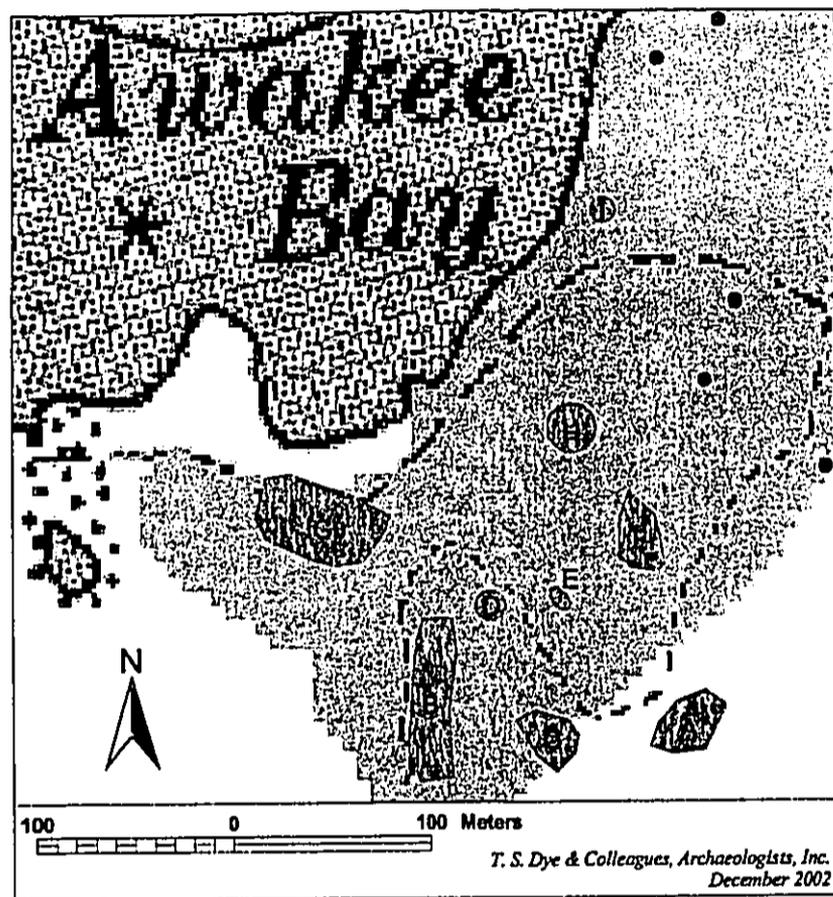


Figure 120. Feature clusters of site 50-10-18-23359.

Immediately behind the beach on a raised section of 'a'a overlooking the bay, is the remains of a "modern" house site, first described by archaeologists in the 1930s. This site, with its white lime plastered cistern, is a northern extension of the historic community at Makalawena, which was abandoned in the early 1920s (Maly 1998:28). The historic-period habitation activity that it represents, constructed at a time when transportation costs were high and locally available building materials were often used in many of the same ways that they had been used in traditional Hawaiian times, complicates interpretation of the archaeological landscape. Unlike the coast to the north, which historically has been used primarily by fishermen who lived elsewhere, the settlement at Awake'e bridges the transition from old Hawai'i to the modern era. The traditional Hawaiian structures that were here were either abandoned like their coun-

terparts up the coast, modified and re-used by people in the historic period, or broken down to make way for new activities and uses.

Cluster A

At the *mauka* end of the survey area in an area of broken *pāhoehoe* are four outcrops that have been modified to create a group of three small, rude enclosures and a terrace, which is removed from the enclosures. These features were originally described as site T-107 (Donham 1987:34–35). The central feature of the cluster appears to be feature 33, an outcrop cleared of loose boulders, which have been piled somewhat haphazardly around the edges of the outcrop to heights of 30 and 40 cm, forming an enclosure. Near the center of the enclosure is a small depression around which four *pāhoehoe* slabs on end protect a small deposit of ashy, gray sediment. Marine shell midden, weathered coral, and 'ili'ili are found within the enclosure. Just south of feature 33 are two similar enclosures, features 31 and 32. Feature 32 takes advantage of a naturally C-shaped outcrop to form one side of a partial enclosure with a surface area calculated at 37 m² (Donham 1987:34). Stones have been piled on the outcrop and off the outcrop to the north to form an enclosure open to the west. The ground within and around the enclosure has a thin mantle of sediment, which contains marine shells including *pipipi* and *Thaididae*, and a portion of a cowry shell octopus lure (Donham 1987:35). The north and east sides of feature 31 appear to have been walled at one time, but the walls are now collapsed into relatively amorphous piles. On the west side, in a low area, rocks have been placed as fill, creating a rough terrace. A shallow sediment deposit here contains marine shell, coral, and 'ili'ili.

Sixteen meters southwest of the enclosures is feature 35, an outcrop, which has been modified in a low section by the addition of a small terrace to create a surface level with the surrounding outcrop (fig. 122). Donham suggested that this feature might represent a crevice burial (Donham 1987:35).

Cluster B

Cluster B consists of two features, 26 and 27, which were described and mapped as site T-103 features A and B, respectively (Donham 1987:22–24). Feature 27 is a rectangular enclosure built at the edge of the 'a'ā lava flow (fig. 123). It

is constructed from aa boulders and cobbles intermixed with waterworn basalt boulders. The interior has a surface area of 6.9 sq m (2.3 by 3.0 m), and the overall dimensions of the enclosure are 5.3 m N/S by 4.1 m E/W. Wall height varies from 0.8 m on the exterior of the southwest corner to 0.3 m on the interior of the west wall. Average interior wall height is 0.55 m, and average exterior wall height is 0.60 m. Wall width varies from 1.1 to 0.7 m, with the widest sections near the northwest corner. No formal opening occurs in the wall. The interior surface of the enclosure is principally exposed aa bedrock, with scattered wall fall, waterworn beach pebbles ('ili'ili), coral pebbles, and sparse shell midden. No soil was observed

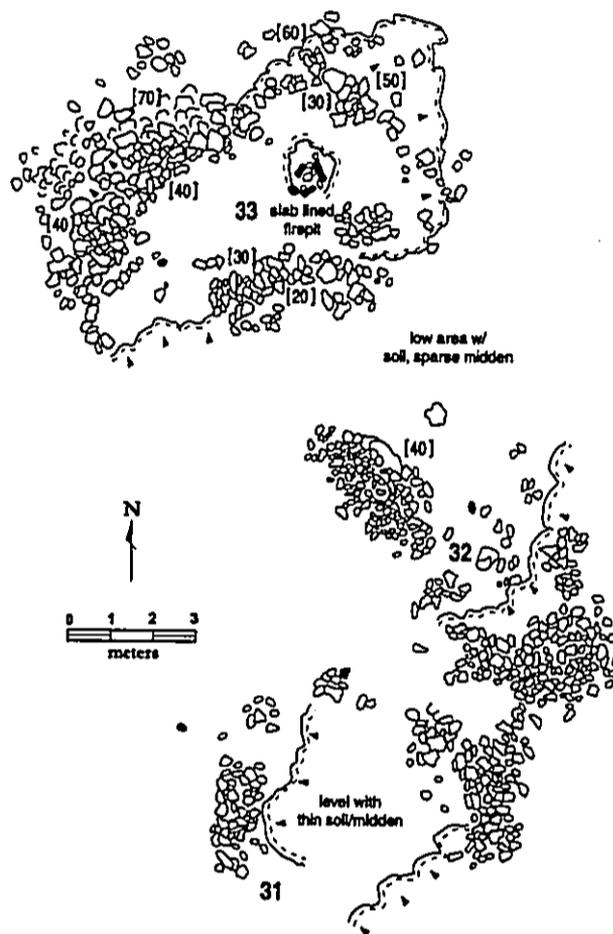


Figure 121. Features 31-33, site 50-10-18-23359. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

in or around the enclosure, and no internal structural features are present (Donham 1987:23).

At the east end of feature 27 enclosure is the south end of feature 26, a long finger of *pāhoehoe* lava that has been artificially levelled by filling and facing low spots, creating a 75 m long path from the *pāhoehoe* up on to the 'a'ā lava (Donham 1987:22). This feature has no precise analogs among traditional Hawaiian architectural features elsewhere. It somewhat resembles a *hōlua*, but is set at such a gentle slope that it could not have functioned as a sled run. Alternatively, the feature served as a trail, perhaps constructed in the historic period to facilitate the movement of pack animals over the steep edge of the loose 'a'ā flow.

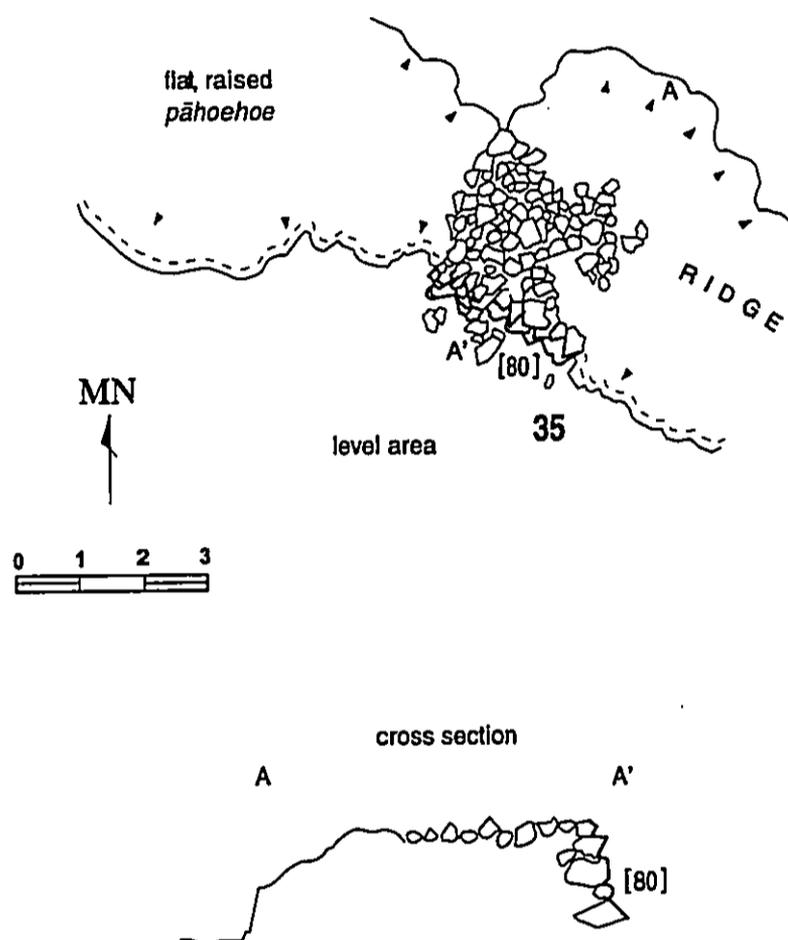


Figure 122. Plan and cross section of feature 35, site 50-10-18-23359. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

Cluster C

Cluster C was described and partially mapped by Donham, who recorded a platform with associated landscaped areas, two stone mounds and a cairn, along with "various low terraces along the slopes" east of the platform (Donham 1987:26). The platform with associated landscaped areas, feature 30, is a complex structure with external and internal retaining walls, interior alignments, and a coral paved extension on the east side (see fig. 4, pg. 13). It was mapped in 1987 (Donham 1987:fig. 5). The current survey mapped the low terraces east of feature 30 as features 29 and 28. Feature 29 is actually an enclosure built against the slope on the west. Portions of the north wall are intact, with an exterior face up to 90 cm high, but the east and south walls are now tumbled down. Feature 28 extends a slab of flat *pāhoehoe* with a small section of badly

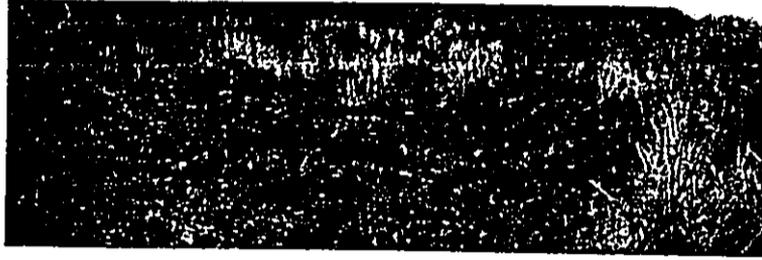


Figure 123. Features 26 and 27, site 50-10-18-23359, looking east. The scale, marked in 10 cm increments, is against the face of feature 26. The feature 27 enclosure, with two large clumps of fountain grass inside, is to the right of the scale.

deteriorated terrace along its northeast end.

The central structure of feature 30 is rectangular platform with a surface area of 60 m².

It is erected on a raised aa knoll that has been artificially terraced along the west and north slopes and leveled to the south of the platform ... The faced platform walls are constructed from aa boulders and are raised to a maximum height of 0.9 m along the exterior side ... Exterior wall height averages 0.6 m. The central portion of the eastern wall has collapsed, but all other walls are in relatively good preservation. The platform surface is paved with waterworn beach pebbles ... intermixed with coral pebbles ... A small localization (5.3 sq m) of soil occurs near the center, along the west wall ... This deposit appears to be less than 10.0 cm thick. A well-defined hole, 0.4 m in diameter and 0.4 m deep ... occurs in the southeastern quarter of the platform.

Retaining walls occur on the north and west sides ... The west retaining wall is ... 6.5 m long and 0.9 to 1.2 m high along the west (downhill) side. This wall is positioned from 0.8 to 2.0 m away from the side wall of the platform, and it follows the general contour of the hill. The north retaining wall is 1.2 to 2.5 m north from the wall of the platform. It is 11.0 m long and slightly curved to follow the natural topography. This wall is 1.0 to 1.25 m high on the north (downhill) side (Donham 1987:24, 26).

A small platform paved with coral is attached to the southeastern corner of the large platform.

This smaller platform appears to have been added to the larger structure, rather than incorporated at the time of initial construction. It has a surface area of 8.75 sq m ... and is raised 0.7 to 0.8 m above ground surface. The side walls of this extension are faced and are constructed from aa boulders. The extension platform surface is paved with beach pebbles and coral boulders and cobbles. (Donham 1987:26).

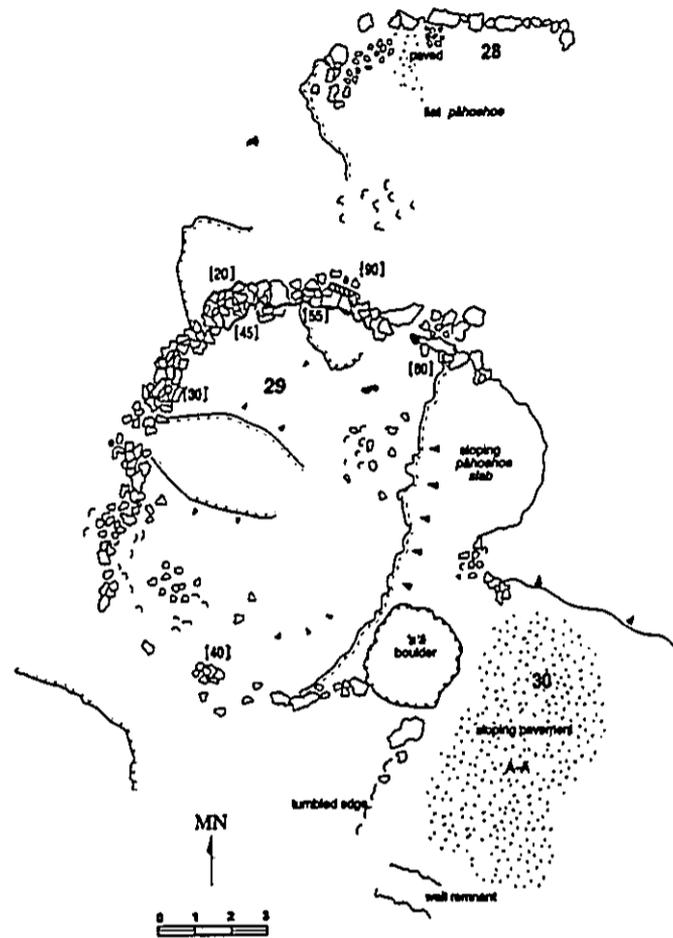


Figure 124. Features 28, 29, and a portion of 30, site 50-10-18-23359. The large 'a'a boulder, tumbled edge, and wall remnant match the southwest corner of the feature mapped by Donham (Donham 1987:fig. 5). Tape and compass map drawn by M. Maigret. The legend is on page 39.

The landscaped area to the south of the platform is also structurally complex.

A partially buried alignment ... is L-shaped, with the long axis ... oriented north-south. The east-west section roughly parallels the platform's southern wall and is 1.2 m from its exterior side. The eastern end of this 5.4-m-long section connects with the south wall of the small extension platform. This alignment may represent an old retaining wall; it currently has an average height of 0.15 m ... A ... wall, constructed from large aa boulders, defines the southern perimeter ... Average height is 0.5 m along the outside and 0.35 m along the inside. The east side is intact for a length

of 7.3 m; the north side is badly disturbed, with only a few stones still in place; and the west side is partially intact for a distance of 5.5 m. The north end of the west side abuts a bedrock protrusion that also acts as part of the wall. Total area enclosed by this wall is 11.5 m N/S by 10.2 m E/W (117.3 sq m).

Two small localizations of surface midden occur along the west wall ... These localizations include Cypraeidae, Neritidae, Patellidae, Tahididae, Echinoidea, and coral. Shell fragments, beach pebbles and cobbles, and weathered coral pebbles and cobbles are thinly scattered over the entire enclosed area (Donham 1987:26).

Three outlying features are located in the 'a'ā lava behind feature 30. Features 22 and 25, both faced mounds, were described by Donham as features B and C, respectively. The size and relative care given to the construction of these features suggests that they are burials. Neither of the features was dismantled to look for bones. Feature 34, described by Donham as feature D, is a relatively large and well-constructed cairn that might represent a boundary.

Cluster D

This cluster consists of a single small feature, feature 20, which was relocated and found to match the description provided by Donham for site T-102. The feature

consists of a low wall constructed across the opening of a small pahoehoe depression and shallow overhang ... The wall is constructed from roughly piled subangular basalt boulders and has no faced sides. Average width of the wall is 1.0 m, length is 2.65 m, and height varies from 0.4 m on the interior side to 0.3 m on the exterior side.

The shallow bedrock depression is surrounded on three sides by sloping bedrock, with the southern side enclosed by the wall. Maximum depth of the depression is 0.75 m against the northern side of the bedrock slope. Total enclosed area is 5.1 sq m (2.3 m N/S by 2.2 m E/W). A low, shallow overhang (0.5 m ceiling height) occurs along the eastern wall of the depression. The area sheltered by the overhang is 1.7 m wide at the opening and 0.8 m deep. This small overhang appears to have been too small for use as a temporary shelter.

A very sparse amount of Cypraeidae shell fragments is scattered inside the depression, in addition to small mammal bone fragments and a shallow deposit of loose, brown loam (Donham 1987:22).

Cluster E

Feature 36, a depression surrounded on most sides with *pāhoehoe* lava and walled to make it complete, was found to match the description provided by Donham for site T-109.

It consists of a roughly oval-shaped depression in pahoehoe and contains an apparently natural deposit of loose, brown soil. A loosely constructed wall encircles the perimeter of the depression and encloses portions that are not well-defined by natural bedrock. Interior area of the enclosed depression is 33.5 sq m (10.0 m NW/SE by 3.35 m NE/SW). Interior depth of the depression varies from 1.20 to 0.15 m along the natural rock face, and from 0.4 to 0.5 m along sections of constructed wall. Four major wall sections occur in the low areas around the perimeter; these vary from 4.2 to 1.4 m long and from 0.4 to 0.6 m wide. Some portions of the wall have collapsed.

Portable remains present include a few waterworn coral and basalt cobbles and pebbles. No subsistence remains or items which might indicate period of construction or use were observed.

Cluster F

Cluster F was described and partially mapped in 1987 (Donham 1987:35–38). The cluster consists of four features: a large enclosure built against a high *pāhoehoe* outcrop; a low platform and an adjacent C-shape enclosure with associated habitation refuse located a short distance south of the large enclosure; and a modified outcrop located at some distance from the other features and with no clear functional association with them.

Feature 52 was originally mapped and described as feature A,

a somewhat amorphous enclosure that utilizes natural bedrock features as part of the enclosing wall. Maximum interior length is 18.5 m ... and interior width varies from 5.5 to 7.0 m. The constructed wall segments are faced on the interior and exterior sides and are core-filled. Width of constructed sections ranges from 0.7 to 0.85 m, and height varies from 0.15 to 0.9 m, depending upon the height of utilized bedrock. Portions of the enclosure are defined by bedrock ... 0.95 to 2.2 m high. Pockets of loose, brown colluvium occur between exposed bedrock inside the enclosure; no other portable remains were observed. There is no readily identifiable opening in the enclosure (Donham 1987:35).

Feature 53, a low, rectangular platform, was mapped and described as feature B.

The platform is constructed from subangular basalt cobbles and boulders, with larger stones placed along the perimeter. It has a surface area of 12.6 sq m ... and a height of 0.25 to 0.40 m. The platform is situated near the base of a *pāhoehoe* slope, in an area of relatively thick ... soil accumulation. Marine shell midden occurs on the west side of the platform; it includes Cypraeidae, Neritidae, and Thaididae fragments. Coral pebbles and cobbles, and waterworn cobbles were also observed near the platform.

Feature 54, a C-shape enclosure open toward feature 53 platform, was mapped and described as feature C.

The wall is constructed from loosely stacked subangular pahoehoe boulders, and it is in a collapsed condition. Overall surface area of the structure is 9.88 sq m ... and the interior has a surface area of 3.0 sq m ... Average width of the wall is 0.8 m and height ranges from 0.1 to 0.35 m. A deposit of loose, brown colluvium is present within the shelter ... Two waterworn boulders were observed; one is inside the shelter and one is incorporated into the west wall (Donham 1987:38).

Feature 51 is a modified bedrock outcrop that has been leveled with boulders and cobbles that fill a crevice (fig. 125).

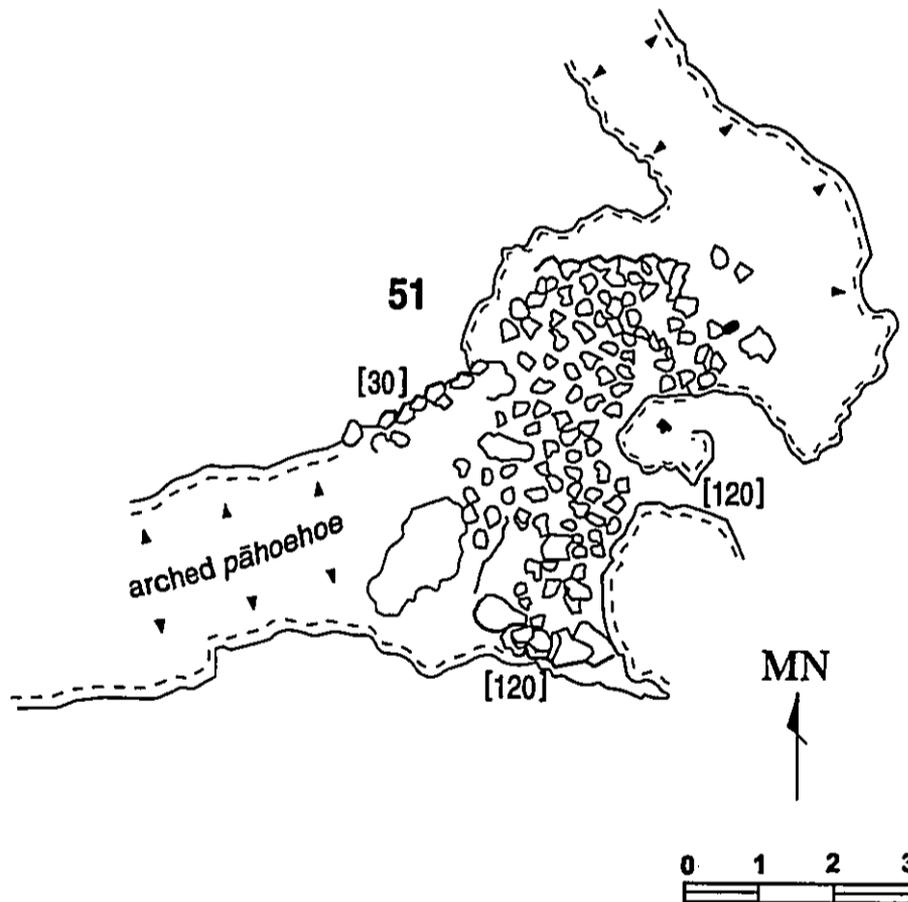


Figure 125. Feature 51, site 50-10-18-23359. Tape and compass map drawn by M. Maigret. The legend is on page 39.

Cluster G

At the south end of Awake'e Bay on an 'a'a flow that stands above the beach and overlooks the bay is a large terrace enclosure first recorded by Reinecke, who described it as a "modern" house site (Reinecke 1930). It was later described by Soehren and by Donham, both of whom noted additional features (Donham 1987:17). The survey found the site much as it had been described by Donham and mapped it as fourteen features (see vol. 2, map 40).

The primary features of the cluster are two large terrace enclosures, features 2 on the east and feature 6 on the west, separated by about 20 m. A platform, feature 1, is constructed on the east end of the eastern terrace enclosure, at an angle to its main axis. The platform has

a surface area of 27.0 sq m ... and is raised 0.3 to 0.4 m above the ... terrace surface. The perimeter is defined by a partially buried wall which extends one course above the platform surface and the west and north corners. The wall is faced along the northwest side and is 0.4 m above the terrace surface. The platform is paved with a thick deposit of waterworn basalt and coral pebbles; a number of coral cobbles also occur on this platform and are aligned along the perimeter wall in places (Donham 1987:21).

The feature 2 terrace upon which the platform stands is in relatively poor condition. It

appears to have been enclosed by a low wall, which is now partially intact along the southwest, southeast, and northeast sides. It was apparently irregular in shape and followed the contours of the bedrock slope ... The northwest side was stepped along the slope, with an upper level wall 0.5 to 0.6 m above a lower level wall.

Overall length of the terrace ... is 14.5 m; width varies from 9.4 to 9.8 m. It is paved with small waterworn basalt pebbles intermixed with coral pebbles and cobbles. A few Cypracidae shell fragments are present, and a considerable amount of dark gray soil occurs on the terrace.

The remaining portions of the enclosure wall ... are constructed from aa boulders and slabs, some of which have been positioned upright along the base of the interior side. The wall is faced on two sides and is core-filled with smaller aa boulders and cobbles. Average width is 0.8 m; present height varies from 0.6 to 0.9 m (Donham 1987:21).

Outside the south wall of feature 2 are two wall segments that, with the south wall of feature 2, define a level area of 'a'a cobbles and pebbles about 12 m². The western wall segment aligns with the west wall of feature 2, suggesting that the two features are contemporaneous. Two clearings near the northeast and southwest ends of feature 3 might represent the former extent of the feature 3 level area, before the wall segments were constructed.

Donham recorded a disturbed terrace between the two terrace enclosures, its perimeter defined by large 'a'a boulders and "occasional upright slabs" (Donham 1987:21). This area today contains a modern fireplace, one upright slab, and several large boulders, but did not exhibit the raised face that defines a terrace. It is possible that the

terrace recorded by Donham has been further disturbed, so that it is no longer recognizable on the surface.

The western enclosed terrace, feature 6,

has a surface area of c. 135 sq m, and is raised on the northern side. This side was originally vertical and was constructed from aa boulders; it is presently sloping and is collapsed in places due to storm wash. Currently the shoreline is less than 20.0 m from this side of the terrace, and it is c. 5.0 m lower in elevation. The north side protrudes onto the slope of the cliff and is raised 0.8 to 1.0 m above a narrow natural terrace which occurs *downslope* ...

The terrace is paved with a thick deposit of small waterworn basalt pebbles ... intermixed with coral pebbles ... A low enclosure wall defines the north, south, and east sides of the terrace.

The enclosure walls are constructed from aa boulders stacked up to six courses high; they are faced on both the interior and exterior sides. The 0.9-m-wide wall is core-filled with small aa gravel. A few waterworn basalt and sand conglomerate boulders are interspersed in the wall, and waterworn pebbles occur in the core filling. Maximum intact height of the wall is 1.1 m along the south side. The southeast corner appears to be at the original height, which is 0.87 m on the interior side. The north and east walls are 23.0 m long, measuring from the interior of the corners. The west wall, if formerly present along that side of the terrace, is completely down ...

A small compartment occurs inside the southeastern corner of the enclosure, formed by a 5.0-m-long linear wall that parallels the south wall. A compartment 5.0 m long by 3.0 m wide ... was formed by this interior wall; the compartment is open to the west ...

On the west end of the terrace is a cistern, feature 7.

It is constructed from aa and waterworn basalt boulders that have been joined with lime-based mortar. The interior surfaces of the cistern walls appear to have been completely mortared. The cistern walls rise 1.0 m from the present terrace surface ... Exterior diameter is 2.7 m at ground surface and 2.1 m at the opening. The wall is stepped inward 0.23 m below the rim of the cistern, and the smaller upper section of the wall is comprised (sic) primarily of waterworn boulders, with a considerable amount of lime mortar applied to the exterior ... This upper section may be a later addition to the cistern. The interior diameter at the opening is 1.3 m (Donham 1987:20).

A series of features surround the terrace enclosure. To the south is a low, square enclosure, feature 9, built against the southern wall, and to the west is a terrace, feature 8, over which a recent trail heads to the anchialine ponds and to feature 14, a walled pool that might have served as the water source for the cluster. A wall remnant, feature 13,

at the western edge of the cluster might represent the edge of this western terrace. To the north of feature 6, between it and beach, are the possible remains of a lower terrace, feature 11, whose dense deposit of 'ili'ili and shell midden indicate former habitation use, augmented by erosion from the terrace above. Today, this feature supports two modern fire rings and a trail.

Between cluster G and cluster H to the north, Donham recorded the remains of a poorly preserved complex of wall remnants, with a scatter of marine shell midden, in an area that is used today by campers. Field inspection indicates that the poorly preserved features here are the ephemeral remains of camp sites.

Cluster H

Cluster H consists of three lava tube cave shelters and associated features located near the beach and a popular camping area (fig. 126). It was described in 1987 as site T-111 (Donham 1987:39-41), but the description at that time differs from conditions found in the field, a likely result of modifications made by campers.

Features 37-39 are entrances into the looted cave site described by Donham as feature A. The cave has two branches, one leading west 8.4 m from feature 39 and the other north for 6.5 m. The feature 39 entrance has two boulders placed within to act as steps into the cave. The other two entrances, features 37 and 38, were not described by Donham, and it is possible that they are recent additions to the cave. Looters' back-dirt here contains "Conidae, Cypraeidae, Echinoidea, Isognomonidae, Neritidae, Patellidae, bird bone, kukui nut shell, volcanic glass, coral, coral abraders, a Cypraeidae shell octopus lure part, and waterworn basalt pebbles" (Donham 1987:41).

Feature 40 is an 8 m long cave whose floor is now scattered with loose boulders and cobbles after having been thoroughly looted. Feature 42 is a larger cave, 17 m long, 6-7 m wide, and 0.7-1 m high, with a single entrance at the end of a long, cobble-filled crack. Donham described this cave as having two entrances, and it seems likely that the second entrance has been filled with cobbles. The floor of the cave is covered with loose roof-fall and water-worn basalt boulders; sediment within the cave has been extensively disturbed by looters although pockets of apparently undisturbed material were present in 1987.

Feature 41 is a collapsed lava blister whose interior is partially filled with cobbles and boulders and does not appear to have been modified. A low mound of stones lines the north edge of the blister, but another mound on the east side described by Donham as part of feature D is now gone.

Feature 43 is a possible cave entry that is now filled with cobbles, and feature 44 is a slab of *pāhoehoe* with some evidence of filling to create a level surface surrounded by natural outcrop to form a C-shape shelter.

Cluster I

Cluster I consists of two badly deteriorated sections of wall (fig. 127). One of the sections with no remaining faces and a break near its mid-section, was described earlier as structural remnant site T-114 (Donham 1987:43). The second, shorter wall section

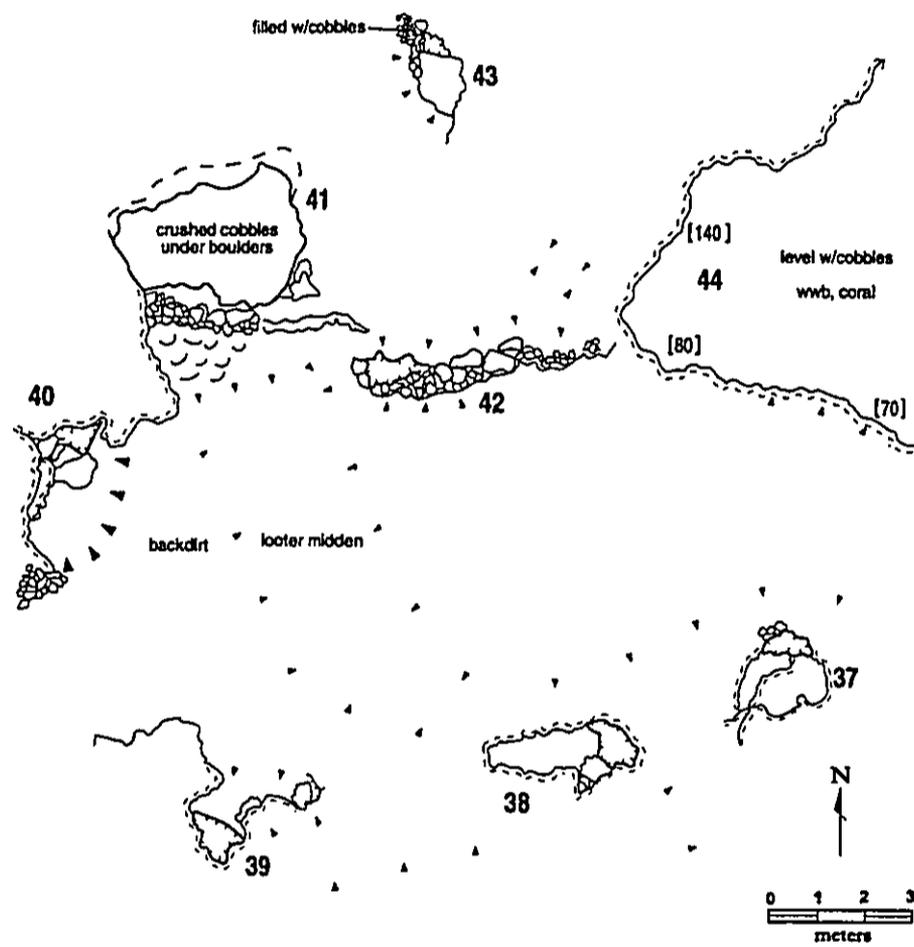


Figure 126. Features 37-44, site 50-10-18-23359. Tape and compass map drawn by M. Major. The legend is on page 39.

retains a face on its west side. These walls might represent the remains of an enclosure, but is now too disturbed to infer its former configuration with any confidence.

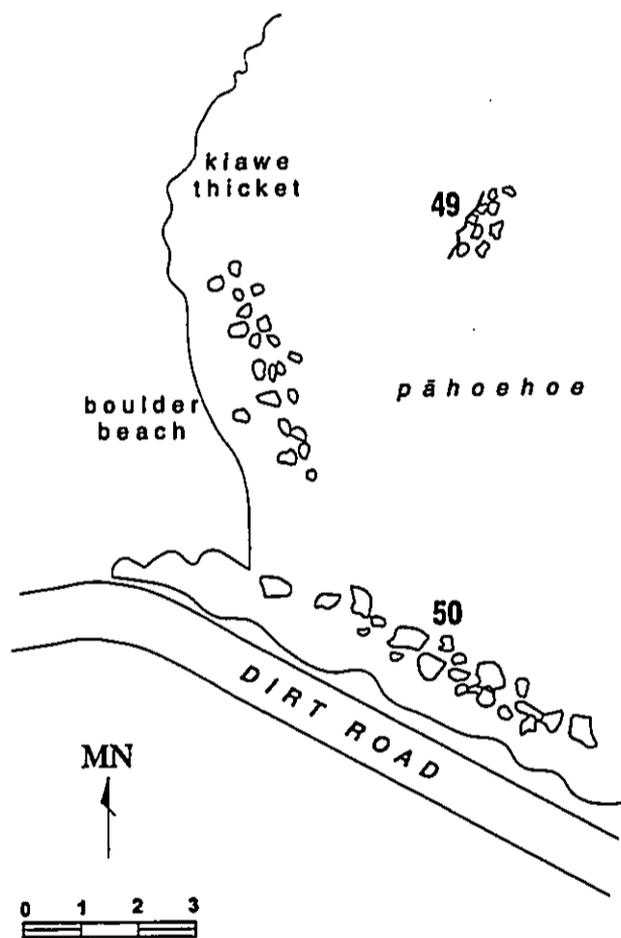


Figure 127. Features 49 and 50, site 50-10-18-23359. Tape and compass map drawn by M. Maigret. The legend is on page 39.

Site 50-10-18-23360

Site 50-10-18-23360 is the coastal trail and features alongside the trail in areas away from the centers of habitation. Feature 1 is the coastal trail, which exists today as a few preserved remnants, but elsewhere has been taken by the sea or overrun by modern dirt roads (fig. 128). The trail is not visible where it enters the project area from the north at Kīkai Point. The first short section is found on the small 'a'ā point at the middle of Kākapa Bay. It is lost on the cobble beach of Heiau Bay, but picks up again when it crosses the 'a'ā of Papiha Point. Another branch follows the coast, but formal evidence of the coastal branch is lacking until just north of Manini'ōwali Bay, where there are some intact sections (fig. 129). The trail is lost once again as it crosses the sandy beach, but picks up on the *pāhoehoe* to the south, where a few short paved sections are preserved (fig. 130). Farther down the coast, the trail is occasionally expressed as a worn path on *pāhoehoe*, finally exiting the project area along the four-wheel drive jeep road to Makalawena.

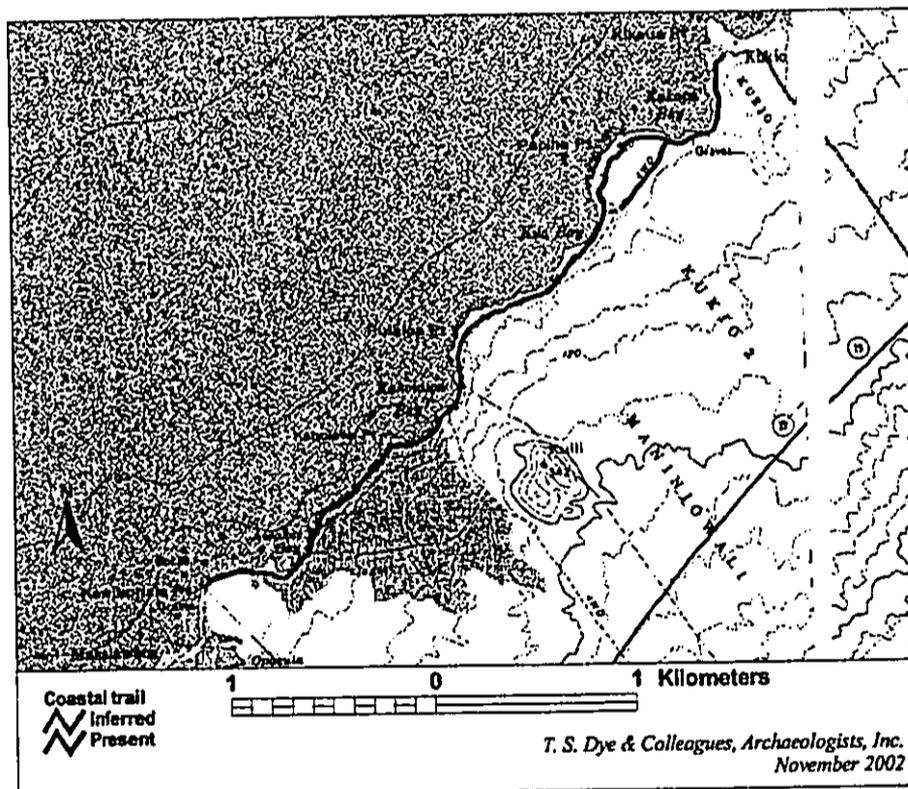


Figure 128. Site 50-10-18-23360, showing segments identified in the field and the probable location of destroyed sections.

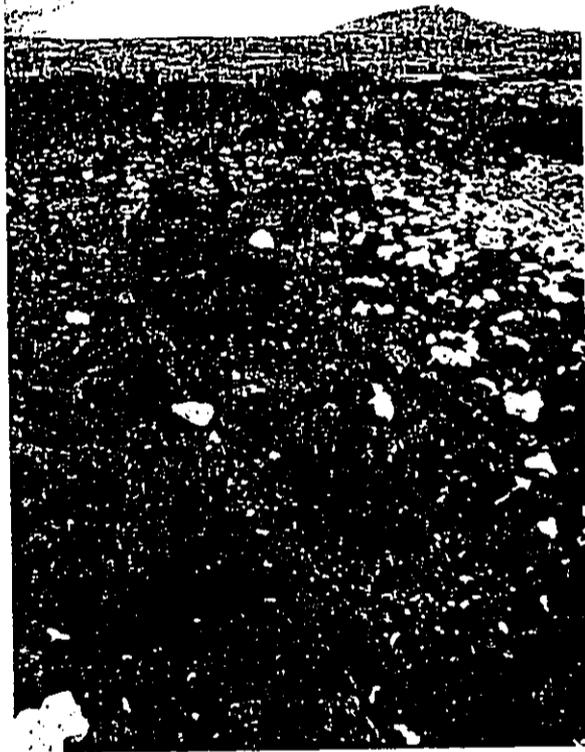


Figure 129. Intact section of coastal trail, site 50-10-18-23360, north of Manini'ōwali Bay, looking south to Pu'u Kuili. The scale, barely visible midway along the *makai* side of the trail, is marked in 10 cm increments.

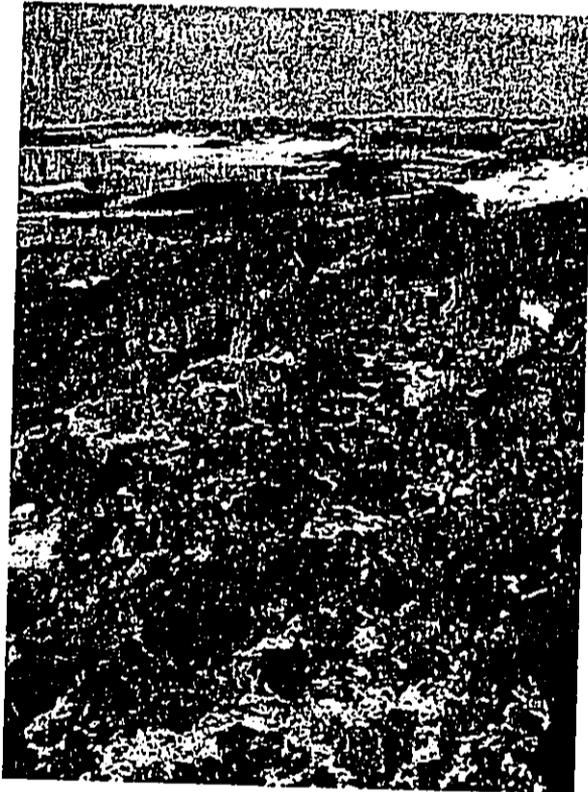


Figure 130. Intact section of coastal trail, site 50-10-18-23360, looking north to the beach at Manini'ōwali Bay. The scale is marked in 10 cm increments.

Branches of the coastal trail were recorded in several areas. These trails generally serve small features clusters near the coast and do not head far inland. The branches are discussed with the sites they service (see pgs. 96, 108, 158, 160, 163, and 190).

Thirty-five features were recorded within the survey corridor around the trail through the 'a'ā lava at Papiha Point (fig. 131). Most of these are 'a'ā pits, which are commonly excavated at the bases of boulders where they receive shade for part of the day. Other feature types include rough enclosures, an overhang shelter, a wall, a platform, and boulders bashed with water-worn basalt cobble hammerstones. There is no obvious pattern to the distribution of these features. The survey boundary restricted the search to a narrow corridor near the trail, so the feature distribution map makes it appear that activity centered on the trail. But similar features are abundant in the 'a'ā lava north of site 50-10-18-23356, located well away from the coastal trail, and it is likely that a complete survey of the 'a'ā here would find similar features spread over a wide area.

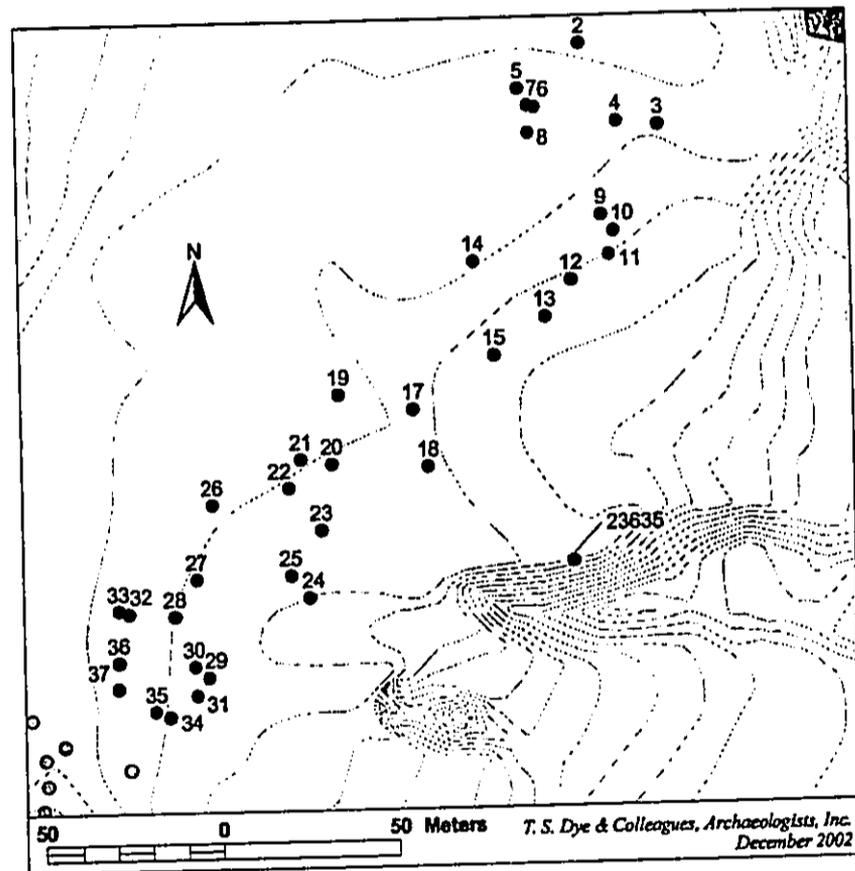


Figure 131. Features along the northern end of trail site 50-10-18-23360.

Feature 2 is a 25 m long wall of stacked 'a'ā cobbles and boulders that cuts across the trail just south of the site 50-10-18-23356 boundary. It is crudely built and not imposing, rising to a maximum height of 1 m on the *makai* side of the trail (fig. 132). The wall doesn't form an enclosure; it might have defined the southern boundary of the village at Kākapa Bay, although its layout and form seem ill-suited to this purpose.



Figure 132. Portion of wall, feature 2, site 50-10-18-23360, looking south. The *makai* section of the wall is at the right hand side of the photograph. The wall extends *mauka* off the left hand side of the photograph.

Feature 3 is an enclosure at the base of a massive boulder with an exposed, ropy, red lava face (fig. 133). The enclosure is formed on the southeast and southwest by walls of crudely stacked 'a'ā cobbles and boulders with a maximum interior height of 1.0 m. The northwest side of the enclosure is marked by an elevated section of the 'a'ā lava flow. The massive boulder marks the northeast side of the enclosure, whose interior dimensions are approximately 2 m by 2 m.

Large 'a'ā boulders were frequently modified by bashing with water-worn basalt cobble hammerstones. Often the bashing exposed a ropy, red interior lava, but other times no such visual effect was produced. Four bashed boulders were found isolated from other features.

Feature 4 consists of two pits in the top of a massive boulder (fig. 134). The pits are about 20 cm deep and were made by breaking through to bubbles in the approximately 5 cm thick outer lava crust of the boulder. They were probably made with cobble hammerstones, two of which were found at the edge of the westernmost hole.

Feature 11 consists of three overlapping pits pecked into the top of a massive 'a'ā boulder (fig. 135). The pits are approximately 20 cm deep. They broke through the

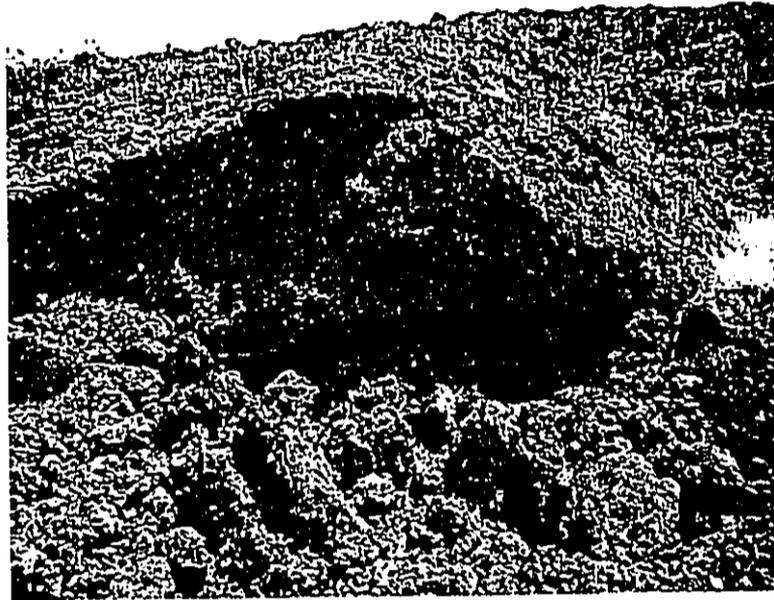


Figure 133. Enclosure, feature 3, site 50-10-18-23360, looking northeast. The scale is marked in 10 cm increments.

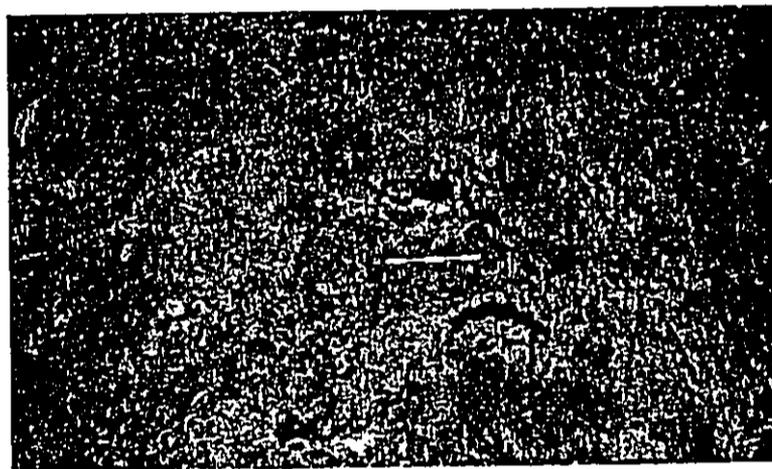


Figure 134. Pits in top of boulder, feature 4, site 50-10-18-23360, looking west. Note the two cobble hammerstones at the edge of the hole above the scale. The scale is marked in 10 cm increments.

surface layer of lava to expose reddish and black lava of the boulder interior. The pits appear to have been made with a cobble hammerstone, one example of which was found on top of the boulder (fig. 136). It is a piece of the outer crust of the boulder that has been worn smooth along its edges through use. A portion of an *'ōpihi* shell was also found on top of the boulder.



Figure 135. Pits in top of boulder, feature 11, site 50-10-18-23360, panorama looking southwest. The scale is marked in 10 cm increments.

Feature 21 is a boulder bashed on the southeast end.

Feature 27 is a massive *'a'ā* boulder that has been extensively worked on the top and south sides to break away the outer crust of lava (fig. 137).

Features 19 and 20 are water-worn basalt cobble hammerstones found in the *'a'ā* lava apparently unassociated with other features. A single stone was found at feature 19 and three stones at feature 20.

Features 5, 6-10, 12-18², 22-25, and 29-37 are *'a'ā* pits. Most of these are adequately described in appendix A, but the more complex pits are described individually below.

Feature 6 is an *'a'ā* pit that measures 0.3 m long, 0.2 m wide, and 0.5 m deep (fig. 138). Two cowry shells, both badly weathered, were found at the feature. One is inside the pit and the other is just outside. Also present is a water-worn cobble.

Feature 13 consists of two *'a'ā* pits, one on the north side and the other on the south side of the intersection of two massive boulders. The pit on the north side is 1.5 m in diameter and 0.6 m deep. The pit on the south side is 1.2 m long, 0.6 m wide, and 0.5 m deep.

Feature 22 is a complex *'a'ā* pit excavated between three large boulders and walled at both ends with short segments of stacked *'a'ā* cobbles (fig. 139). The pit is 0.8 m deep.

Feature 23 is a heavily worked *'a'ā* pit broken through a crack in a boulder and exposing the gray interior of the rock (fig. 140).

Feature 24 is an *'a'ā* pit at the base of a boulder that has a cobble alignment on top (fig. 141). The cobble alignment is 1.7 m long, 1.1 m wide, and typically 0.2 m high. The pit is shaded by a natural *'a'ā* arch.

²Feature 16 was not assigned.

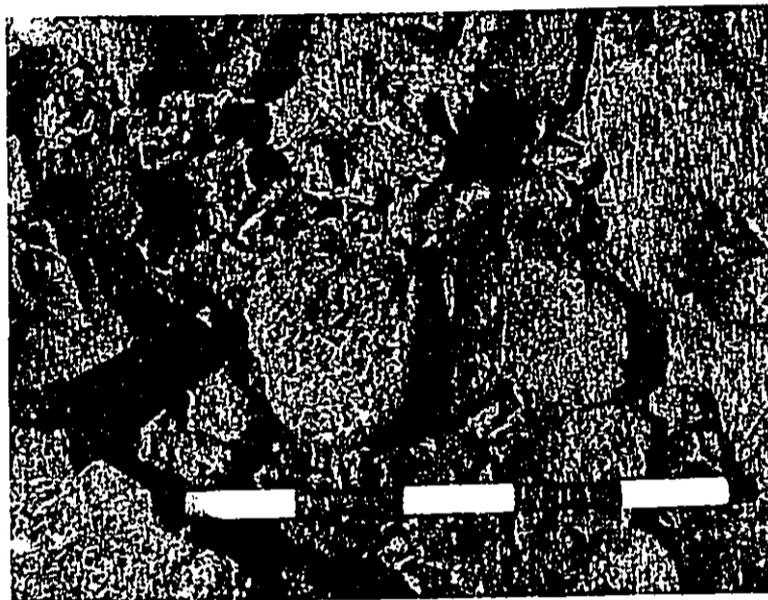


Figure 136. Possible hammerstone, feature 11, site 50-10-18-23360. The scale is marked in 10 cm increments.



Figure 137. Boulder, feature 27, site 50-10-18-23360, looking southwest. The scale is marked in 10 cm increments.

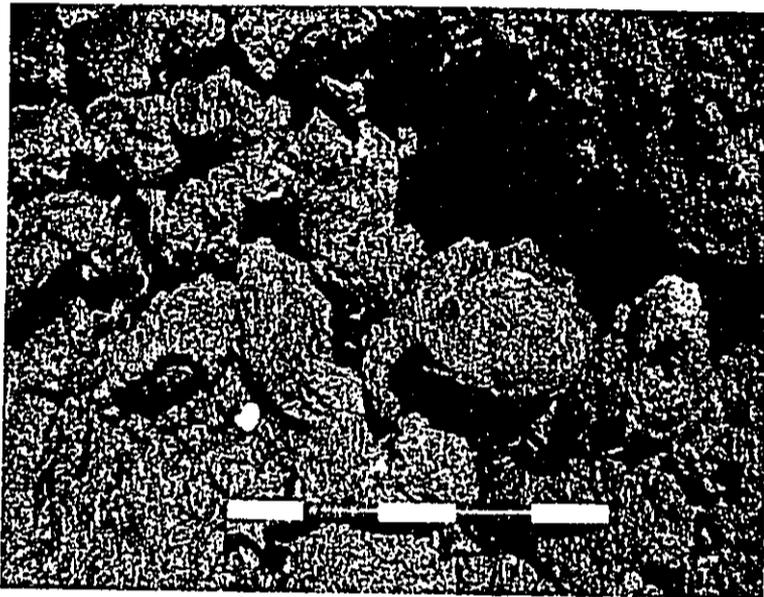


Figure 138. 'A'ā pit, feature 6, site 50-10-18-23360. The scale is marked in 10 cm increments.

Feature 31 is excavated in the space between four large boulders. It appears that cobble and larger-sized rocks were removed, leaving an 'a'ā pebble floor. It measures 0.7 m long, 0.6 m wide, and is 0.7 m deep.

Feature 33 consists of two pits. The northern, smaller pit is 0.7 m long, 0.6 m wide, and 0.4 m deep. The southern pit is 1.5 m long, 0.6 m wide, and 1.0 m deep.

Feature 26 is a rough platform built against the side of a massive 'a'ā boulder and partially covering the top of the boulder (fig. 142). The platform is 2.0 m long, 1.4 m wide, and about 0.5 m tall. Its surface is roughly paved with 'a'ā cobbles. The east face of the platform includes two slabs set on end. The platform possibly marks a burial. It was not dismantled to look for bones.

Feature 28 is an overhang shelter under a naturally arching 'a'ā boulder (fig. 143). It has been excavated to a depth of approximately 1.4 m, creating a shelter 2.2 m long and 1.3 m wide. A short section of stacked wall, about 50 cm high, is located at the south end of the entrance to the shelter. The interior of the shelter contains an 'ōpihi shell, water-worn basalt and coral cobbles, and a glass bottle.

South of Manini'ōwali Bay, feature 38 is a slightly curved segment of wall on the *makai* side of a worn *pāhoehoe* segment of the coastal trail. It stands 50 cm tall and runs parallel to the edge of an outcrop about a meter away. The area between the wall and the outcrop is roughly paved with *pāhoehoe* cobbles.

South of Kaho'iawa Bay the coast is rough and steeply sloping. There is no good place to land a canoe until Awake'e Bay. Archaeological features are relatively scarce along the rough coast, and although some are found inland on the *pāhoehoe* (Donham

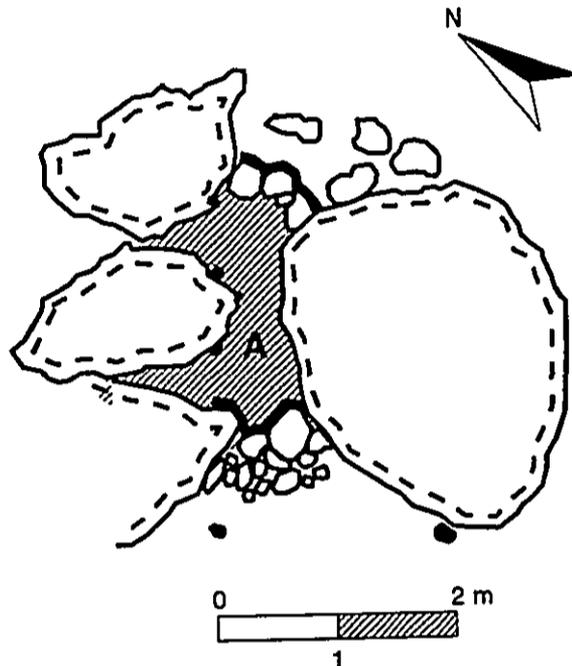


Figure 139. Plan map of site 50-10-18-23360, feature 22. Tape and compass map drawn by A. Dye. The legend is on page 39.

1987), most are located at the coast in association with the coastal trail (fig. 144).

Partially recorded as site T-139 (Donham 1987:62-63), features 39-43 are located on a *pāhoehoe* knoll with a clear view north to the sandy beach at Kaho'iawa (fig. 145). Feature 39, a large boulder with a flat side facing due west, is the focal point of this feature cluster, standing 2.5 m above the surrounding terrain (fig. 146). Its height has been augmented by two courses of cobbles stacked on top. At the base of the boulder, feature 41 is a low overhang shelter paved with coral and basalt cobbles, feature 40, that extend away from the shelter to the north. A few meters east of the boulder is a nearly circular, largely coral, paving about 3 m in diameter, feature 42. Near the center of the paving is a small deposit of sediment on two sides of which *pāhoehoe* slabs are set upright. Five meters east of the pavement, a scatter of marine invertebrate remains, including the common food items cowrie, sea urchin, and *pipipi* among others, is feature 63. Taken together, these features appear to represent temporary habitation probably associated with ritual activity at the shrine feature 59. Glass sherds described as bottle necks with "hand-applied lips" (Donham 1987:62) at feature 43 indicate use of the site in the early history period.

Feature 44 was originally described as site T-130 (Donham 1987:54), a well-preserved U-shape enclosure probably constructed relatively recently as a fisherman's shelter. Today, the feature resembles Donham's description:

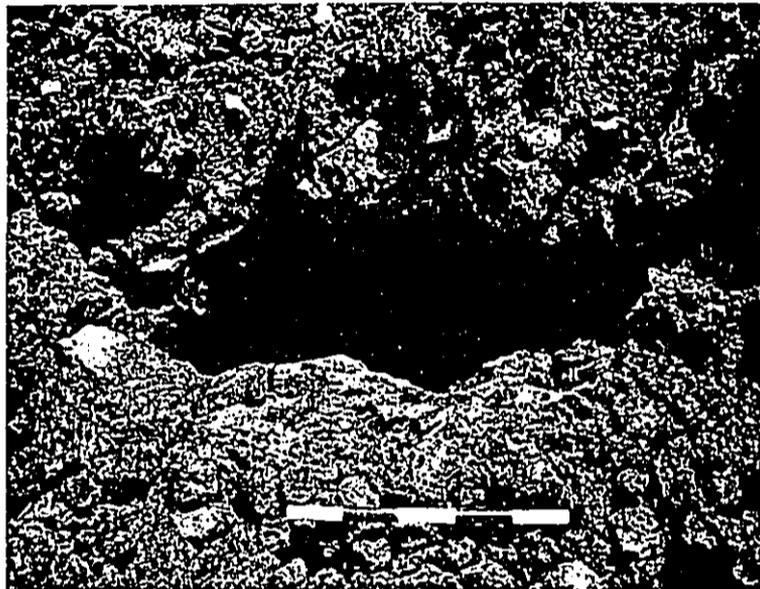


Figure 140. 'A'a pit, feature 23, site 50-10-18-23360, looking east. The scale is marked in 10 cm increments.

The wall is relatively substantial and is in good preservation; it is currently 1.0 m high and 0.5 to 0.8 m wide. Overall shape is box-like; the two east corners are squared and the west side is completely open. Overall surface area of the structure is 7.0 sq m (2.8 by 2.5 m), but the interior space is only 2.7 sq m (1.35 m N/S by 2.0 m E/W) ... The wall is constructed from angular and subangular pahoehoe boulders and slabs stacked five to six courses high. Both sides of the intact wall sections are faced. A light scatter of Cypraeidae and Neritidae shell fragments occurs on the surface, inside the wall (Donham 1987:54).

Feature 45 was originally described as site T-123 (Donham 1987:48-49), a partially buried alignment of small *pāhoehoe* boulders on a coarse sand deposit behind the *pāhoehoe* coast. The alignment described by Donham has since been destroyed, its blocks moved to create other features. The sand deposit contains numerous angular *pāhoehoe* blocks that were not deposited by storms, but instead must have been brought here from the *pāhoehoe* flow immediately *mauka*. Three additional feature numbers were assigned to these blocks, although little could be determined about the types of features that they might have represented. The two perpendicular alignments of feature 46 might be the remnant of an enclosure, but all that can be said about features 47 and 48 is that their stones were likely brought here by humans, although when and for what purpose cannot be determined.

Feature 49 was originally described as site T-115 (Donham 1987:44-45) an enclosure remnant heavily disturbed by wave action (fig. 147). Donham's description is



Figure 141. 'A'ā pit, feature 24, site 50-10-18-23360, looking north. The scale is marked in 10 cm increments.

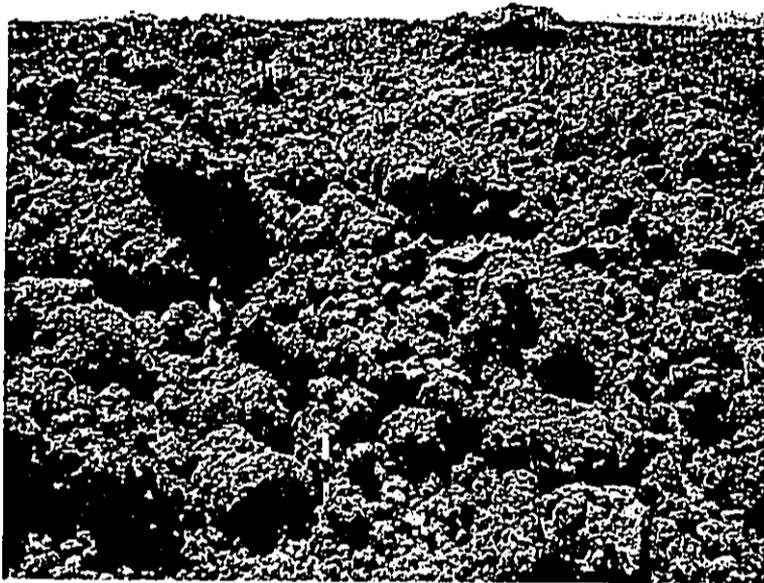


Figure 142. Platform, feature 26, site 50-10-18-23360, looking southwest. The scale is marked in 10 cm increments.



Figure 143. Overhang shelter, feature 28, site 50-10-18-23360, looking northwest. The shelter is immediately behind the scale, which is marked in 10 cm increments.

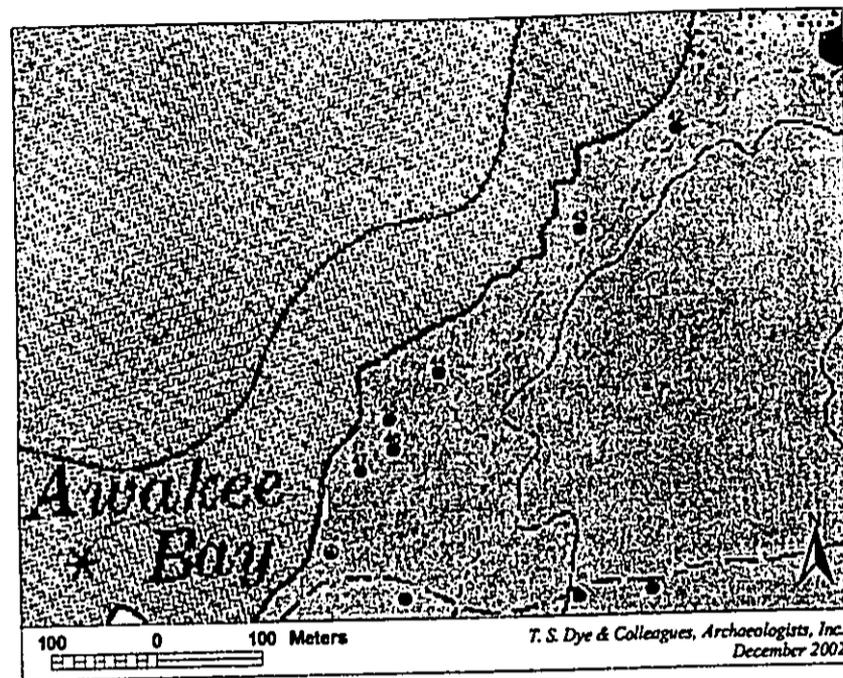


Figure 144. Features along the southern portion of trail site 50-10-18-23360.

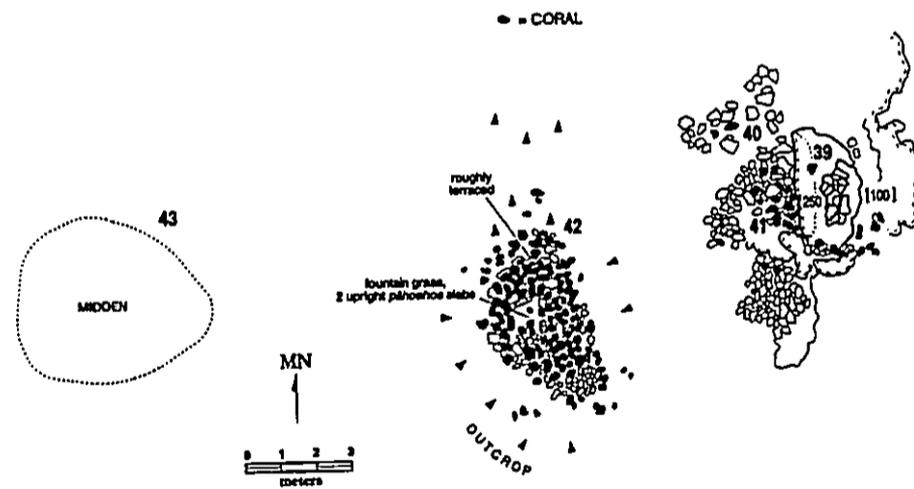


Figure 145. Plan map of site 50-10-18-23360, features 39-43. Tape and compass map drawn by A. Carpenter. The legend is on page 39.



Figure 146. Site 50-10-18-23360, features 39-42, looking east to Pu'u Kuili. The scale is marked in 10 cm increments.

generally accurate, although interior and exterior wall heights were transposed. Her description, with the wall heights corrected, is as follows:

The enclosure is currently represented by an intact southeastern corner and by nearly intact south and east walls. The northern wall is visible as a buried alignment, and only a small portion of the west wall remains ... Intact wall sections are 1.0 m wide and vary in height from 0.4 m on the interior side to 1.0 m on the exterior side. The exterior side of the eastern wall is faced, and both sides of the intact corner are faced, and the wall has a core fill of smaller cobbles. Construction material used includes waterworn coral, and waterworn and rough basalt (Donham 1987:44).

The enclosure was large, with an area somewhat greater than 300 m². The intact *mauka* wall, raised to a height of at least 1 m and with core-fill construction, indicates a substantial structure with relatively great construction effort. Donham identified the site tentatively as a permanent habitation; in size and construction it most closely resembles the modern habitation enclosure, feature 6, site 50-10-18-23359, located at the south end of Awake'e Bay. Thus, feature 49 might, with feature 6, represent northern extensions of the historic settlement at Makalawena. Alternatively, the feature could date to the traditional Hawaiian period, in which case its large size would indicate some community and perhaps ritual function.

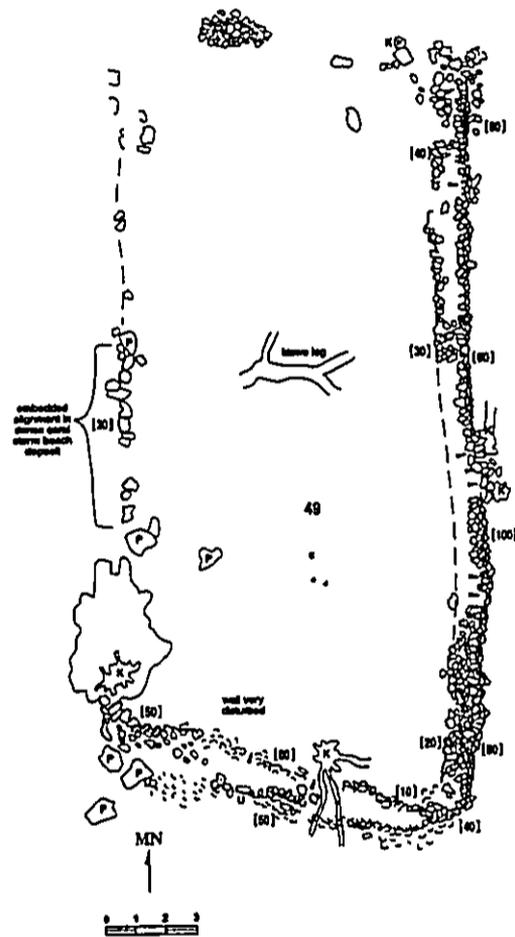


Figure 147. Plan map of site 50-10-18-23360 feature 49. Tape and compass map drawn by A. Carpenter. The legend is on page 39.

Miscellaneous Sites

Four site numbers were assigned to isolated features and to groups of features whose boundaries were determined almost solely by the survey areas. Two of the sites are probable burial sites and the other two serve as convenient labels for features recorded during surveys of proposed road corridors.

Site 50-10-18-23635

Site 50-10-18-23635 is a platform located well *mauka* of the trail, at the base of an 'a'a ridge to the southeast. West of the platform is a ravine filled with folded and broken lava slabs. The platform is constructed of locally available 'a'a and is about 6 m long and 4 m wide (fig. 148). It ranges in height from about 40 cm on the northeast, facing the 'a'a ridge, to about 70 cm next to the ravine. The platform is in generally good condition, but portions of the facing have collapsed, especially along the east and southeast sides. Much of the interior is paved with 'a'a gravel; near the edges the paving is rougher. A poorly paved pit depression, partially bordered by boulders, is located at the southwest end of the platform.

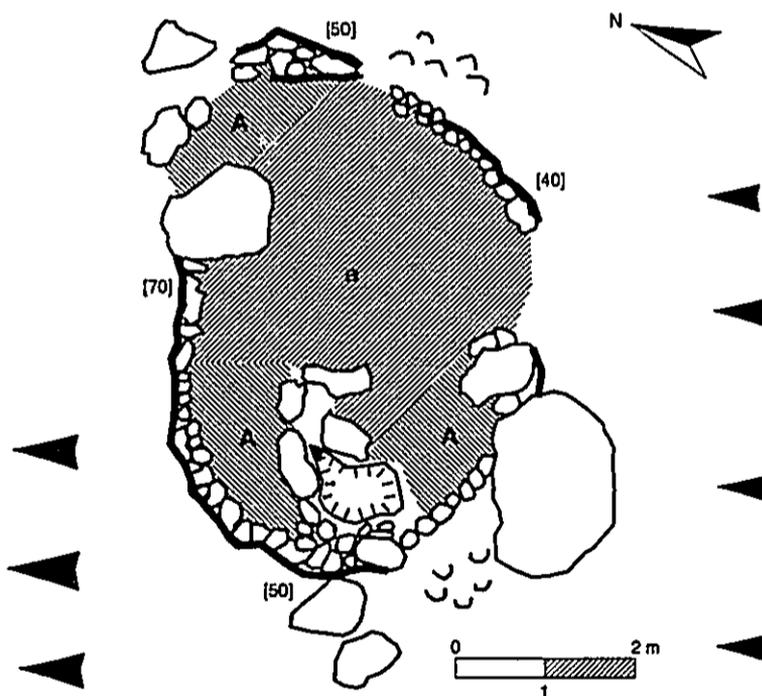


Figure 148. Plan map of site 50-10-18-23635. Tape and compass map drawn by T. Dye. The legend is on page 39.

The isolated location of this feature and the relatively great amount of effort ex-

pendent in its construction suggest that it performed an important function. One possibility is that the feature is a burial, although excavations weren't undertaken to search for bones. Other special purpose functions can't be ruled out on surface evidence alone.

Site 50-10-18-23636

Site 50-10-18-23636 is a mound at the top of Pu'u Kuili that has been modified repeatedly and extensively over the years. Donham described it as a rubble pile, site T-175, and suggested that it might represent the remains of an old survey point established at the top of the *pu'u* (Donham 1987:103). When Donham visited the site it had no formal shape, but was concentration of rubble about 3.0 m in diameter and with a maximum height of 0.3 m. Most recently, the rocks were piled into a mound about 2.0 m in diameter and 0.5 m high. The mound might represent a burial site indicated on historic maps and noted by the surveyor J. S. Emerson in 1882. He wrote that the "most distinguishing feature [of Pu'u Kuili] is the tomb which was erected on the top to the memory of a former owner of that land" (Maly 1998:37), identified as Laanui (Maly 1998:34). There is no solid evidence linking the mound to the historically recorded tomb, and no excavations were carried out to determine whether the mound contains human bone. No other possible tomb features at the top of the *pu'u* have been identified, however. Until further information on the location of the historic burial at Pu'u Kuili is obtained, this site should be treated as significant for its important value to native Hawaiians as a burial site of ancestral bones. No other possible tomb features at the top of the *pu'u* have been identified.

Site 50-10-18-23637

Site 50-10-18-23637 is a group of small features located along a proposed road corridor near Pu'u Kuili (fig. 149). They reflect a combination of traditional Hawaiian and modern activity.

Feature 1, located at the side of a four-wheel drive road in a partially collapsed lava blister, contains the human remains of possibly three individuals (fig. 150). Burials #1 and #2 are placed beneath overhangs at the north and south ends of the main area of collapse. The bones are in compact piles indicating secondary deposition and have been partially concealed by stacking cobbles across the opening to the overhangs. Burial #3 is located near the top of the blister, where a slab of *pāhoehoe* has been thrust up, creating a small chamber. The partial remains of an individual have been placed in the chamber and the opening concealed by filling it with cobbles. When found during the inventory survey, the bones were exposed and cobbles were added to conceal them again.

Feature 2 is a C-shape enclosure and a filled area located in an area of buckled *pāhoehoe* lava south of Pu'u Kuili. The C-shape enclosure is crudely constructed of boulders and cobbles and raised to an interior height of 40 cm. It encloses an area about 2 m wide and 1 m deep and is open to the west. Four meters west of the enclosure is a depression in the lava that has been filled with boulders and cobbles.

Feature 3 is an enclosure apparently constructed recently to conceal a small-scale marijuana cultivation.

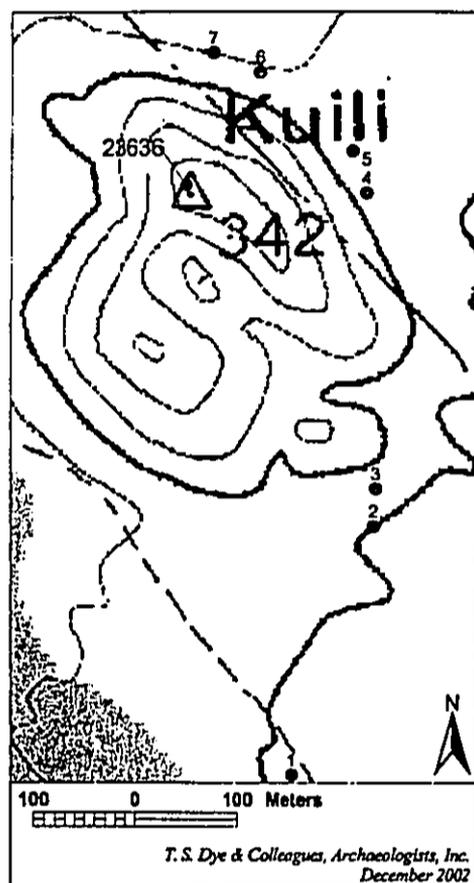


Figure 149. Features of site 50-10-18-23637

Feature 4 is a single stone placed on top of a large boulder at the edge of the 'a'a flow as it intersects the cinders of Pu'u Kuili. Waterworn coral is present at the base of the boulder. The feature appears to mark the end of trail site 50-10-18-5351 (Pantaleo et al. 1992), where it descends the 'a'a flow.

Feature 5 is an 'a'a pit excavated at the base of a large boulder that has been bashed. The pit extends 60 cm under the boulder and rocks removed from the pit have been stacked 2-3 courses high at the outer edge.

Features 6 and 7 represent markers along a possible trail that might represent an extension of site 50-10-18-5351 across the *pāhoehoe* south of Pu'u Kuili. Feature 5 is a series of three water-worn basalt stones and worn areas in the *pāhoehoe* lava in a line trending northwest toward feature 6. Feature 6 is a series of six water-worn small boulders and some scattered coral set out in approximately the same line.

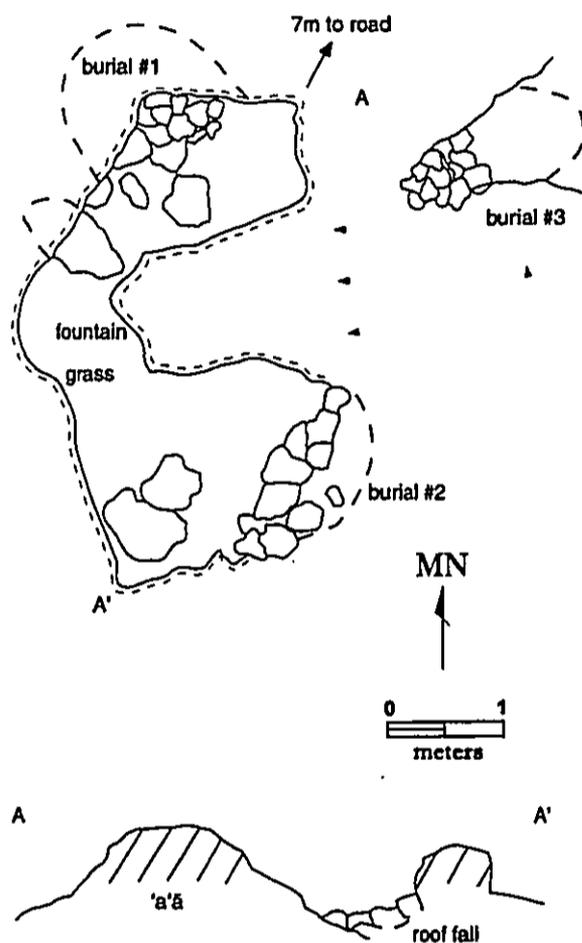


Figure 150. Human burials, feature 1, site 50-10-18-23637.

Site 50-10-18-23638

Site 50-10-18-23638 consists of nine mostly small features located along a proposed road corridor leading from Pu'u Kuili to Awake'e Bay (fig. 151). It includes features previously recorded as sites T-113 and T-118 Donham (1987), as well as several small features identified during the inventory survey.

Feature 1 is a filled *pāhoehoe* pit near a popular camping spot. It is not associated with other features and might be modern.

Feature 2 is an enclosure 3.8 m long and 2.2 m wide formed by a short, 0.45 m high wall at one end of a natural depression in the *pāhoehoe* lava. The wall is broken down and has no extant face. The *pāhoehoe* stands 1.2 m above the soil floor of the enclosure, forming a relatively protected interior. Immediately east is of the enclosure is a short section of broken down wall, about 2 m long, on a *pāhoehoe* outcrop.

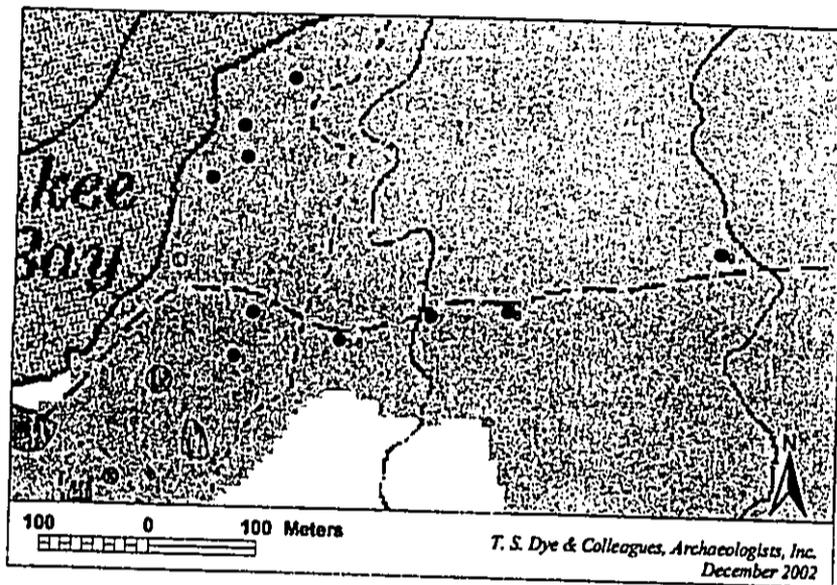


Figure 151. Features of site 50-10-18-23638

Feature 3, a C-shape enclosure, and feature 4, an overhang shelter, were previously recorded as site T-113 (fig. 152). Feature 3 rises to an interior height of 1.0 m with a 3-5 course wall of blocky *pāhoehoe* boulders, many of which are set upright. The enclosure is open to the south and feature 4. Feature 4 is located

in a partially collapsed lava blister and is entered from a horizontal, west-facing opening in the side of the blister. The entrance ... has been artificially closed with piled boulders along the south side ... The cave chamber is nearly circular (2.5 [m] N/S by 2.3 [m] E/W), and ceiling height ranges from 0.6 to 0.8 m. A thin soil deposit ... occurs in patches on the cave floor, and a sparse scatter of marine shell is present (Conidae, Cypracidae, and Neritidae) (Donham 1987:43).

About 20 meters south of feature 4, are feature 5, a *pāhoehoe* pit, and feature 6, a mound of quarried rock piled next to the pit (fig. 153).

Feature 7 is a mound located just off the four-wheel drive road, sufficiently large to protect a burial. Feature 8, previously described as site T-118 (Donham 1987:46), is a 27 m long, deteriorated wall set up along the eastern edge of a *pāhoehoe* depression. The area to the east has been bulldozed. Feature 9 is a small mound of undetermined function.

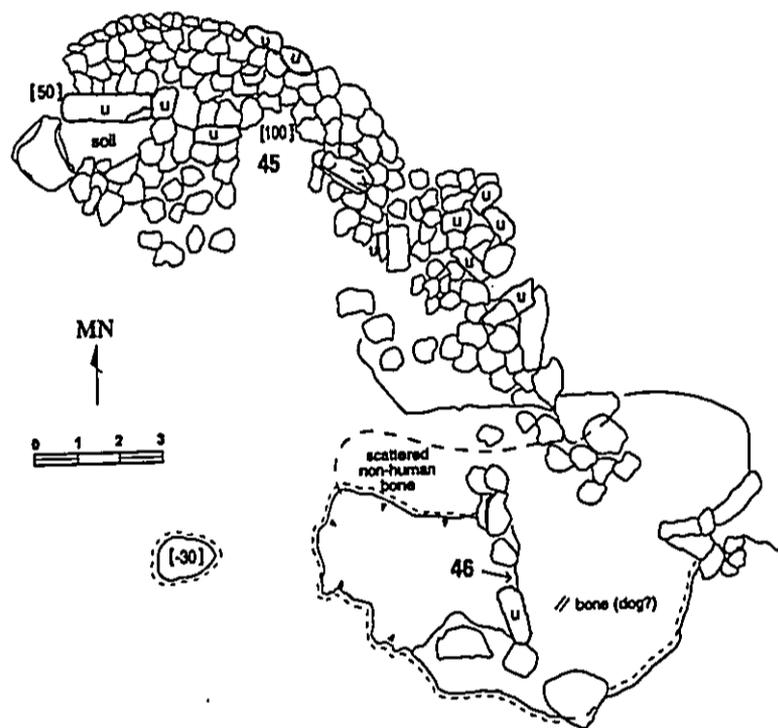


Figure 152. Site 50-10-18-23638, features 3 and 4. Tape and compass map drawn by Toni Palermo and Martha Yent. The legend is on page 39.

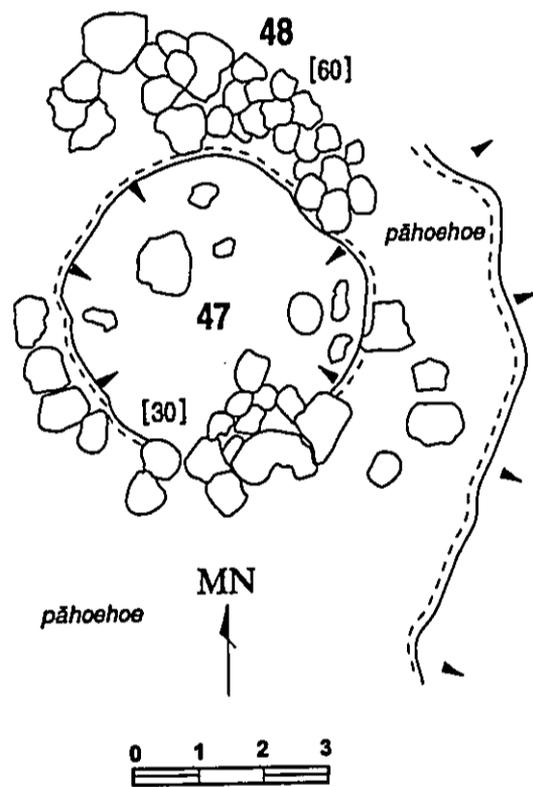


Figure 153. Site 50-10-18-23638, features 5 and 6. Tape and compass map drawn by Toni Palermo and Martha Yent. The legend is on page 39.

Chapter 5

Laboratory Results

This chapter presents invertebrate and vertebrate faunal identifications, artifact descriptions, results of ^{14}C dating, and a synopsis of wood charcoal identifications. It is supported by several appendices: the field catalog, appendix B (pg. 341); the artifact list, appendix C (pg. 343); the categories used in vertebrate faunal analysis, appendix D (pg. 371); minimal faunal data tables, appendix E (pg. 377); wood charcoal identifications, appendix F (pg. 381); and graphical displays of ^{14}C date calibrations, appendix G (pg. 395).

Invertebrate Faunal Remains

Invertebrate faunal remains were collected from TU-1 at site 50-10-18-2335, feature 93 (see pg. 52). The remains are dominated by cowry shells, *pipipi*, and sea urchins (table 4), typical of archaeological collections along this coast.

Vertebrate Faunal Identification

Vertebrate faunal remains from six proveniences were identified by Alan C. Ziegler, who provided a series of general and specific, largely subjective, comments regarding the identified vertebrate faunal remains, which are paraphrased below. The remains recovered from the seventh provenience, site 50-10-18-23356 feature 104 TU-1, could only be identified as fish; no skeletal elements diagnostic of specific taxa were present. These remains are not included in the discussion below.

Most of the material identified by Ziegler derives from five proveniences, including site T-140 feature B, site 50-10-18-23355 features 23 and 93 TU-1 layers I and II, and site T-164 feature A (table 5). The charcoal concentration in site 50-10-18-23355, feature 93 TU-1 had very little material.

The five proveniences all tend to have a great taxonomic variety of, especially, fishes, as well as relatively large amounts of their remains, although site 50-10-18-23355 feature 93 TU-1 layer II has fewer fish taxa and lesser amounts of skeletal elements than the other four.

Table 4. Invertebrate faunal weights in grams

Taxon	Common name	Layer		Charcoal conc.
		I	II	
Gastropoda				
<i>Cypraea capuserpentis</i>	snake's-head cowry	1583	401	12
<i>Nerita picea</i>	pipipi	641	125	5
<i>Cypraea</i> sp.	cowry	368	76	
Thaididae		271	29	
<i>Conus</i> sp.		102	11	
<i>Strombus</i> sp.		29		
<i>Drupa ricina</i>		19		
Littorinidae		11	1	
<i>Nerita polita</i>	kūpe'e	6	1	
Hipponicidae		5	1	
Unidentified		162	6	
Bivalvia				
<i>Cellana</i> sp.	'ōpihi	33	5	
<i>Isognomon</i> sp.		3		
Unidentified		43	5	
Other				
Echinoderms	urchins	90	49	6

Table 5. Numbers of identified faunal remains by taxonomic class

	50-10-18-23355					-23356	
	T-140 B	Fca. 23	Fca. 93 TU-1		Charc. conc.	T-164 A	TU-1
			I	II			
Aves	73	33	1	1	0	45	0
Chondrichthyes	1	1	0	0	0	0	0
Indeterminate	0	1	0	0	0	0	0
Mammalia	50	20	2	0	0	51	0
Osteichthyes	10,181	5,338	1,082	524	197	14,666	62
TOTAL	10,305	5,393	1,085	525	197	14,762	62

All five of the proveniences were unquestionably occupied by humans, with probably little or no use by avian raptors or nonhuman mammalian carnivores. Essentially all of the vertebrate faunal material recovered presumably represents the discarded remains of animals eaten here. Fishes and, to a much lesser extent, seabirds, formed most of the diet. This food consumption appears to have been the primary human activity carried out at all three of the proveniences.

Traditional artifact fabrication—especially of fishhooks—was similarly a frequent activity, and replacement of broken fishhooks on lines was also carried out to some extent. The very limited human skeletal items—two teeth—indicate that human interments did not occur in the excavated areas.

There are no vertebrate remains, such as prehistorically extinct birds, that would certainly place deposition during early Polynesian time. On the other hand, the near absence of remains of vertebrates introduced only after Contact strongly suggests little deposition occurred here during historic time. The only such vertebrate material com-

prises a single House Mouse bone in site T-140 feature B, and a single Small Indian Mongoose bone in site T-164 feature A. Both of these items, of course, could be from the surface, or intrusive into older stratigraphic depths from younger ones.

The collective food midden recovered appears generally representative of part of a traditional Hawaiian diet. At least the many unusually small fishes, the seabirds, as well as the occasional dog, present would not seem typical dietary items of most post-Contact foreign groups.

The relatively abundant traditionally worked mammal bones and a few similarly treated bird bones strongly suggest a significant amount of the human habitation here took place prior to Contact. There is no vertebrate artifactual material that exhibits working with metal implements.

These observations lead to the conclusion that all the proveniences were occupied primarily or entirely during the (later?) pre-Contact period and possibly also the first several decades of the post-Contact period before most historically introduced vertebrate species became common in the area.

Almost all of the large number of fish families identified are common reef groups, and a majority of the individuals are of only small to medium body size, between about 10–15 and 25–30 or 35 cm in length. These could all have been taken from or relatively close to the shore, and by a variety of methods. An exception to human capture might possibly be the rather large number of individuals of the small monacanthid, *Pervagor pilosoma*. This species is not usually considered a human dietary item.

In spite of the prevalence of inshore fish types, at least a few bones identified as Scombrid, a taxon that includes tunas and mackerels, appear at most of the proveniences, suggesting there was some amount of offshore trolling, necessarily entailing the use of watercraft. The occasional shark present might also signify offshore fishing.

No amphibian or reptilian material was identified. It seems odd that sea turtle is unrepresented.

Among birds, mostly oceanic types were identified other than by size category, and these were somewhat limited in terms of species represented. No recovered bones of these seabirds are immature, so apparently no rookeries were being exploited. Chicken is very sparsely represented, and there is one Small Anatid, or duck.

The total nonhuman mammalian component of the collections seems to comprise only an occasional dog and pig, as well as a fair number of individuals of the Polynesian-introduced *Rattus exulans*.

Artifacts

A total of 813 artifacts was collected during the inventory survey. Most of the artifacts were collected by sieving looters' back-dirt piles at three habitation caves: site 50-10-18-23355, feature 23; site T-140, feature B (Donham 1987:63); and site T-164, feature A (Donham 1987:86). A total of 695 artifacts was collected this way. Smaller collections were made during controlled test excavations at site 50-10-18-23355, feature 93, where 17 artifacts were found, and site 50-10-18-23356, feature 104, which yielded a single piece of volcanic glass. In addition, surface collections were made at several sites over a period of twenty years. During the inventory survey fieldwork, 59 artifacts

were collected both from the ground and the surface of cave floors. Independently, a collection was made by Bobby Camara, who cataloged and stored 41 artifacts either left behind by looters active in the 1980s or in danger of being looted. Camara provided the artifacts and notes on provenience to be stored with the other materials collected during the inventory survey.

The artifact assemblage is characterized by tools for cutting, scraping, abrading, piercing, and percussion. Volcanic glass flakes are the most common artifact type in the collection, totaling 275 pieces, more than one-third of the assemblage. Although abundant, it is not clear how big a role these artifacts played in traditional Hawaiian life. Evidence for use-wear is scant and only one core, the raw material from which useful flakes are made, was found. Volcanic glass artifacts are followed in abundance by 185 sea urchin spine files, and 70 coral abraders of various types. Also recovered were 11 basalt abraders, one complete and three partial adzes, three basalt hammerstones, three bird bone awls, and a possible shell scraper.

Also present in relatively great numbers are fishing implements. Most common are complete and broken fishhooks and fishhook blanks, including 25 fashioned from bone and 26 from shell. Most of the fishhooks that were recovered are very small; apparently they were small enough to pass through the sieves used by looters. Several of the fishhook blanks indicate that larger hooks were being manufactured at the sites; their absence in the assemblage is due to the work of the looters. Other fishing implements include nine octopus lures and three basalt sinkers.

An unusual surface find is a cache of 49 black and white 'ili'ili pieces, almost certainly for use in the game of *kōnane*.

The rest of the assemblage consists of basalt, bone, coral, and shell pieces that show some evidence of human modification or transport to a site for use as something other than food. Many of these represent waste by-products of manufacture or raw materials. *Pipipi* shells with perforations on the top of the shell likely made to extract the animal for eating were also collected.

A descriptive list of all the artifacts is presented in appendix C.

Site T-140 Feature B

Site T-140 Feature B is a looted lava tube habitation site located at Kaho'iawa Bay (Donham 1987:63). The cave offers about 24 m² of covered living area with post-looting roof heights of 1.0–1.3 m. The cultural deposit in the cave was moderate to thick, based on the size of back-dirt piles outside and within the cave. Re-sieving of looters' back-dirt piles yielded 65 lithic artifacts, 24 sea urchin spine files, and 25 other artifacts, including five of coral, 14 of bone, and 6 of shell.

Lithic Artifacts

The site T-140 lithic collection includes 61 volcanic glass flakes, one volcanic glass core, one basalt adze fragment, and two reddish siltstone pebbles (fig. 154, table 6). Of the relatively large sample of volcanic glass flakes recovered, none show clear evidence of retouch or use-wear. Most of the debitage pieces do not exhibit well defined conchoidal fracture attributes.

The volcanic glass core is fairly typical of its kind. It is sub-rounded with a diameter of about 20 mm. Several flake scars are identifiable on its surface. The material is of poor quality with a distinctly grainy surface. Given the size of the core and associated debitage, it is likely that a bipolar reduction technique was used to work this material. A bipolar reduction technique is also consistent with the high proportion of shatter in the site T-140 collection.

bipolar reduction
shatter

The adze fragment is small and exhibits two adjoining ground surfaces. The piece appears to have been removed from the upper lateral edge of an adze. Although its ventral surface shows clear conchoidal fracture characteristics, it cannot be ascertained whether this flake was detached intentionally or in the course of adze use.

The two siltstone pebbles are unremarkable. One is rounded while the other is angular and exhibits cortex over most of its surface. They may have been transported to the site.

It is clear from the lithic material recovered at site T-140 that bipolar reduction of volcanic glass was performed at the site. Although an adze fragment was found, its presence probably indicates nothing more than an incidental use-related event unconnected with manufacturing activity.

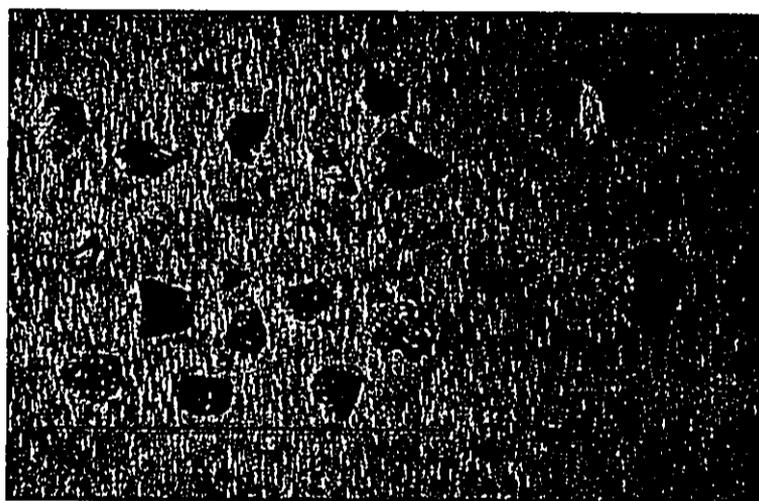


Figure 154. Selected artifacts from site T-140 feature B lithic collection: *a*, volcanic glass debitage; *b*, basalt adze fragment; *c*, volcanic glass core.

Coral Artifacts

Five pieces (14.5 g) of coral were recovered from site T-140 (fig. 155). One has been shaped into a formal tool. The tool is an elongate abrader with six facets and one sharp working edge. It was likely used to work bone or shell.

The other four coral fragments show no clear signs of modification, although one has a smooth, flat surface which may have been ground. All coral from site T-140 was imported to the site, likely from the nearby shoreline.

Table 6. Lithic artifacts recovered from site T-140

Artifact Type	Count	Weight (g)
Basalt		
Adze fragment	1	5.0
Volcanic glass		
Flake	61	23.9
Core	1	11.7
Siltstone		
Pebble	2	4.2

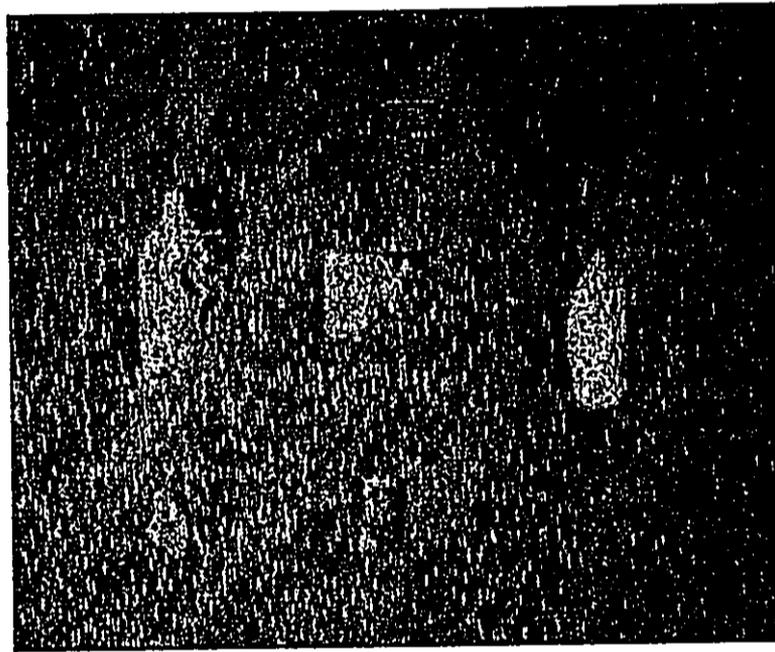


Figure 155. Coral artifacts from site T-140: *Left and center*, Coral fragments; *right*, multi-faceted, elongate abraded.

Bone Artifacts

Fourteen bone artifacts were recovered from site T-140 feature B. These include one complete and four broken fishhooks fashioned from bird or mammal, other than a small species of either. All of the hooks are very small. The complete hook (fig. 156 *n*) is only 11 mm long and 6 mm wide, and the other hook fragments are similarly sized. The head of the complete hook has a single notch on the outer side, but the other three hook fragments with heads are all knobbed. Two of these (fig. 156 *q* and *r*) exhibit very fine workmanship at a miniature scale. Another hook fragment appears to have been burnt (fig. 156 *p*). Two fishhook blanks were for hooks of very different size. One is large enough to produce a hook with a shank length of 30 mm and a width of 11 mm (fig. 156 *f*); the other, nearly finished, has a shank length of 12 mm and a width of 6 mm (fig. 156 *s*). Six pieces of worked mammal bone, mostly limb bone fragments,

were also recovered (fig. 156 *a-e*), along with the proximal end of the humerus shaft of a Medium Procellariid that has been ground on one side and notched on the other, apparently to prepare a small fishhook blank.

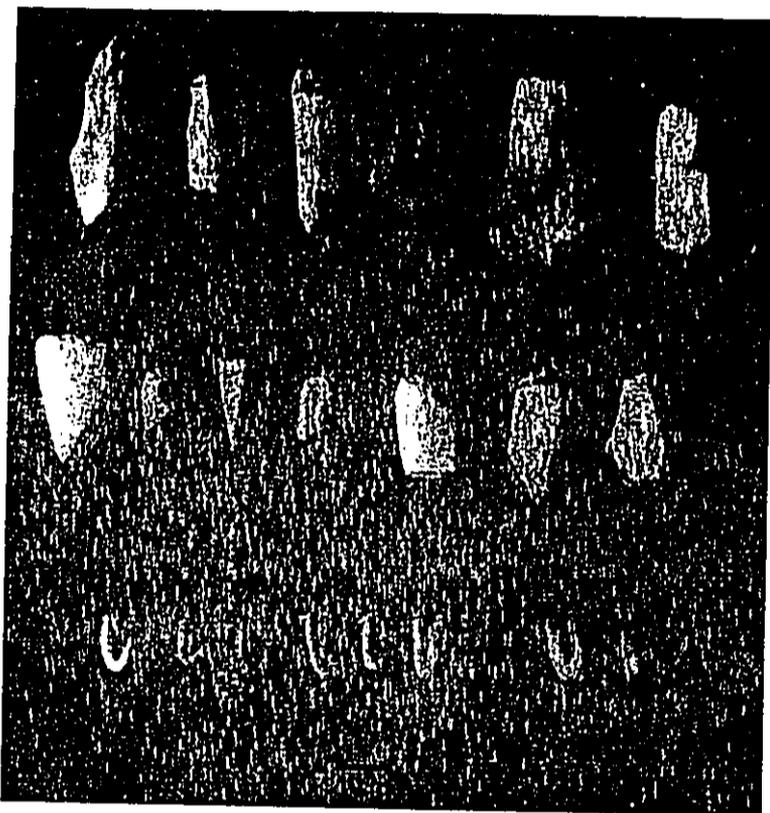


Figure 156. Bone artifacts from site T-140 and site 50-10-18-23355, feature 23: *a-e*, cut bone from site T-140; *f*, fishhook blank from site T-140; *g, i, k-m*, cut bone from site 50-10-18-23355, feature 23; *h, j*, filed fishhook blank fragments from site 50-10-18-23355, feature 23; *n-s*, fishhooks from site T-140; *t, u*, fishhooks from site 50-10-18-23355 feature 23.

Shell Artifacts

Twenty-three shell artifacts were recovered. Most of these, 18, are *pipipi* shells that have been pierced through the top, a treatment that generally left an uneven perforation. It is likely that the holes were made to extract the animal for food. *Pipipi* shells used to make *lei* and other ornaments were generally strung through the aperture and a hole made by grinding and punching through the large whorl behind the aperture on the underside of the shell (Buck 1957:543). Also recovered were four nacreous shell fishhook fragments in poor condition. The most complete and best preserved of these has a shank 19 mm long (fig. 157 *l*). The others are fragmented in such poor condition that

they don't preserve characteristics diagnostic of type. A single *puka* shell fashioned from the spire of *Conus* sp. completes the shell artifact collection.

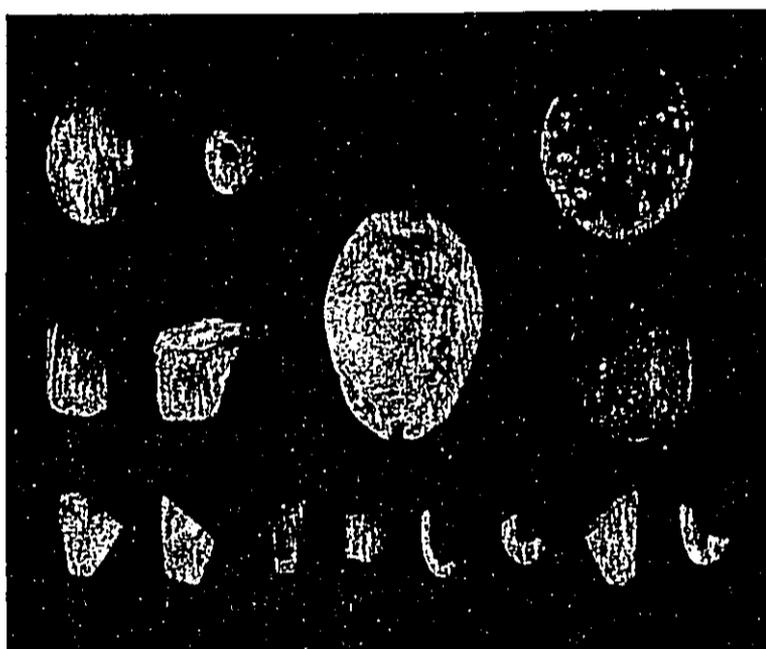


Figure 157. Modified shell from site T-140, site 50-10-18-23355, features 23 and 93, and site T-164: *a-c*, worked *Cypraea* sp. from site T-164; *d, e*, fishhook blanks from site 50-10-18-23355, feature 93; *f, g*, octopus lure and worked *Cypraea* sp. from site T-164; *h-k*, fishhook blanks from site 50-10-18-23355, feature 23; *l*, one-piece fishhook from site T-140; *m-o*, fishhook blanks from site T-164 in various stages of completion.

Sea Urchin Spine Artifacts

Twenty-four sea urchin spine files were recovered at site T-140. Ten were worked on the proximal end of the spine and the other 14 were too fragmented to determine which end had been worked.

Site 50-10-18-23355, Feature 23

Feature 23 is the largest of four caves at the *mauka* end of a paved yard in cluster C, the upper bluff *kauhale*. All four of the caves were looted and the sediment from them sieved near the cave entrances. The largest back-dirt pile is located in front of feature 23, but there is no way to tell the original provenience of the material, though considerations of size and proximity suggest that much of it derived from feature 23. Thus, the provenience label for this collection is an inference, rather than a definite

statement about archaeological context. Some of the items in the collection might have derived from one or more of the other three, smaller caves adjacent to feature 23.

Lithic Artifacts

The site 50-10-18-23355, feature 23 lithic collection includes 140 volcanic glass flakes, seven unground basalt flakes, three ground basalt flakes, one basalt pebble hammer, one chert flake, and one broken discoidal cobble (fig. 158, table 7).

Of the large sample of volcanic glass flakes recovered, none show clear evidence of retouch or use-wear. Most of the debitage do not exhibit well defined conchoidal fracture attributes. This can be attributed to the poor quality of the material—although a few fine-grained, glassy flakes are present—and the likely use of a bipolar reduction technique.

In addition to the volcanic glass flakes, ten basalt flakes were recovered. Three of these exhibit grinding on a single surface. They likely derive from use-related flaking of adzes since there is little evidence of manufacture. The basalt flakes are generally coarse grained, although one is distinctly fine grained. None of the basalt flakes show evidence of retouch or use-wear.

One chert flake was recovered. This flake is small and has a white and brown mottled appearance. No other chert artifacts were collected during the Kekaha Kai inventory survey.

The site 50-10-18-23355, feature 23 collection includes one basalt pebble hammerstone. The pebble hammerstone is oblong with a flattish cross-section. It measures 5.9 cm long, 3.3 cm wide, and 2.0 cm thick and exhibits marked wear on its two ends. Pitting on one end has succeeded in wearing the working surface nearly flat. The opposite end exhibits similar wear, but in addition has a relatively large flake scar running from the working surface down the side of the tool. Given the pebble hammer's association with a large number of volcanic glass flakes and its suitability for working such small raw material, it is reasonable to suggest that both artifacts are part of the same lithic reduction industry. The pebble hammerstone was likely used to work small volcanic glass nodules using a bipolar reduction technique.

The final artifact to be discussed from site 50-10-18-23355, feature 23 is a broken cobble. The cobble is water rounded and was almost certainly transported to the site from the nearby shoreline. Judging from the remaining broken piece, it appears that the original cobble was discoidal with a 2.0 cm thick rim and a depression in the center. The depression may be at least partly natural. As can be seen from its cross-section, the cobble is vesicular in its center, but composed of dense basalt around its periphery. The traditional Hawaiian occupants of site 50-10-18-23355, feature 23 may have taken advantage of the vesicular and more easily worked interior to form the depression in the cobble. The function of this artifact is unknown, although one possibility is that it served as an anvil during the bipolar reduction of volcanic glass nodules. The depressed center would serve well to stabilize the target piece during reduction.

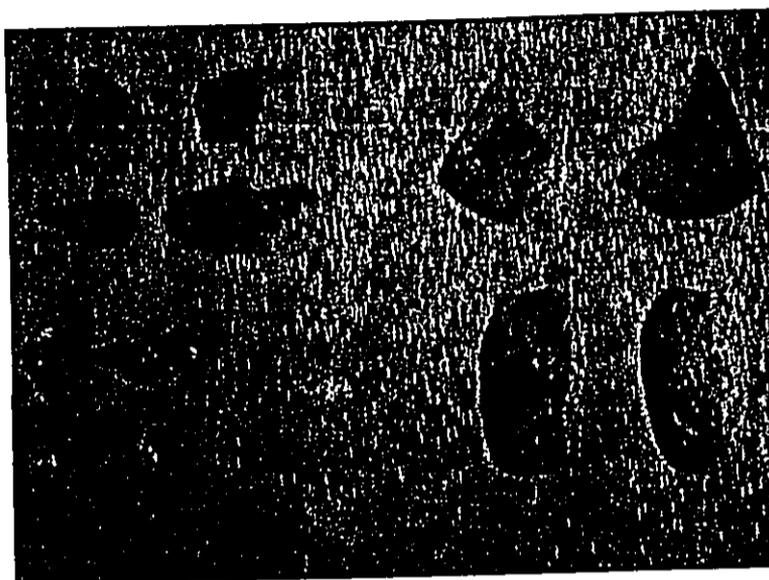


Figure 158. Selected artifacts from site 50-10-18-23355, feature 23 lithic collection: *a*, basalt flakes; *b*, volcanic glass flakes; *c*, chert flake; *d*, cobble fragment; *e*, basalt pebble hammer.

Coral Artifacts

A total of 31 coral pieces was recovered from site 50-10-18-23355 feature 23 (table 8). Of these, four are unmodified coral fragments and three are small coral fragments with worn surfaces. The worn coral pieces are probably abrader fragments, but their tool type cannot be determined due to the small size of the pieces. Also included in the site 50-10-18-23355, feature 23 coral collection are eighteen abraders and abrader fragments. These artifacts are divided into three distinct tool types: surface abraders, edge abraders, and subconic abraders. This classificatory scheme is based on both the type of surface used for abrasive work and the overall morphology of the tool. The fundamental technological distinction to be drawn is that between active and passive tools. That is to say, between passive abraders upon which the target material was

Table 7. Lithic artifacts recovered from site 50-10-18-23355, feature 23

Artifact Type	Count	Weight (g)
Basalt		
Unground flake	7	34.4
Ground flake	3	3.2
Hammer	1	62.4
Cobble fragment	1	49.1
Volcanic glass		
Flake	138	71.9
Chert		
Flake	1	0.7

Table 8. Coral artifacts recovered from site 50-10-18-23355, feature 23

Artifact Type	Count	Weight (g)
Coral abrader		
Surface	1	80.0
Edge	2	21.3
Subconic	15	27.9
Subconic round	1	1.2
Subconic edged/subround	20	30.5
Modified fragments	3	11.1
Unmodified fragments	4	18.1

worked and active abraders which were held in the hand and worked upon the target material.

Surface abraders fall into the passive category. These tools were useful for their broad, flattish surfaces. These tools may also exhibit slightly concave or convex surfaces. Material in the early shaping stage of manufacture would be worked against the stationary surface of the abrader. Given the fairly soft nature of coral, it is likely that these abraders were used primarily for working bone, shell, or wood. Surface abraders are functionally analogous to tabular basalt abraders.

Edge abraders are active tools. They are defined by their sharply beveled edge or edges. Edge abraders typically have a single edge, but some examples have two. If the tool has two edges, one is usually much sharper than the other and is obviously the primary working edge. Edge abraders would be well suited to sawing bone to create notches, grooves, indentations, or to cut blanks or fishhook tabs. These tools come in a great size range.

Subconic abraders are also active tools, being held with the fingers and worked into a piece of raw material. Their defining characteristics are a sub-conical to conical section and elongate shape. Although the artifacts recovered are typically only fragments, they suggest that the complete tool would be long relative to its width or diameter.

A single surface abrader is present in the site 50-10-18-23355 feature 23 collection (fig. 159). It has one working surface and one adjacent faceted edge. The bottom of the tool also appears to have been artificially smoothed, but was probably not used as a working surface.

Two edge abraders were recovered at site 50-10-18-23355, feature 23. The larger of the two closely resembles the form of edge abraders from the site T-164 collection. It also exhibits a crude, single, uniaxially ground working edge opposite the primary edge. The smaller edge abrader is almost triangular in section and appears to be only a part of a complete tool.

Twenty-one subconic abraders are present in the site 50-10-18-23355 feature 23 collection. One of these has the distinctive round section found in the site T-164 collection. The other twenty exhibit a range of different cross-sectional shapes, but most have a distinct working edge. One has been finely worked into a round shape and ground flat on one side. Subconic abraders with a round section would be useful for working the inside surface of a curved object such as a fishhook. Those with an edge may be used to cut fine grooves, notches, or other incisions requiring an edge.

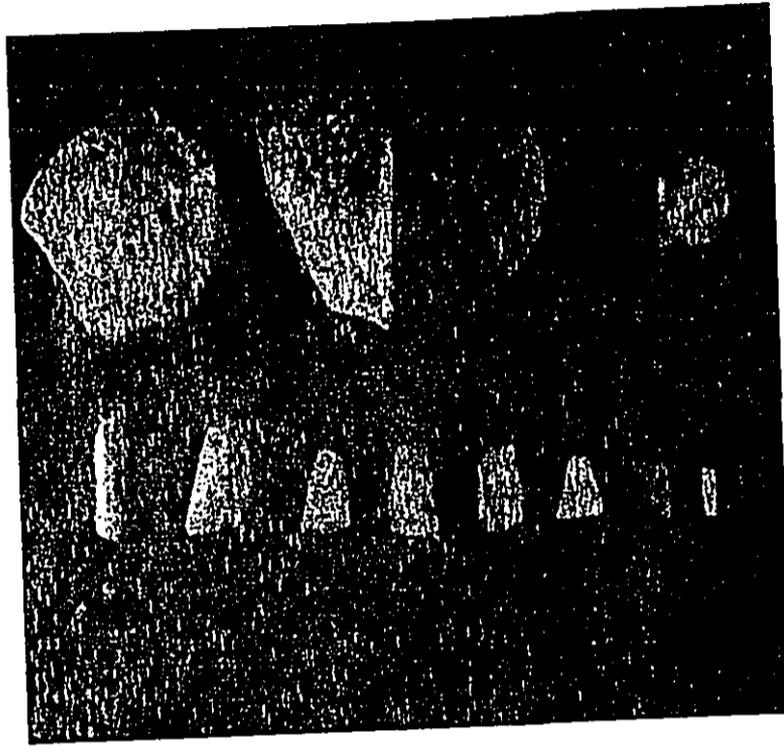


Figure 159. Coral abrasers from site 50-10-18-23355, feature 23 collection: *a*, surface abraded; *b* and *c*, edge abrasers; *d*, subconic abrasers.

Bone Artifacts

Thirty bone artifacts were recovered from site 50-10-18-23355 feature 23, primarily the by-products of fishhook manufacture. Two fragments of fishhooks, both quite small, were recovered (fig. 156 *t* and *u*). Both are made of undetermined bones of a bird or mammal other than a small species of either. Two small pieces of small-to-medium or medium mammal bone show relatively finished surfaces and appear to be fragments of fishhook blanks (fig. 156 *h* and *j*). The other 26 pieces generally represent waste materials, though a few of them conceivably could have been used to fashion small hooks, and so might represent raw material not yet worked to the fishhook blank stage (fig. 156 *g*, *i*, *k-m*). Most of these pieces could only be identified as small-to-medium or medium mammal bones, but two fragments from the ends of bones could be identified more specifically. One is a distal-end fragment of the metapodial of a dog at least 5-6 months old. The other is an extreme distal-end fragment of the radius of a pig at least several months old.

Shell Artifacts

Shell artifacts include four nacreous shell fishhook blanks (fig. 157 *h-k*), six nacreous shell fishhook blank fragments, a fragment from what might have been an octopus lure

of *Cypraea leviathan*, thirteen *pipipi* shells with uneven holes punctured in the top, a piece of nacreous shell pierced with a small hole, and two *puka* shells fashioned from the base of *Conus* shells.

Sea Urchin Spine Artifacts

Site 50-10-18-23355, feature 23 yielded a large collection of sea urchin spine files. Most of them, 72, were too fragmented to determine which end had been worked. Thirty-eight of the files were worked on the proximal end and seven were worked on the distal end.

Site 50-10-18-23355, Feature 93

Artifacts from site 50-10-18-23355, feature 93 were collected from Layers I and II of TU-1, a 1 m² excavation unit (see pg. 52).

Lithic Artifact

Excavation of TU-1 at site 50-10-18-23355 feature 93 produced a single, small volcanic glass flake from Layer I. No other lithic material was recovered. The flake is similar to those recovered at site T-140, site 50-10-18-23355, feature 23, and site T-164 feature B.

Coral Artifacts

Four coral pieces weighing just 23.5 g were recovered from site 50-10-18-23355 feature 93 layer I (fig. 160). Two exhibit surfaces which may have been ground. All the coral could have been collected from the nearby shoreline.

Bone Artifacts

Two bone artifacts were recovered from Layer I. One is the base of a two-piece fishhook point, badly weathered. It was fashioned from an undetermined bone of a medium mammal. The other is a small limb bone fragment of bird or mammal other than a small species of either that has been cut.

Shell Artifacts

Three shell artifacts were recovered from Layer II. Two of these are nacreous shell fishhook blanks (fig. 157 *d* and *e*), large enough to have produced hooks with shanks 24-27 mm long. The other, a smaller piece of nacreous shell, appears to be a waste by-product of fishhook manufacture.

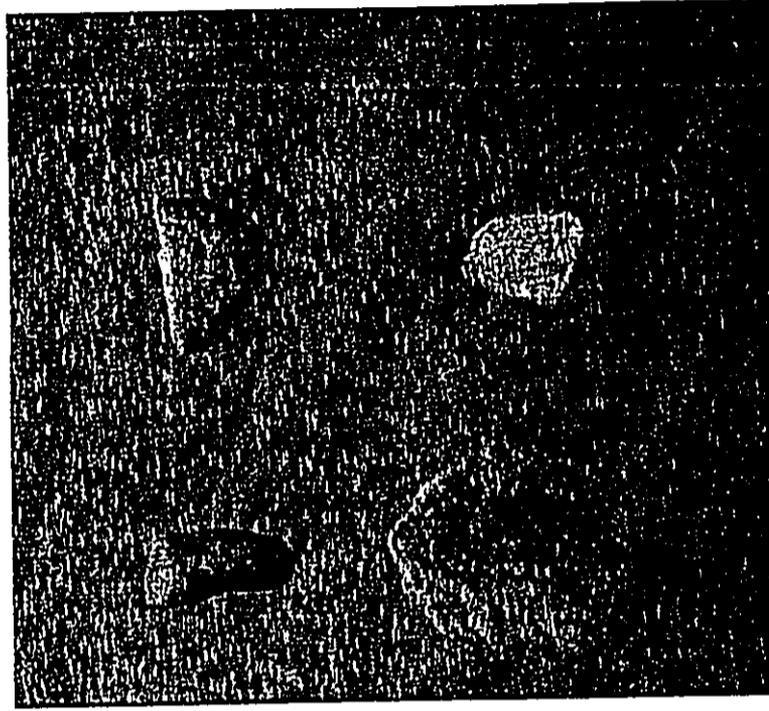


Figure 160. Coral artifacts from site 50-10-18-23355 feature 93.

Sea Urchin Spine Files

The five sea urchin spine files recovered from layer I were too fragmented to determine which end of the spine had been worked. The single specimen recovered from layer II was worked on the proximal end.

Site T-164 Feature A

Site T-164 feature A is a thoroughly looted habitation cave, one of the largest caves along this section of coast. It has approximately 500 m² under a roof that is 2.0 m or more high over most of the area (Donham 1987:83). When the site was first recorded in the 1980s, the cave interior showed evidence of traditional Hawaiian construction, including low walls, hearths, and cobble pavements. All of these interior features are now absent, having been removed by looters.

Re-sieving looters' back-dirt piles yielded 206 artifacts, including 71 volcanic glass flakes and basalt artifacts, 45 coral abraders and manuports, 35 bone fishhooks, awls, and worked pieces, 20 shell fishhooks, octopus lures, and worked pieces, and 35 sea urchin spine files.

Table 9. Lithic artifacts recovered from site T-164

Artifact Type	Count	Weight (g)
Basalt		
Unground flake	4	51.2
Adze fragment	1	2.2
Spall flake	1	5.7
Hammer	2	1,352.1
Pebble fragment	1	7.1
Water-rounded pebble	1	8.0
Vesicular basalt		
Tabular abrader	6	186.0
Sub-conical abrader	4	3.5
Fragment	1	0.4
Volcanic glass		
Flake	50	38.6

Lithic Artifacts

Site T-164 feature A produced the most diverse lithic collection of the project. Included are cobble hammerstones, tabular and sub-conical abraders, basalt and volcanic glass flakes, and an adze fragment (table 9).

The most abundant artifact type at site T-164 is the volcanic glass flake. A total of 50 volcanic glass flakes was recovered, most of which are of a poor, coarse-grained quality. The flakes are comparable to those collected at site T-140 and site 50-10-18-23355, feature 23. No evidence of intentional retouch was found on the flakes. Edge damage and flake scars running across the ventral surfaces of a few flakes may indicate use-wear. The majority of flakes are quite small, however one exceptionally large piece of volcanic glass, 34 mm long and 23 mm wide, is present. It showed no indication of having been used as a core.

Five basalt flakes were collected. One of these appears to have resulted from spall fracture of a rounded cobble. Another of the flakes is water-worn. It was likely transported to the site from the shoreline. The other three flakes are typical coarse-grained basalt flakes. Two are quite large in comparison with other flakes collected during the project, measuring 50 mm and 44 mm long.

One small adze fragment was collected at site T-164. This artifact exhibits two adjacent, finely ground surfaces. The adze fragment measures 13 mm long, 13 mm wide, and 8 mm thick.

One water-worn basalt pebble and one vesicular basalt cobble fragment were recovered. These lithic artifacts do not show evidence of human modification. They are clearly exotic to the site and were likely procured from the shoreline.

Two types of abrading tool were recovered (fig. 161). The first type is tabular. These tools have a characteristically flat working surface and are commonly flat and sub-rectangular in cross-section. Six tabular abraders were collected. Two of these appear to have had only one working surface, while both sides of the others show evidence of use. More interestingly, three of the tabular abraders have a single, clearly beveled edge. These tools appear to have been used for at least two types of grinding activities. The beveled edge is particularly suitable for sawing.

The second type of abrading tool recovered at site T-164 is small and sub-conical

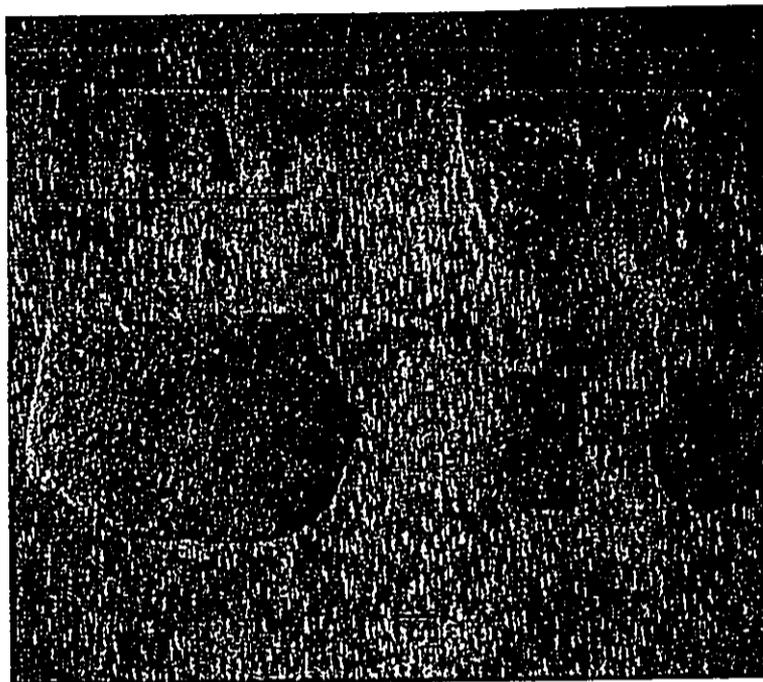


Figure 161. Vesicular basalt abraders from site T-164: *a*, sub-conical abraders; *b*, large tabular abrader; *c*, tabular abrader with finely beveled edge; *d*, tabular abrader with blunt beveled edge.

in shape (fig. 161). Some of these abraders are clearly broken. In fact, it is not certain that any of them are complete. These tools are not truly round, as the term sub-conical implies, but rather have a roughly lenticular cross-section. There seems to be, in other words, a working edge created along the length of the abrader. These artifacts bear a striking resemblance to urchin spine abraders also collected during the project. The nature of the vesicular basalt, however, gives them a much more abrasive quality than urchin spines. It seems likely that they were used for similar purposes as urchin spine abraders, but perhaps for earlier stages of reduction and shaping. These long, narrow tools would be well suited to fishhook manufacture.

Finally, two basalt cobble hammerstones are included in the site T-164 lithic collection. The smaller hammerstone is sub-triangular in plan and exhibits percussion-induced pitting on several surfaces (fig. 162). It measures 77 mm long, 70 mm wide, and 48 mm thick. Pitting is present on both of the flatter surfaces of the cobble such that shallow indentations were created. The apex of the hammerstone shows substantial battering and appears quite worn (fig. 162). In addition to pitting, just over half of the cobble's edge has been intentionally ground smooth (fig. 163). The purpose of the grinding is not clear. It seems that at some point the hammer was intended to be worked into some other object, perhaps an *'ulu*.

The second cobble hammerstone is substantially larger, 146 mm long, 87 mm wide,



Figure 162. Small cobble hammerstone from site T-164 lithic collection: *a*, view of battered working end of hammerstone (apex); *b*, plan view of one side of hammerstone. Note pitting in center. Left side, base, and top are artificially shaped.

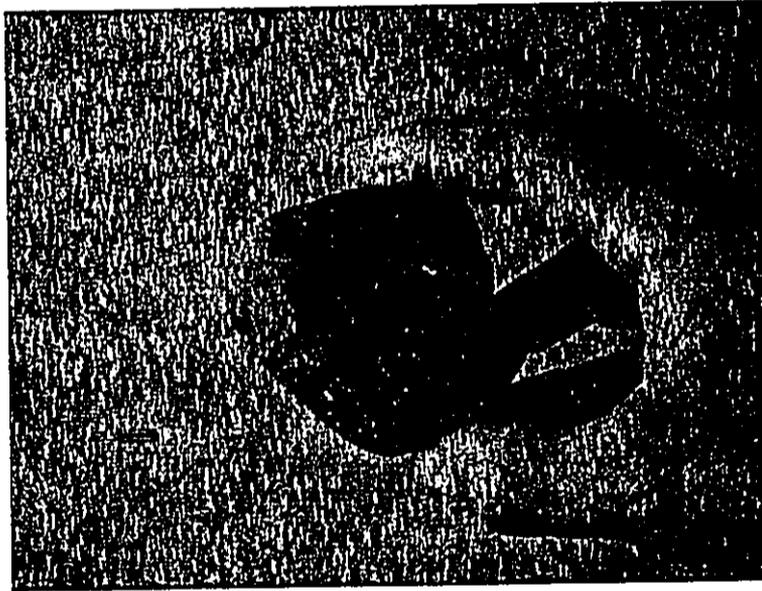


Figure 163. Close-up of ground side of small cobble hammerstone. Site T-164 lithic collection.

and 50 mm thick, and is sub-trapezoidal in plan (fig. 164). Pitting is present on its two working ends. Also present is a deeply ground, 7.3 cm long facet on one lateral edge (fig. 165). Flakes have been detached from one end of the cobble in what appears to

have been an intentionally bifacial manner. Similar to the small hammerstone, the large hammerstone has localized pitting on one of its flat surfaces. The opposite side also has pitting that resembles use-wear, but upon close examination is actually a spall flake scar. Wear or grinding is also evident on the edge opposite the highly ground lateral margin shown in figure 165. Although this tool appears to have functioned primarily as a hammerstone, it is notable that it exhibits modification similar to that found on the small cobble hammerstone. The deeply ground lateral margins and bifacial flake removal are likely early stage attempts to transform the cobble into a formal tool. Given the size and sub-trapezoidal shape of the cobble, it is plausible that this hammerstone is also an unfinished adze blank.

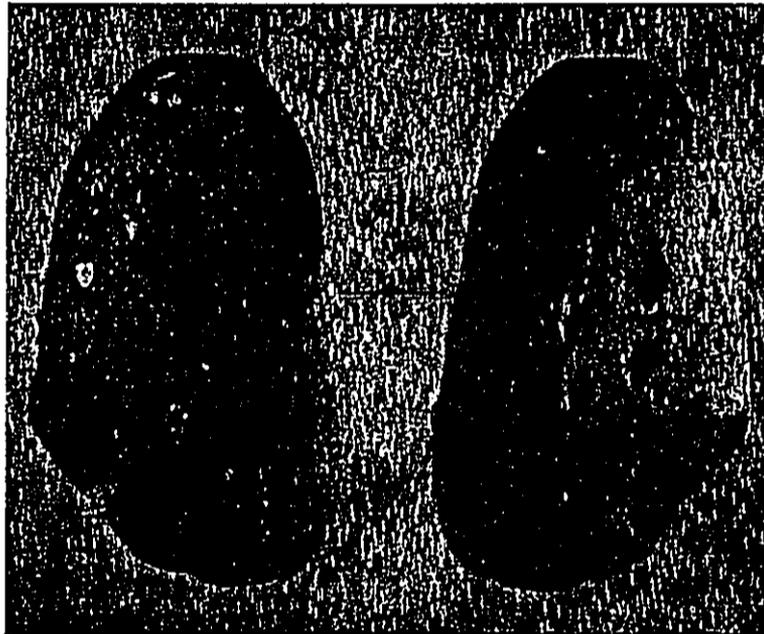


Figure 164. Large basalt cobble hammerstone. Site T-164 lithic collection.

Bone Artifacts

Site T-164 yielded a relatively large and varied collection of bone artifacts. It was the only site to yield an awl. Three awls from the site include one fashioned from the primary dorsal spine of a Monacanthid of a genus other than *Pervagor* or *Aleutera* (fig. 166 *a*), one from the distal two-thirds of the humerus of Bulwer's petrel (fig. 166 *b*), and the third from a limb bone of a medium bird (fig. 166 *c*). Two complete fishhooks and eight fishhook fragments were recovered, all made from undetermined bones of birds or mammals other than a small species of either, except for one, which was from a small to medium mammal or medium mammal. The two complete hooks are both small hooks: one with an incurved point has a shank length of 10 mm and a width

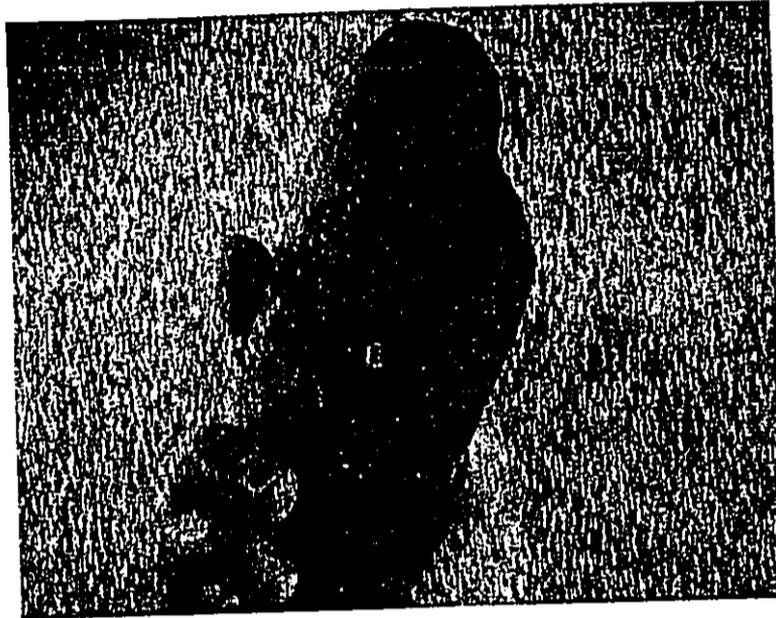


Figure 165. Close-up of large basalt cobble hammerstone showing ground lateral margin. Site T-164 lithic collection.

of 7 mm (fig. 166 *h*); the other with an angular bend has a shank length of 14 mm and a point 11 mm long (fig. 166 *i*). They both have knobbed heads, HT4 in the classification of Sinoto (1968), although the point at the top of the head of the smaller hook appears under 20x magnification to have broken off. Four fragments broken at the bend preserve the fishhook head. Two of these are pointed with a distinctive protruding knob, similar to the complete hooks, while the other two are notched on both sides, HT1b in the classification of Sinoto (1968). Two small pieces appear to be the base of two-piece hook points (fig. 166 *o* and *p*). The other two fishhook fragment lack diagnostic characteristics (fig. 166 *n* and *q*), but the larger one could not have been made from bird bone and was fashioned from a undetermined bone from a small-to-medium or medium mammal. Twelve of the 19 pieces of worked bone were from small-to-medium or medium mammals, five were from medium mammals, and two were from medium birds. At least two of the worked medium mammal bones look very much like adult human bone to Alan Ziegler, though he can't be completely certain because of the fragmentary nature of the remains.

Coral Artifacts

A total of 45 coral artifacts and unmodified fragments was recovered at site T-164 (table 10). Most are abrading tools or fragments of abrading tools. The modified and unmodified fragments recovered likely resulted from use-breakage, or else are debitage associated with abrader shaping. One artifact, a pecked coral sphere, appears to be an intentionally shaped object rather than a part of the abrader tool assemblage (fig. 167).

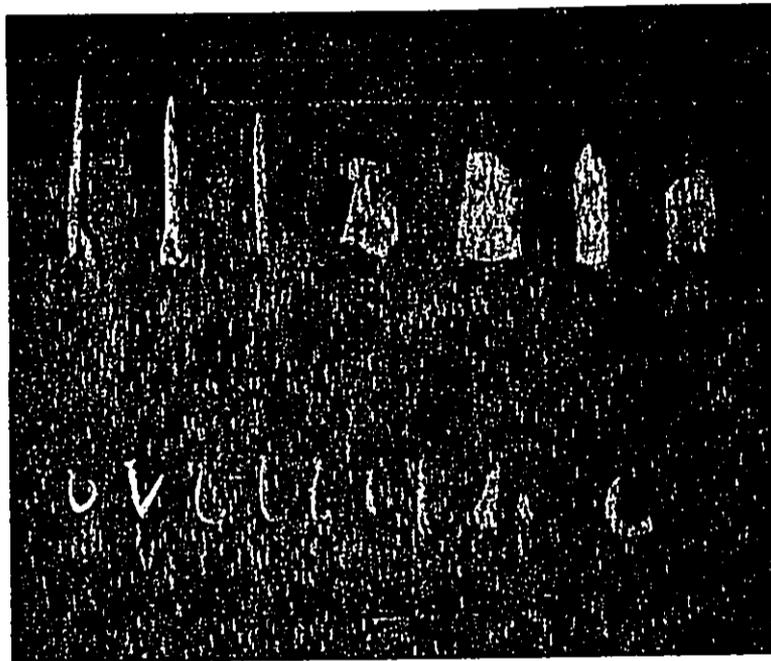


Figure 166. Modified bone from site T-164: *a-c*, awls; *d-g*, fishhook blanks and blank fragments; *h*, one-piece rotating fishhook; *i*, one-piece jabbing fishhook; *j-n*, shank portion of one-piece fishhooks; *o, p*, base of two-piece fishhook point; *q*, one-piece fishhook fragment.

This object may be a hammerstone or possibly a slingstone.

Three surface abraders were recovered. One is complete, although broken into three pieces (fig. 167). The other two appear to be partial, but likely represent at least half of the original tool. The complete surface abrader is sub-rectangular in shape and measures 131 mm long, 60 mm wide, and 32 mm thick. The abrader sits well on its flat bottom. Its upper surface is slightly convex and has been worn smooth through use. Its sides and bottom are also artificially shaped and smoothed. Any or all of the abrader's surfaces might have been utilized. The upper side, however, appears to have been the primary working surface.

The other two surface abraders are likely fragmentary. The larger of the two has two broad, adjoining ground surfaces which meet along a rough, slightly curved, blunt edge. Although partial, this tool resembles the largest of the edge abraders in its overall morphology. Its edge, however, lacks the well defined character of the large edge abrader. The tool's broad surfaces also lack the topologically even nature of a tool with an intentionally beveled edge. Its surfaces are actually noticeably irregular and curved in a manner suggesting it has been worked upon. It is possible that its edge is simply highly worn, and an alternative assignment to the edge abrader class cannot be ruled out.

The final and smallest of the surface abraders has three modified surfaces, two of

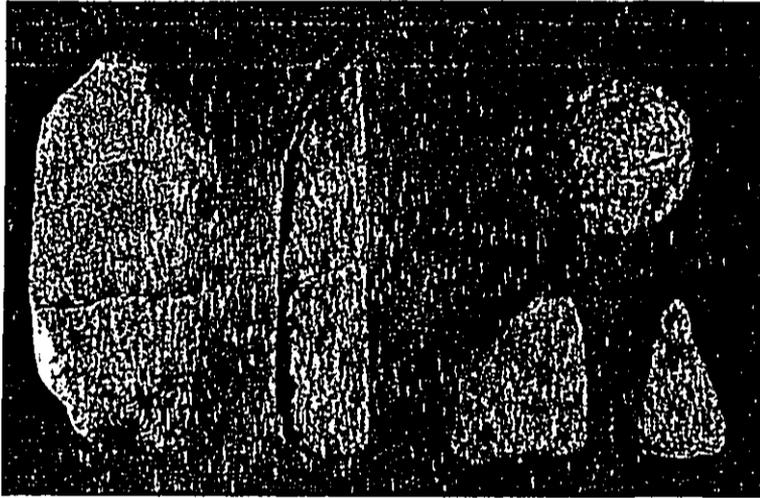


Figure 167. Coral artifacts from site T-164 collection: *a*, complete surface abrader; *b*, shaped coral sphere; *c*, coral surface abrader.

Table 10. Coral artifacts recovered from site T-164

Artifact Type	Count	Weight (g)
Coral abrader		
Surface	3	390.6
Edge	9	355.5
Subconic	19	45.5
Subconic round	5	19.3
Subconic edged	15	33.9
Subconic fragment	1	3.8
Other		
Spherical hammer or sling-stone	1	128.6
Fragments/debitage	11	17.1

which appear to have been used for grinding (fig. 167). The two working surfaces are both concave. This is unique to the coral abrader collection, as all other tools have a flat or convex working surface. It is not clear whether the concave shape is the end result of use or rather was intentionally created because of its suitability to working certain materials.

The largest complete edge tool in the site T-164 collection weighs 206.8 g with a 9 cm long edge (fig. 168, bottom right). It is important to note that at the small end of the size range are tools that grade morphologically into the next class to be discussed, subconic abraders. Although there is undoubtedly a classificatory gray zone between these types, most tools fit well into one or the other class.

Two subclasses of subconic abrader are recognized in the T-164 coral collection based on differences in type of working edge: subconic-round and subconic-edged. Subconic-round abraders exhibit a distinctly round section and would be useful for working the inside surface of a curved object such as a fishhook (fig. 169). Subconic-

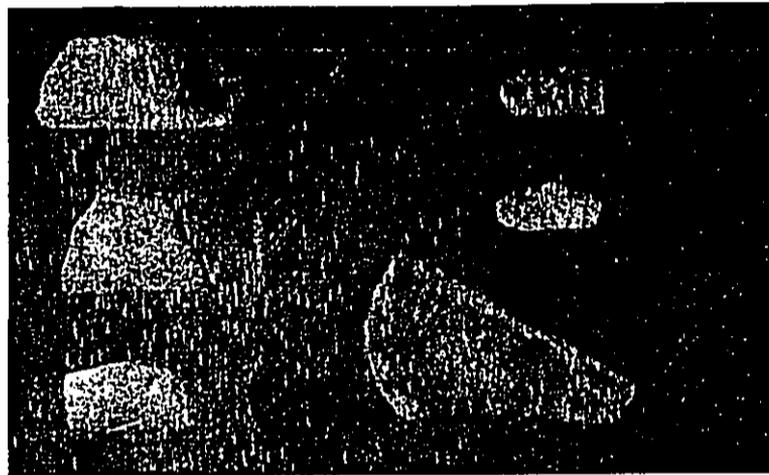


Figure 168. Six edge abraders from site T-164 coral collection.

edged abraders have an oblong and sometimes irregular section, typically with at least one distinct edge (fig. 170). These tools also exhibit some rounding on at least part of the tool and so could be used like subconic-round abraders. With their working edge, however, they may also be used to cut fine incisions, grooves, notches or other attributes requiring an edge.

Shell Artifacts

Site T-164 yielded eight shell fishhook and fishhook blank fragments, one complete and one broken octopus lure, two possible scrapers, and eight pieces of worked shell. All of the fishhooks and fishhook blanks are made of a nacreous shell (e.g. fig. 157 *n*); none of them exhibits any diagnostic hook characteristics. The two most complete and finished hooks are both bend fragments (fig. 157 *m* and *o*). The complete octopus lure is weathered, but exhibits two well formed perforations for lashing and the typical broken columellar lip (fig. 157 *f*). The broken lure retains the top of the shell and one perforation (fig. 157 *g*). Two cowry shell tops with worn edges are possible scrapers (fig. 157 *a* and *c*). Two *kūpe'e* shells have holes in the large whorl behind the aperture, typical of shells used to make *lei*. Also present are two *Conus puka* shells. The other four worked shells are small nacreous pieces that probably represent waste by-products of fishhook manufacture.

Sea Urchin Spine Files

Thirty-five sea urchin spine files were recovered from site T-164. Twelve had working surfaces at their proximal ends and three at their distal ends. The other 20 files were fragments and it wasn't possible to determine which end of the spine had been worked.

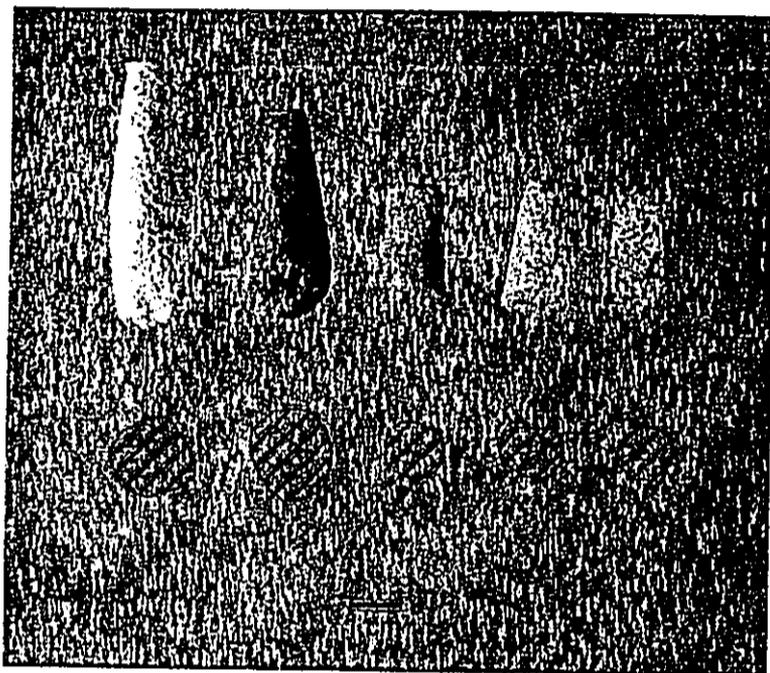


Figure 169. Subconic-round coral abraders from site T-164 coral collection.

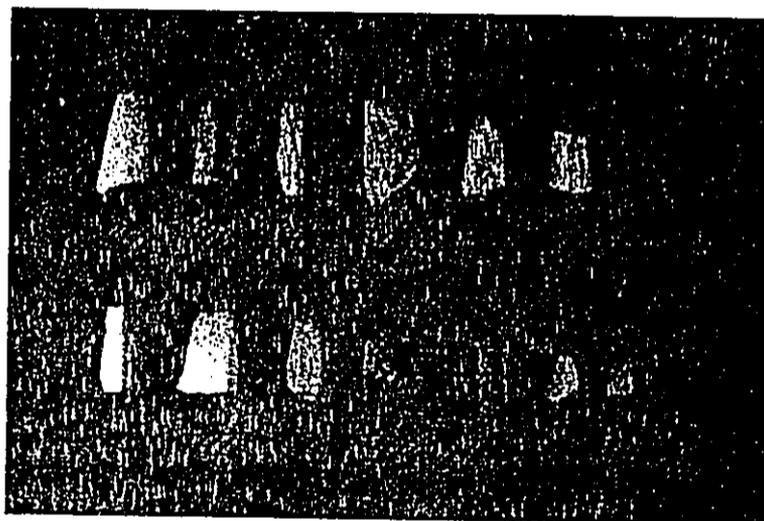


Figure 170. Subconic-edged coral abraders from site T-164 coral collection.

Site 50-10-18-23356, Feature 104

A single coral edge abradar was recovered from Layer III of TU-1. The tool is roughly triangular in plan, with a blunt point at one end. The facets on this tool are not uni-

formly ground, giving the artifact a somewhat informal look, as if it hadn't been used often.

Surface Collections

Surface collections were made during the inventory survey on an opportunistic basis at six features, primarily to secure materials that might be taken by looters. Also reported here are collections made by Bobby Camara in the 1980s and now in the possession of the landowner.

Lithic Artifacts

An adze fragment was collected from the surface of site T-129 feature A, a low overhang shelter and depression outlined with *pāhoehoe* boulders (Donham 1987:52) that was assigned field catalog 27. The fragment is a black, aphanitic rock. It has polish on three sides, including the front, back, and one side of the adze. The cutting edge of the adze is absent and no complete dimensions are preserved on the fragment.

A complete adze was collected from the surface of the graded road to Manini'ōwali Bay, a location assigned field catalog 25. The adze is made from a black aphanitic rock that polishes to a high gloss. The adze has a rectangular cross section. It is small, 57 mm long, 23 mm wide, and 10 mm thick, and weighs 29.5 g. The butt, 16 mm wide, is narrower than the cutting edge, which is 27 mm wide. The longitudinal section is curved, giving the adze an "incipient" tang.

A breadloaf sinker was collected from the surface of site 50-10-18-23356, feature 117 as field catalog 26. It is fashioned from a black, vesicular basalt. It is 65 mm long, 45 mm wide at the top and 28 mm wide at the base, and 44 mm high. The base has a groove running along its length. The sinker weighs 113 g.

A probable breadloaf sinker fragment was collected from the surface between features 31 and 45 of site 50-10-18-23355 as field catalog 24. The artifact is fashioned from a gray, coarse-grained, volcanic rock. It most resembles a breadloaf sinker that has been broken at the base, but its shape is somewhat unusual due to the high arch of the top. This portion of the artifact resembles an *'ulu*, and it might be that an attempt was made to fashion a sinker from a possibly broken game piece. It weighs 109.5 g. Although the function of the artifact cannot be determined conclusively, it shows evidence of careful work on a type of material not found in the immediate vicinity of the site.

Two pieces of volcanic glass were collected from the interior of site 50-10-18-23356, feature 147. One is a relatively large flake, 29 mm long, with standard conchoidal fracture attributes. It is a relatively low-quality volcanic glass with cortex covering almost the entire dorsal surface, reminiscent of surface chill glass. The other is a small piece of shatter with patination on all surfaces.

A cache of *'ili'ili* stones was also recovered from the interior of site 50-10-18-23356, feature 147 consisting of 40 black volcanic pieces and nine white coral pieces (see pg. 255). The volcanic pieces are fine and medium gravels, ranging in diameter from 8-16 mm (fig. 171). They are well-rounded and spherical to discoidal in shape. The rock is a black, aphanitic lava with rare, small vesicles. Most of the pieces exhibit

a smooth, slightly shiny surface, but some have a light gray weathering, typically on one side.

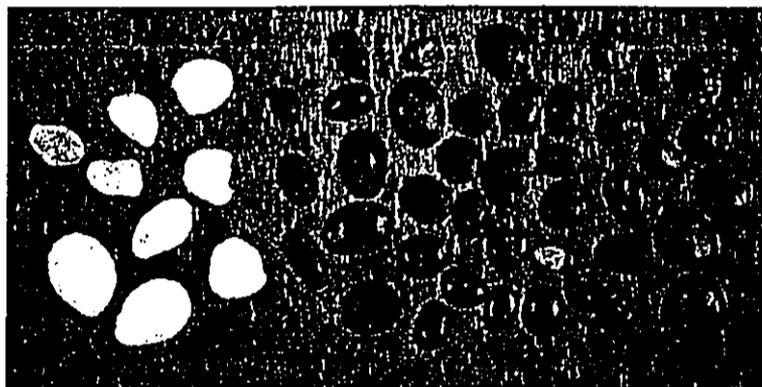


Figure 171. 'ili'ili from site 50-10-18-23356, feature 147.

Bobby Camara collected a breadloaf sinker from a cave outside the inventory survey area *mauka* of Punaloa Point. The sinker is made of vesicular basalt with a distinctly reddish color, outside the range of colors included in a standard Munsell soil color chart. He also collected 20 pieces of volcanic glass from site 50-10-18-23356 feature 147. Eleven of these are complete flakes, five are broken or incomplete flakes, and four pieces are shatter.

Coral Artifacts

Nine white coral 'ili'ili pieces were collected from the interior of site 50-10-18-23356, feature 147 along with 40 black lava pieces (see pg. 254) as part of field catalog 22. The coral pieces are medium gravels, 12-18 mm in diameter (fig. 171). They are rounded and sub-discoidal to discoidal in shape. Four of the pieces are white over their entire surfaces and the other five show a brown stain over all or a portion of one side.

Three coral edge abrader fragments were also recovered from the interior of cave site 50-10-18-23355, feature 147. The largest, 56 mm and 24 mm wide, has five facets forming two sharp edges suited for cutting grooves or sawing. It is broken at both ends. The two smaller fragments both have a single edge.

Bobby Camara collected six coral abraders from site 50-10-18-23356. There are four coral edge abraders and one surface abrader from cave feature 147, collected on two occasions assigned field catalogs 28 and 31, and a surface abrader from the midden pile outside the cave, field catalog 30. He also collected two large surface abraders from site 50-10-18-23355 cluster A, a collection assigned field catalog 29.

Shell Artifacts

The shank of a beautifully finished nacreous shell fishhook was recovered from an eroding deposit at site 50-10-18-23356, feature 63, a location assigned field catalog

23. The shank was broken before the bend and is 25 mm long. The head is pointed with a distinctive protruding knob, HT4 in the classification of Sinoto (1968).

Bobby Camara collected three highly weathered cowry shell octopus lures from a cave outside the survey area *mauka* of Punaloa Point. All of the shells have the characteristic two perforations on the dorsum. Two of them have all or a portion of the columellar lip removed, but the columellar lip is present in the third shell.

Camara also collected six shell artifacts from site 50-10-18-23356. From cave feature 147 he collected a cowry shell octopus lure (fig. 172 *a*), a cowry shell scraper (fig. 172 *b*), and two *puka* shells. From the large midden pile outside the cave came a large perforated miter shell that Camara believes was used as a gourd stopper (fig. 172 *c*). A nacreous shell fishhook fragment collected from the midden pile outside site 50-10-18-23356 feature 113 has a complete incurved point and bend, but the shank is broken below the head (fig. 172 *d*).

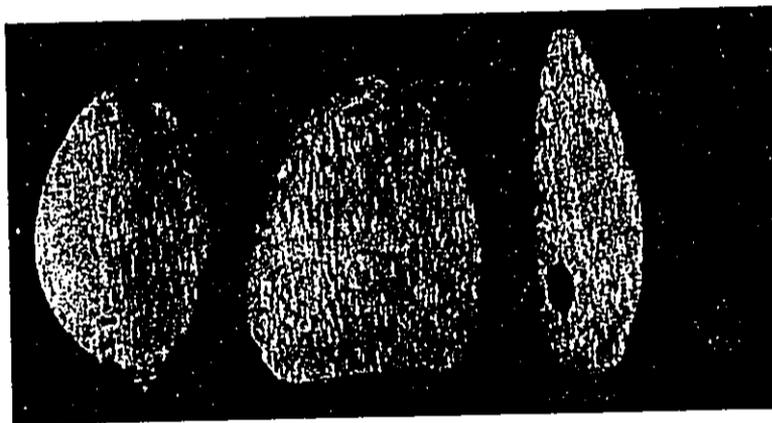


Figure 172. Shell artifacts collected by Bobby Camara. *a* Octopus lure, *b* scraper, *c* gourd stopper, *d* fishhook fragment.

Sea Urchin Spine Artifacts

Bobby Camara collected three sea urchin spine files from site 50-10-18-23356, feature 147. Two of them are worked on the proximal end. The position of the working surface of the third fragment can't be determined with confidence.

Discussion

Quantitatively, volcanic glass debitage dominates the collection at all excavated proveniences. The production of flakes for immediate use appears to have been the goal of lithic reduction at site T-140 feature B, site 50-10-18-23355, feature 23, and site T-164 feature A. Clearly, a good deal of volcanic glass was reduced at these sites, probably using a bipolar technique. Basalt debitage is also present at some sites, though in much smaller amounts. Volcanic glass flakes were the primary lithic tool produced,

although little evidence of use-wear or retouch was found on the flakes. The presence of hammerstones at site 50-10-18-23355, feature 23 and site T-164 complete the lithic reduction toolkit.

Functionally, the volcanic glass flakes were likely used for simple scraping tasks such as defleshing bone. Given the presence of sharply incised cut marks on some of the bone recovered at Kekaha Kai, it is also plausible that the flakes were used to cut or score bone during the early stages of bone tool manufacture.

A second important tool type in the collection is the vesicular basalt abrader. These tools take two forms, tabular and sub-conical. The tabular variety exhibits up to two types of working surface. The first and most common is the broad, flat surface of the stone. The second, found on half the tabular abraders, consists of a beveled edge formed on a lateral margin of the stone. This type of working edge would be well suited for sawing in the early stages of bone tool manufacture, examples of which are the fishhook tabs recovered at these sites. Given the large amounts of worked bone in the site T-164 artifact assemblage, it seems clear that the abraders were central to the production of bone fishhooks, awls, and other implements. Larger tabular abraders were probably used during the initial shaping of tool blanks and preforms, while the sub-conical abraders were likely used to work curved objects such as fishhooks.

Substantial modification of the lateral margins of the hammerstones in the site T-164 collection suggests that some attempt was made to work them into more formal tool types such as adzes or 'ulu.

Adze fragments and flakes with ground surfaces were also recovered from site T-140, site 50-10-18-23355, feature 23, and site T-164. Although a small amount of basalt debitage was also found at these sites, it is unlikely that adze manufacture was performed here on any scale. The ground lithic flakes are more likely the result of use-breakage of existing adzes at the site.

¹⁴C Dating

Thirteen samples of identified, short-lived materials were submitted to Beta Analytic, Inc. for ¹⁴C dating (table 11). Nine of the samples were *kukui* nutshells, two were the native shrub *Chenopodium oahuense*, and two were the native shrub *Chamaesyce* sp. The *kukui* nutshells were collected from looters' back-dirt piles at cave sites 50-10-18-23355, feature 23, T-140 feature B, and T-164 feature A. Because *kukui* trees do not grow near the caves today, and almost certainly did not do so in the past, the ages of the nutshells can be confidently associated with their deposition in the caves by native Hawaiians. The native shrubs were selected from charcoal samples recovered from the dune profile at Manini'owali Bay (see pg. 99) and identified by Gail Murakami of the International Archaeological Research Institute Wood Identification Laboratory. Taxa identified in the samples include only native and Polynesian-introduced taxa; modern introductions and non-native taxa present in the vicinity of the sites today were not identified in the samples.

At Beta Analytic, each sample was gently crushed and dispersed in deionized water. It was then given hot HCl acid washes to eliminate carbonates and NaOH alkali washes to remove secondary organic acids. The alkali washes were followed by a final

acid rinse to neutralize the solution prior to drying. Chemical concentrations, temperatures, exposure times, and number of repetitions, were adjusted according to the characteristics of the particular sample. Each chemical solution was neutralized prior to the application of the next solution. During this series of acid and alkali rinses, potential contaminants such as sediments and rootlets were eliminated. This is considered a "full pretreatment."

Each of the samples provided plenty of carbon for accurate measurements and all the analyses went normally. No students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses.

The dating results are presented as conventional radiocarbon ages (Stuiver and Polach 1977), which by definition include a correction for isotopic fractionation.

§13-278-4(c)(3)(C)

Table 11. ^{14}C samples

Field Cat.	Sample	Material	Wt. (g)	Beta-	$^{13}\delta$ per mil	CRA*	95%HPD† (A.D.)
10	013-10-1	<i>Chamaesyce</i> sp.	0.2	167589	-12.4	250±40	1655-1811
10	013-10-2	<i>Chenopodium</i> <i>oahuense</i>	0.32	167590	-25.9	230±40	1663-1812
11	013-11-1	<i>Chamaesyce</i> sp.	0.07	167591	-11.4	210±40	1527-1794
11	013-11-2	<i>Chenopodium</i> <i>oahuense</i>	0.23	167592	-26.6	250±40	1519-1794
03	013-3-1	<i>Aleurites moluc-</i> <i>cana</i> nutshell	0.5	167583	-23.3	200±40	1647-1844
03	013-3-2	<i>Aleurites moluc-</i> <i>cana</i> nutshell	0.6	167584	-26.1	110±40	1676-1857
03	013-3-3	<i>Aleurites moluc-</i> <i>cana</i> nutshell	0.3	167585	-22.3	140±40	1671-1849
01	013-1-1	<i>Aleurites moluc-</i> <i>cana</i> nutshell	0.9	167580	-22.3	130±40	1666-1841
01	013-1-2	<i>Aleurites moluc-</i> <i>cana</i> nutshell	0.5	167581	-23.1	140±40	1662-1837
01	013-1-3	<i>Aleurites moluc-</i> <i>cana</i> nutshell	0.3	167582	-22.4	370±40	1453-1642
09	013-9-1	<i>Aleurites moluc-</i> <i>cana</i> nutshell	0.2	167586	-23.8	210±40	1642-1814
09	013-9-2	<i>Aleurites moluc-</i> <i>cana</i> nutshell	0.2	167587	-23.3	190±40	1651-1814
09	013-9-3	<i>Aleurites moluc-</i> <i>cana</i> nutshell	0.5	167588	-25.1	190±40	1655-1814

* CRA = Conventional ^{14}C age

† HPD = Highest posterior density

The samples were calibrated using the BCal software package (Buck et al. 1999), using the 1998 international standard atmospheric curve (Stuiver et al. 1998). The *kukui* nutshell samples from the looted caves were calibrated as a single, unordered group, with no *a priori* chronological information for the lower boundary of the event, and a date of A.D. 1820±30 for the upper boundary. The prior chronological information for the upper boundary indicates the belief, based on the general lack of historic materials in the caves, that they were abandoned by the early historic period. The native shrub samples from the dune profile were calibrated using a model derived from the dune stratigraphy. The model specifies that the ages of the samples from Layer III are not

younger than the ages of the samples from Layer II, which reflects a belief in the stratigraphic integrity of the dune profile but takes into account the possibility that some Layer III charcoal could be mixed into the unconsolidated sands of Layer II.

The 95% highest posterior density regions, given in the column of table 11 labeled "HPD," indicate the most likely calendar date range for the age of each sample. BCal forms the interval by choosing the years with the highest posterior probabilities and summing their probabilities until the total probability included in the intervals corresponds to 95%. In this manner, any year included in a reported HPD region has a higher posterior probability than any year outside the region. Where the BCal software reported multiple intervals, these were ignored and the total range reported instead. Graphical representations of the calibrations are presented in appendix G.

Wood Charcoal Identification

Twenty-nine woody taxa were identified in the two samples from Kua Bay, three from site 50-10-18-23355, and one each from sites T-140 and T-164. In addition, *Aleurites* kernel and nutshell were identified. Parenchyma tissue was also recognized but not identified further to taxa. Six woody taxa remain unidentified. The identified samples comprise six Polynesian introductions and possibly 23 native woody taxa. The Polynesian introductions include four trees, one shrub, and one vine. The native taxa include 10 shrubs and 13 trees. These taxa have been found in environments ranging from coastal to alpine. Coconut, *kamani* and *dheahea* are known to grow in coastal environments but most of the taxa occur in mesic to dryland habitats.

The results of wood charcoal identification are presented in the report by Gail Murakami in appendix F.

Chapter 6

Data Analyses

This chapter presents results of analyses carried out on excavated materials and survey data collected during the inventory survey. The excavated materials derive primarily from looters' back-dirt piles at the cave sites 50-10-18-23355, feature 23, T-140 feature B, and T-164 feature A. These sites yielded abundant vertebrate faunal remains, artifacts, and short-lived dating materials. Dating analyses were also carried out on dated samples from the Manini'ōwali dune profile, which yielded the only securely stratified cultural deposits in the project area. Survey data chosen for analysis derive primarily from site 50-10-18-23355 at Kākapa Bay, where preservation has been good and a relatively large area was surveyed.

The analyses reported here focus on dating and vertebrate faunal remains, rather than artifacts, because the artifact collections are presumably missing many of the most interesting and diagnostic specimens.

The ages of the sites are analyzed first, using a Bayesian statistical framework (Buck et al. 1996) as implemented by the BCal software package (Buck et al. 1999). The aim of this analysis is to estimate the duration of occupation at each site based on the available dating evidence. The lack of stratigraphic context for the dated samples renders the results relatively imprecise, but the exercise does accurately summarize the current state of knowledge on an important topic of inquiry.

Next, the large vertebrate faunal collections from the looted cave sites are compared with collections from other archaeological sites on leeward Hawai'i Island. This comparison extends an analysis of vertebrate faunal remains recovered from temporary habitation sites located near more than a thousand *pāhoehoe* pits on the lands immediately *mauka* of the survey area in Manini'ōwali and Kūki'o 2nd *ahupua'a* (Dye 2002). The goal of that analysis was to determine whether pumice left by seabirds in 17 of the *pāhoehoe* pits was evidence of widespread use of the pits as seabird nests, which were harvested by traditional Hawaiians in much the same way mullet and milkfish were harvested from fishponds. Results indicated that the temporary habitation sites did not have elevated levels of seabird bones, thus providing no support for the seabird nest hypothesis. It was argued, however, that the negative results didn't necessarily damage the hypothesis.

If *pāhoehoe* pits were constructed as seabird nests then it is reasonable to expect that sites in the vicinity would show elevated levels of seabird bones when compared to areas that lack *pāhoehoe* pits. However, comparative faunal analyses failed to show any concentration of seabird bones in the project area sites. Instead, the analyses clearly indicate the dominant position of fish in the diet, consonant with an interpretation of the sites as fishermen's shelters. These results are difficult to interpret for several reasons. First is the question of whether it really is reasonable to expect elevated levels of bird bones in sites temporarily inhabited by fishermen, such as those excavated in the project area? This concern is allayed somewhat by the presence of basalt cobble hammerstones, similar to the tools found abandoned at *pāhoehoe* pits throughout the project area, in several of the temporary habitation sites, where they have no clear function. Still, if the pits did attract large colonies of nesting seabirds, which were harvested for food, then it might be more reasonable to suppose that they were managed by people with a more regular and lasting presence at the coast. Also, given the fondness of chiefs for the flesh of some young seabirds, it might be reasonable to expect that most of the birds harvested at the pits were not consumed locally, but instead were transported to chiefs living elsewhere (Dye 2002:91).

The vertebrate faunal collections from the caves provided materials with which to test the idea that the *pāhoehoe* pits were managed by people with a more regular and lasting presence at the coast than the fishermen who inhabited the shelters on the lands *mauka* of the project area. This was especially the case with cave site 50-10-18-23355, feature 23, which is located at the *makai* end of trail site 50-10-18-5337 around which most of the *pāhoehoe* pits are located (Dye 2002:64 ff.). If the hypothesis that the *pāhoehoe* pits were seabird nests harvested by traditional Hawaiians with permanent habitations along the coast is correct, then it is expected that at least this site should yield elevated numbers of bird bones.

One of the somewhat surprising results of the comparative faunal analysis carried out by Dye (2002) is that the typical archaeological faunal collection is likely too small for detailed comparison. A correspondence analysis of faunal collections in which specimens were identified to the lowest possible taxonomic level yielded results that were not archaeologically interpretable. Instead, the results indicated that the analysis was likely swamped by variability linked to small sample sizes. Correspondence analysis only yielded interpretable results when specimens were grouped at the level of taxonomic class, a procedure that markedly increased the number of identified specimens per category at the expense of taxonomic detail. The large faunal collections from the looted cave sites provide a test of the hypothesis that the typical archaeological faunal collection is too small for detailed comparison. This hypothesis is explored in two ways. First is an empirical demonstration of the effect of sample size on the diversity of vertebrate faunal collections from leeward Hawai'i Island. The relationship of sample size and collection diversity is well known in archaeology (Grayson 1984; Leonard and Jones 1989)—rare taxa are under-represented in small collections and are often missing altogether. These effects vary according to the richness and even-

ness of the sampled population, so that the number of identified specimens of a given material type that constitutes an adequate sample size for detailed comparison in a particular region is best determined empirically. Second is a detailed comparison of the fish fauna from the three looted cave sites with information on the abundance of fishes in the nearshore waters along the Kekaha coast. This comparison yields information on natural and cultural determinants of the fish fauna present in the caves.

The chapter ends with an comparative analysis of habitation floor area that expands the investigation of regional differences in traditional Hawaiian architecture.

evenness

Chronology

¹⁴C analyses from four proveniences—three looted cave sites and the Manini'ōwali dune—yielded information on duration of occupation. The ¹⁴C dates from looted cave sites T-140 feature B, 50-10-18-23355, feature 23, and T-164 feature A provide point estimates for three use events at each site, which exist independent of information on stratigraphic context. The three dated use events can be treated as samples from a dateable use event population composed of all the dateable materials in each site, whose distribution over time comprises all of the direct dating evidence left behind by traditional Hawaiians. How well a sample of dates represents the range of the population distribution depends in part on the nature of that distribution. For instance, a distribution in which a long period of very low intensity use is followed by a short period of high intensity use would be relatively difficult to estimate with a sample; chances are low that a sample from the long period of low intensity use would be selected for dating leading most likely to a large underestimation of the duration of site use. On the other hand, a distribution in which the intensity of use was constant over time would be relatively easy to estimate with a sample because samples of all ages would be equally likely to be selected for dating. A second source of imprecision is introduced by the lack of stratigraphic context, which might in favorable circumstances be used to put an upper bound on the age of the cultural deposit. A lower bound on the age of the cultural deposit can be inferred from the general lack of historic-period materials in the caves, and has been incorporated into the calibration in the form of an assertion that the caves were abandoned by A.D. 1820±30. The lack of a similar constraint on the upper bound of the age means an increase in the likelihood that the procedure overestimates the age of the initial occupation event, though there is no way to determine whether this has in fact occurred.

An estimation of the duration of occupation at each of the caves using Bayesian techniques yields the best estimate possible with the information available, given the circumstances left behind by looters.

The 95% highest posterior density region (see pg. 259) for the duration of occupation of site T-140 feature B is 134–982 years (fig. 173). The long tail on this distribution clearly shows the effect of a lack of constraint on the upper age of the site use. The 67% highest posterior density region is 200–467 years, which narrows the range by more than 500 years with relatively little loss in the confidence of the estimate.

The 95% highest posterior density region for the duration of occupation at site 50-10-18-23355, feature 23 is 3–440 years (fig. 174). At 67% it is 26–188 years.

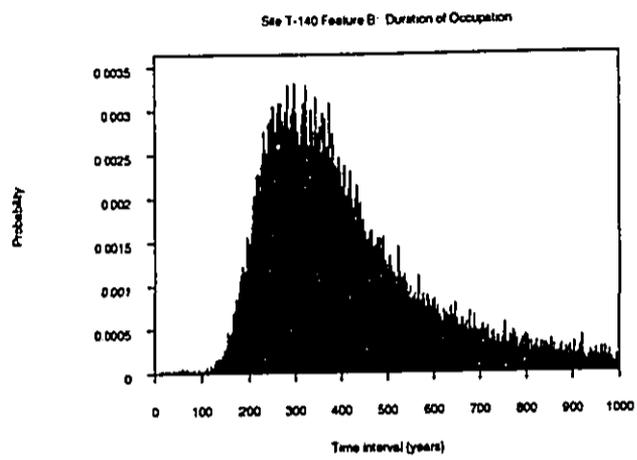


Figure 173. Estimate of the duration of occupation at site T-140 feature B. Graph produced by the BCal software package (Buck et al. 1999).

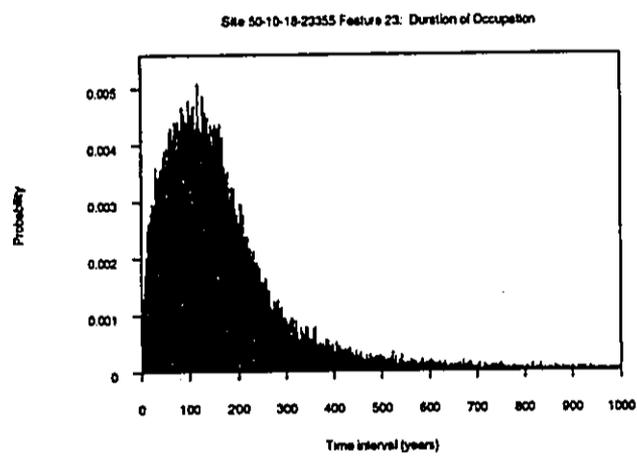


Figure 174. Estimate of the duration of occupation at site 50-10-18-23355, feature 23. Graph produced by the BCal software package (Buck et al. 1999).

The 95% highest posterior density region for the duration of occupation at site T-164 feature A is 2–433 years (fig. 175). At 67% it is 8–126 years.

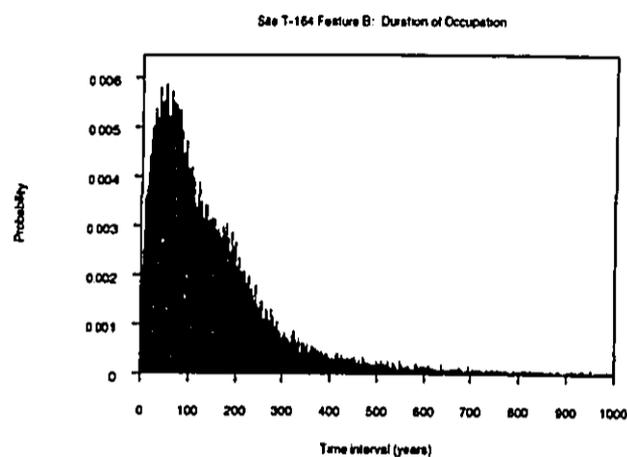


Figure 175. Estimate of the duration of occupation at site T-164 feature A. Graph produced by the BCal software package (Buck et al. 1999).

The situation is different at the Manini'ōwali dune profile where two cultural layers, both of which were dated with multiple samples, are present. Here the constraint on the lower age range of layer III is not the assertion that the site was abandoned in A.D. 1820±30, but rather the upper age of layer II. The upper age range of layer III is still unconstrained. The age of layer II is constrained at both ends, by the lower age range of layer III and the assertion that traditional Hawaiian habitation at the dune ceased in the early historic period.

The 95% highest posterior density region for the duration of occupation represented by layer III is 1–1,015 years, a statement that could have been made without the benefit of dating evidence given that the traditional Hawaiian period likely lasted only about 1,000 years (fig. 176). Once again, the long, unconstrained tail of this distribution yields a large age range estimate. At 67% it is 1–246 years, a reduction of about 750 years in the range with only a small loss in the confidence of the estimate.

The 95% highest posterior density region for the duration of occupation represented by layer II is 2–188 years; at 67% it is 3–91 years (fig. 177). These relatively narrow ranges illustrate the benefit gained in the Bayesian approach by the inclusion of supplementary sources of dating information in an explicit statistical model.

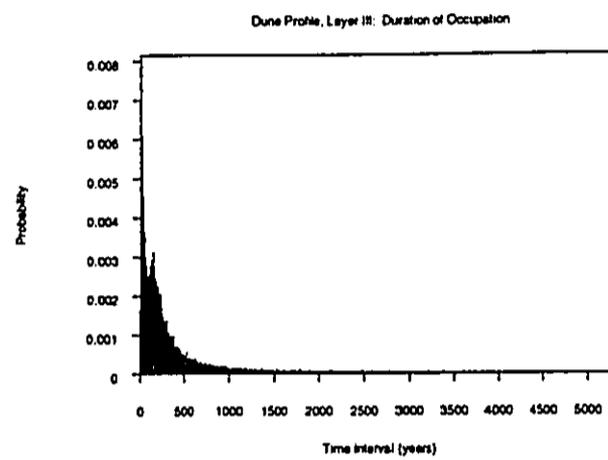


Figure 176. Estimate of the duration of occupation represented in the Manini'owali dune profile, layer III. Graph produced by the BCal software package (Buck et al. 1999).

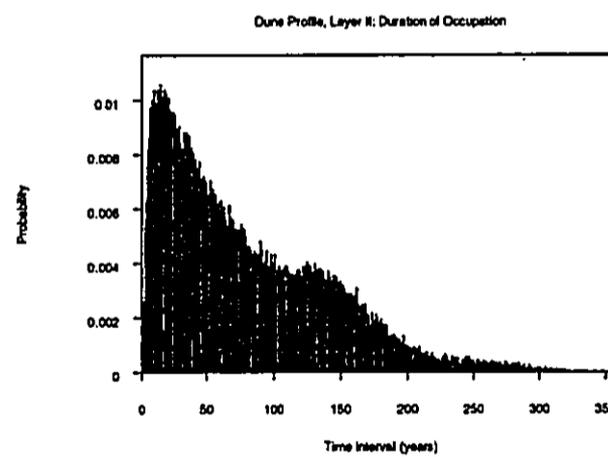


Figure 177. Estimate of the duration of occupation represented in the Manini'owali dune profile, layer II. Graph produced by the BCal software package (Buck et al. 1999).

Vertebrate Fauna

Vertebrate faunal collections from thirteen sites in Kona, Kohala, and Hāmākua districts were selected to compare with the vertebrate faunal collections from sites T-140 feature B, 50-10-18-23355 feature 23, and T-164 feature A. The sites are briefly described in appendix H and their forms and hypothesized functions summarized in table 12.

The sites are divided geographically into four groups: an 'Anaeho'omalu group located just over the Kona boundary on the coast of South Kohala about 18 km north of the project area; the field system group comprised of sites within or near agricultural lands; the upland group of high elevation cave sites; and the Kekaha group of sites in the dry coastal portion of Kekaha at and nearby the project area (fig. 178). Most of the sites are caves of one type or another, which typically yield well-preserved faunal remains. Most of the sites were classified by their excavators as temporary habitations, but two of the caves in the project area are classified as permanent habitations; site T-164 feature A is a large cave that contained numerous interior architectural features before it was looted, and site 50-10-18-23355, feature 23 is located within a *kauhale* at Kākapa Bay.

Table 12. Sites used in the comparative faunal analyses

Label	Site number	Form	Function
'Anaeho'omalu Group			
A1	50-10-10-11239	Blister cave	Temporary habitation
A2	50-10-10-11243	Cave	Temporary habitation
A3	50-10-10-11244	Cave	Temporary habitation
Field System Group			
F1	50-10-37-5151	Cave	Temporary habitation
F2	50-10-28-17938	Lava tube	Temporary habitation
F3	50-10-37-5157	Cave	Temporary habitation
Upland Group			
U1	50-10-22-16238	Cave	Temporary habitation
U2	50-10-31-19495	Lava tube	Temporary habitation
U3	50-10-31-19490	Lava tube	Temporary habitation
U4	50-10-31-19497	Lava tube	Temporary habitation
Kekaha Group			
K1	50-10-18-5341	Enclosure	Temporary habitation
K2	50-10-18-5349	Lava tube	Temporary habitation
K3	50-10-18-5354	Lava tube	Temporary habitation
K4	Site T-140 fea. B	Lava tube	Temporary habitation
K5	50-10-18-23355, fea. 23	Lava tube	Permanent habitation
K6	Site T-164 fea. A	Lava tube	Permanent habitation

The faunal collections from the sites vary widely in size, from the 59 identified specimens at 50-10-10-17938 in the field system group to the 21,233 identified specimens at site 50-10-18-5354 in the Kekaha group (table 13). This latter site yielded an exceptionally well-preserved faunal collection from a crack at floor level along one side of the lava tube. The large number of identified specimens is due in part to the large numbers of fish scales that were recovered. The collections from the three looted cave sites are all comparatively large. With the exception of site 50-10-18-5354, the largest collections elsewhere all contain fewer than 1,500 identified specimens. The

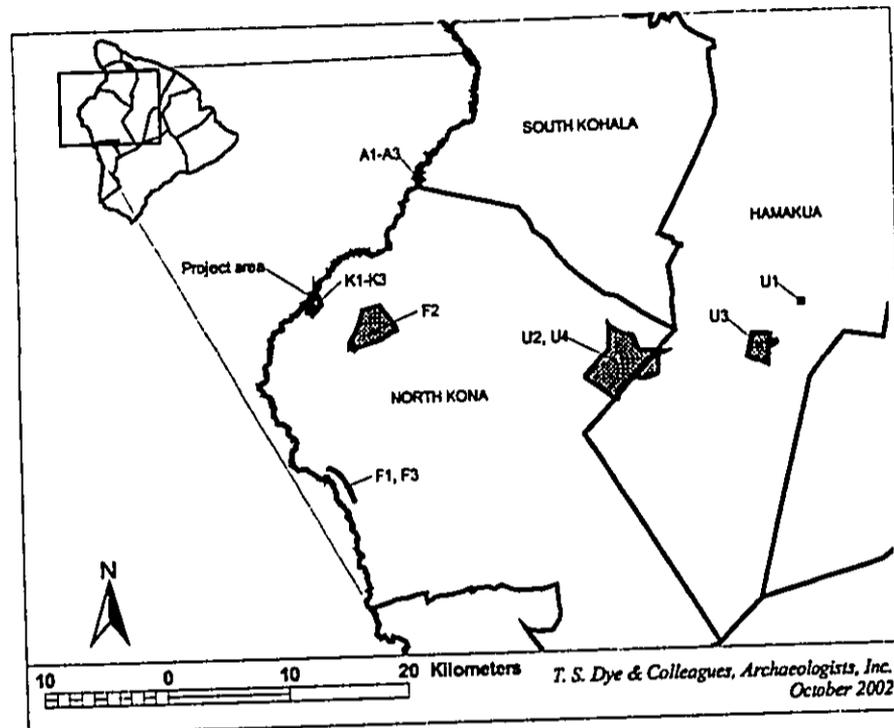


Figure 178. Locations of faunal collections used in the comparative analyses. Provenience labels indicate sites; see table 12 or 13.

collections from the looted cave sites are thus 4–10 times larger than collections usually made at sites in leeward Hawai‘i Island.

A correspondence analysis of the data in table 13, where the remains are classified by taxonomic class with the addition of a category for Polynesian rats, indicates that the composition of the faunal collections varies strongly by region (fig. 179). The first axis of the correspondence analysis plot distinguishes collections dominated by bird bone from collections in which fish, mammals, and rats are prominent. The second axis distinguishes collections with large numbers of mammal and rat bones from collections in which these types of bones are rare. The sites from each of the geographic groups plot with one another. Sites in the upland group are clustered in the lower right corner, indicating the preponderance of bird bones in these collections. Sites in the Kekaha group, including the three looted cave sites, are clustered in the lower left hand corner, indicating the overwhelming importance of fish in these collections. Between these two groups are sites in the ‘Anaeho‘omalu group, collections from which, though rather small, contain relatively great proportions of bird bone, primarily Bulwer’s petrel, in addition to fish. At the top left corner of the plot is a loose cluster of sites in the field

Table 13. Faunal collection numbers of identified specimens (NISP)

Site	Label	Oste- ichthyes	Aves	Mam- malia	Rat	Total
'Anaeho'omalū Group						
50-10-10-11239	A1	235	78	45	2	360
50-10-10-11243	A2	160	125	5	0	290
50-10-10-11244	A3	67	55	9	0	131
Field System Group						
50-10-37-5151	F1	651	24	47	94	816
50-10-10-17938	F2	30	15	11	3	59
50-10-37-5157	F3	849	46	104	338	1,337
Upland Group						
50-10-22-16238	U1	19	1,130	0	5	1,154
50-10-31-19495	U2	6	163	0	0	169
50-10-31-19490	U3	1	202	11	0	214
50-10-31-19497	U4	0	75	0	0	75
Kekaha Group						
50-10-18-5341	K1	272	3	0	1	276
50-10-18-5349	K2	1,398	46	0	2	1,446
50-10-18-5354	K3	21,115	101	16	1	21,233
Site T-140 fea. B	K4	10,181	73	3	47	10,304
50-10-18-23355, fea. 23	K5	5,338	33	9	11	5,391
Site T-164 fea. A	K6	14,666	45	15	36	14,762
Total		54,988	2,124	275	540	58,017

system group, where mammal and rat bones contribute significantly to the collections.

The positions in the plot of the upland, Kekaha, and field system groups are not surprising: the upland group of sites includes temporary habitations of bird hunters and adze makers working relatively close to the nesting sites of dark-rumped petrel; Kekaha, known as *kekaha 'ai 'ole* for its lack of vegetable foods, has a rich near-shore marine environment that supports a large and diverse fish fauna (Brock and Brock 1974); and the agricultural field systems were the sources of the vegetable foods used to feed pigs and dogs, and which coincidentally appear also to have supported large populations of Polynesian rat, which are present in low numbers elsewhere. The position of the 'Anaeho'omalū group, however, is surprising. Although the collections here are small, and thus there are grounds for caution in their interpretation, they do contain large numbers of bird bones. Only the sites in the upland group yielded more bird bones than site 50-10-10-11243 in the 'Anaeho'omalū group, despite the fact that the total collection from this site numbered only 290 specimens, a small fraction of the large collections from Kekaha.

This analysis indicates that comparison of faunal collections identified to the level of taxonomic class yields results that can be interpreted as regional variations in the types of animal foods eaten traditionally. The collections contain more information than was used in the analysis, however, in particular the identification of many specimens to lower taxonomic levels, including family, genus, and species. An initial correspondence analysis using lowest level identifications yielded results that were not archaeologically interpretable, presumably because variability associated with small sample sizes had an undue influence on the results (Dye 2002:77). Collection of large

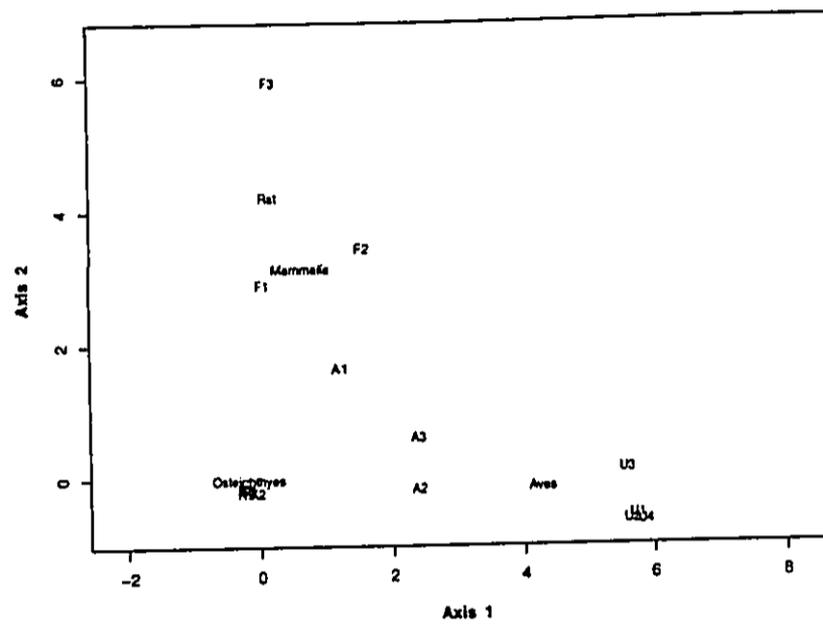


Figure 179. Correspondence analysis plot of faunal collections, axes 1 and 2. 73% of the inertia is accounted for by the first axis, 21% by the second. Note that all of the sites in the Kekaha Group cluster with "Osteichthyes" in the lower left corner.

richness
evenness

samples at the three looted cave sites provides an opportunity to explore the effects of sample size on the composition of faunal collections. Analyses were carried out to assess the influence of sample size on the richness and evenness of faunal collections from leeward Hawai'i Island. Richness and evenness are two measures of diversity whose relationship to sample size has been worked out theoretically for archaeological collections (Grayson 1984; Leonard and Jones 1989). Small samples underestimate both the richness and the evenness of the populations from which they were drawn. This is because items that are relatively rare in the population often do not appear in small samples, but are only recovered when large numbers of items are collected. Plots of both measures against sample size yield similar curves, which rise rapidly at first, then slowly approach population values. The curves describe a situation in which each specimen added to a small collection has a relatively great probability of contributing new information on diversity. As the collection grows, however, the probability that a new specimen adds information on diversity declines. The goal of the analyses reported here is to identify an inflection point on the curve where the expected information of a new specimen falls below a practical level and no longer justifies the effort spent in

its collection. The inflection point identified this way will indicate a minimum size for faunal collections that are likely to reflect the diversity of the populations from which they were drawn, and thus likely to be suited to more detailed comparative analysis.

A plot of richness as a function of sample size yields a curve with the expected shape (fig. 180).¹ The sample sizes used in the figure are the numbers of specimens identified to the lowest taxonomic units. Omitted were specimens assigned to higher-level taxa whose sub-taxa are present in the collection. The percentage of specimens identifiable to lowest taxonomic unit varied among collections from a low of 6% at site 50-10-22-16238 to a high of 96% at site 50-10-31-19497. In general, sites with a high percentage of bird bone had the highest percentages of bones identified to the lowest taxonomic unit, while those with a high percentage of fish bone had the lowest, suggesting that the taxa composition of the collection contributes to this variability along with such obvious factors as differences among faunal analysts and the design of identification projects. Between 7% and 9% of the collections from the three looted cave sites could be identified to lowest taxonomic level.

Among the Kekaha group collections, the usual relationship between sample size and richness can be clearly seen. Richness rises rapidly from four at site 50-10-18-5341, labeled "K1" in the graph, with 276 identified specimens to 25 at site 50-10-18-23355, feature 23, labeled "K5" in the graph, with 5,391 identified specimens. When sample sizes are small, each additional 1,000 identified specimens yields about four new taxa. Thereafter, the addition of specimens contributes relatively little to richness. Richness increases by six from the 25 taxa identified at site 50-10-18-23355 to the 31 taxa identified at site T-164 feature A, where almost 10,000 more identified specimens were collected. When sample sizes are this large, an additional 2,000 identified specimens are required for each new taxon. This suggests a practical limit of approximately 5,000 identified specimens yielding about 500 specimens identified to lowest taxonomic unit is needed to represent the richness of faunal assemblages from sites along the Kekaha coast. Note that this figure is specific to the situation along the Kekaha coast and is not necessarily applicable more widely. Faunal remains in the other geographic groups appear to be somewhat less diverse than those from Kekaha and collections in these areas might not need to be so large to be representative.

A plot of evenness, computed as H/H_{max} (Kintigh 1989:29), as a function of sample size shows a similar relationship (fig. 181). Here the maximum observed evenness is obtained in the collection from site 50-10-18-23355, feature 23, suggesting again that a collection with about 5,000 identified specimens is large enough to represent this aspect of diversity.

The large faunal collections from the looted caves can be compared with abundances of fish taxa offshore. Fishes were inventoried from the intertidal zone to about 10 m in depth at six stations on the leeward coast of Hawai'i island in 1972 (Brock and Brock 1974). Identifications were made while swimming along with semi-quantitative estimates of species abundance. A species was classified as abundant when more than 20 individuals were counted; abundant when 10-20 individuals were counted; few

¹Site 50-10-18-5354 is omitted from this analysis because the exceptional preservation of faunal remains at the site yielded a collection in which fish scales are over-represented. The number of identified specimens in this collection is large relative to sample diversity because faunal analyst Alan Ziegler is able to identify only one type of scale and the vast majority of scales are assigned to the high-level taxon, Osteichthyes.

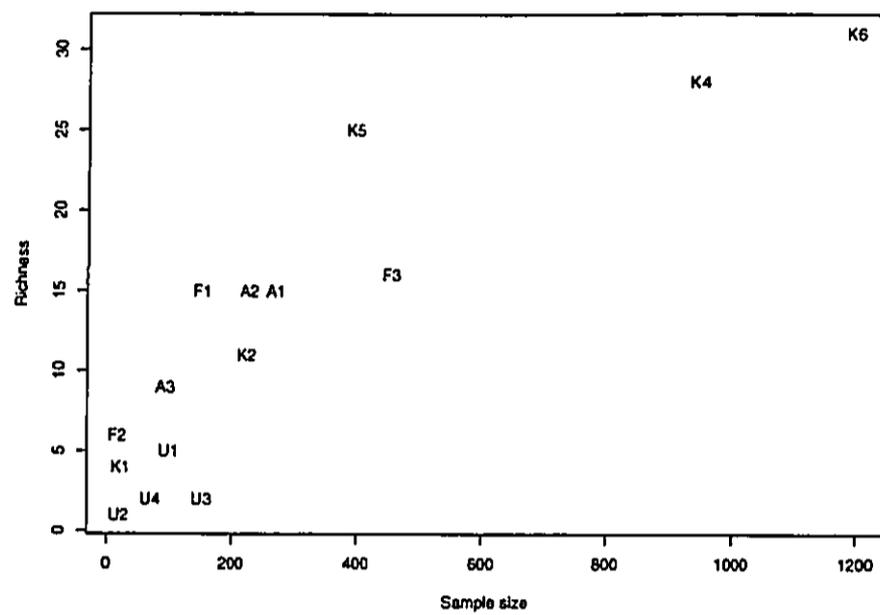


Figure 180. Richness of faunal collections

when 2–9 individuals were counted; and rare when only a single individual was seen.

Two of the sampling stations are located near the project area. Mano Point, north of the project area, is characterized as follows:

The shoreline of this area consists of an extensive lava rock bench several feet above sea level dropping vertically into 15 feet (3 m) of water. A large subtidal bench covered with coral ranging from 15 to 25 feet in depth fronts the shoreline. ... The water is very clear and, although the rock bench receives considerable wave action, the tidepools and rock faces with covered with invertebrates and algae. The fish fauna of this area was the richest in species diversity seen along the entire Kona coast (Brock and Brock 1974:17).

At Makalawena, immediately south of the project area, the nearshore environment was characterized as follows:

Along the northern section of the coast there is a well-developed beachrock and tidepools (receiving fresh water), while a sand beach is present in the southern sector. Corals in the northern area occur at depths of 6 feet (2 m) or more; however, due to the presence of sand in the shallows of the

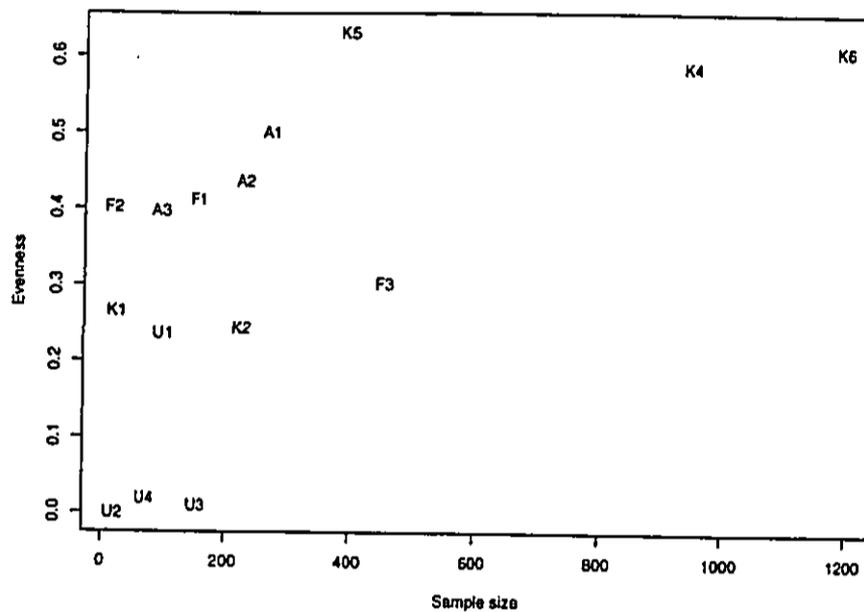


Figure 181. Evenness of faunal collections

southern portion of the Makalawena study area, prolific coral growth is not seen until a 20 foot (6 m) depth is attained. Moving offshore, these beds of corals in both habitats gently slope out to a depth of about 25 to 30 feet where there is a ledge paralleling the shore (Brock and Brock 1974:17).

The fishes inventoried at Mano Point and Makalawena are summarized by family in table 14. The table gives, for each family, the number of species in each of three abundance classes— abundant, common, and rare. None of the species at these two locations was classed as few. The families are ordered, roughly, by abundance, with the most abundant families at the top of the table.

The abundance of fish families in the waters adjacent to the sites can be compared with the relative abundances of bones in the archaeological collections (table 15). The two lists show marked similarities. Eight of the ten most common fish families are regularly found in the archaeological collections—Balistidae, Acanthuridae, Scaridae, Labridae, Mullidae, Holocentridae, Pomacentridae, and Apogonidae. In general, these fishes seem to have been taken in rough proportion to their abundances in the wild. The triggerfishes, family Balistidae, known in Hawai'i as *humuhumu*, appear at first glance to have been taken more frequently than their natural abundance would indicate. The relative abundance of this taxon in the collections is, however, more likely due to the

Table 14. Fish family abundances

Family	Mano Point			Makalawena		
	A	C	R	A	C	R
Acanthuridae	9	5		3	8	2
Pomacentridae	3	5	2	3	2	2
Labridae	2	9	3	2	3	5
Scaridae	3	3		1	3	2
Chaetodontidae	1	6	4		5	1
Mullidae	1	4	1		3	1
Holocentridae	1	3	1	1	1	2
Balistidae	1	1	4	1	4	
Apogonidae	1	1	2	1		
Kuhliidae	1			1		
Atherinidae	1					
Cirrhitidae		3			3	
Scorpaenidae		2	2		2	
Lutjanidae		2	1	1		1
Monacanthidae		1	3			3
Ostraciontidae*		1	1			3
Zanclidae		1			1	
Sparidae		1			1	
Fistularidae		1				
Priacanthidae		1				
Muraenidae			3		1	
Blenniidae			1		1	
Kyphosidae		1				
Gobiidae					1	
Tetradontidae		1				
Carangidae			3			
Aulostomidae			1			1
Pomacanthidae			1			1
Serranidae			1			
Scorpididae			1			
Ostraciontidae						1

Source: Brock and Brock (1974).

* Includes Canthigasteridae.

fact that it is one of the most highly visible fish in the collections, with more than 1,000 parts identifiable, including scales. The damselfishes, family Pomacentridae, a common one of which is known as *mamo* in Hawai'i, and the cardinalfishes, family Apogonidae, known in Hawai'i as *'upāpalu*, both appear to have been taken in somewhat smaller numbers than expected. Two fishes abundant in the offshore waters were not identified in the archaeological collections. The butterflyfishes, family Chaetodontidae, known in Hawai'i as either *kikākapu* or *lauhau*, have "relatively little value as food fishes" (Randall 1985:25) and thus might have been avoided by fishermen. The flagtails, family Kuhliidae, known in Hawai'i as *āholehole*, are fine food fishes, however, and their absence from the archaeological collections is perplexing. Fishes less abundant in nature not found in the archaeological collections are generally not valued as food fishes. Several of these are small fishes not generally worth the effort to capture, including: the silversides, family Atherinidae, commonly used as a baitfish; blennies, family Blenniidae; and gobies, family Gobiidae. Others are similar in shape

to the butterflyfishes, including: the angelfishes, family Pomacanthidae; and moorish idols, family Zanclidae. Still others are long and narrow, including: the cometfishes, family Fistulariidae; and trumpetfishes, family Aulostomidae. Also absent from the archaeological collections are rudderfishes, family Kyphosidae, known in Hawai'i as *nenue*, and their close relatives, the stripeys, family Scorpididae. The lack of *nenue* in the collections might be due to cultural preferences; they are "a food fish of some value, but not highly regarded in Hawaii" (Randall 1985:22).

Table 15. Vertebrate faunal taxa ranked by order of abundance

Taxon	Site		
	23355 fea. 23	T-140 fea. B	T-164 fea. A
Balistid	78	328	326
Acanthurid	77	159	293
Scarid	49	52	125
Labrid	59	68	89
Monacanthid	18	88	43
<i>Rattus exulans</i>	11	47	36
<i>Bulweria bulwerii</i>	12	44	26
Cirrhid	13	37	24
Mullid	11	18	43
Scombrid	3	17	41
Holocentrid	19	18	15
Diodontid	15	8	21
<i>Phaethon lepturus</i>	3	16	11
Pomacentrid	3	13	12
Carangid	1	0	25
Shark or Ray	2	0	14
<i>Canis familiaris</i>	7	1	6
Sparid	1	1	11
Priacanthid	0	6	3
<i>Sus scrofa</i>	2	0	7
Belonid	2	4	1
Congrid	0	1	6
Marine Eel	0	6	1
Ostraciontid	0	1	5
Apogonid	3	0	2
Polynemid	1	4	0
<i>Pterodroma phaeopygia</i>	1	4	0
<i>Gallus gallus</i>	4	0	0
Muraenid	0	2	1
Serranid	1	0	2
Tetraodontid	0	0	3
Lutjanid	0	0	2
<i>Oceanodroma castro</i>	0	1	1
Small Anatid	0	0	2
Sphyrænid	0	2	0
<i>Puffinus</i> sp.	0	1	0

Fishes found in the archaeological collections, but not inventoried in the nearshore waters, mostly include fishes whose ranges are not tied to reefs and which might have been absent when the inventories were made. These include: fishes that inhabit the open ocean, such as the tunas, family Scombridae, and needlefishes, family Be-

lonidae; fishes that are found in a wide range of environments, such as the barracudas, family Sphyraenidae; and the threadfins, family Polydactylidae, which inhabit sandy shores. Also present are two fishes that might have been overlooked by the inventory of nearshore waters. The spiny pufferfish, family Diodontidae, is extremely visible in archaeological collections because of its distinctive dermal spines, of which each individual possesses approximately 350. This fish might be present in very small numbers offshore. The conger eels, family Congridae, hide in the reef by day and come out at night to forage. They appear to have hidden successfully from the biologists.

Habitation Floor Area

An alternative method for comparing the size distribution of habitation floors from different areas was set out in chapter 3 (see pg. 32), where habitation floor sizes from Lapakahi, 'Anaeho'omalu, and Kaloko on Hawai'i Island and Hälawa, Moloka'i were compared and contrasted. The analysis showed considerable variability in floor sizes and this was related to environment, with the smallest houses located in the marginal environment of 'Anaeho'omalu, the largest houses in the lush windward valley of Hälawa, Moloka'i, and mid-sized houses in the relatively substantial leeward settlements at Kaloko and Lapakahi.

A substantial body of information on habitation floor sizes was collected during the inventory survey, especially at Käkapa Bay where site preservation was high and the survey covered a relatively large area. Floor areas of 56 enclosures, terraces, and platforms interpreted as habitations were recorded (table 16).

Table 16. Habitation floor sizes

Feature	Form	Area (m ²)
8	terrace	22.95
28	terrace enclosure	7.29
29	terrace	12.9
30	terrace enclosure	13.44
34	terrace	9.6
35	enclosure	39
36	terrace	8.37
53	enclosure	40.2
54	enclosure	19.5
56	terrace	13.2
64	terrace enclosure	19.04
73	clearing enclosure	12
93	terrace enclosure	93.5
96	terrace enclosure	69
97	terrace enclosure	81.6

Continued on next page

Table 16—Continued

Feature	Form	Area (m ²)
98	terrace enclosure	51.68
104	clearing enclosure	12.25
105	clearing enclosure	4
203.1	clearing enclosure	5
204	clearing enclosure	17.4
205	clearing enclosure	14.4
21	terrace	32.5
215	clearing enclosure	7.2
216	C-shape enclosure	26
217	C-shape enclosure	16
218	terrace	11.4
219	terrace	23.6
220	terrace	14.4
222	clearing enclosure	10.08
226	enclosure	180
226.1	enclosure	5.28
226.2	platform	18.2
228	enclosure	23.37
230	terrace	9.9
235	C-shape enclosure	5.94
236	terrace	20.28
236.1	C-shape enclosure	10.2
238	terrace	12.25
239	terrace	23.76
250	terrace enclosure	39.44
298	terrace	6.72
301	C-shape enclosure	7.04
303	C-shape enclosure	7.5
309	C-shape enclosure	4.5
310	terrace	17.28
314	enclosure	21
316	enclosure	8
318	terrace	26.25
321	terrace	9.75
327	enclosure	12.32
330	clearing enclosure	10
331	clearing enclosure	9.8
332	clearing enclosure	9.02
340	terrace	2.4
341	C-shape enclosure	4.35
396	clearing enclosure	12.22

A density plot of their distribution compared with habitation floor sizes at Lapakahi, 'Anaeho'omalū, Kaloko, and Hālawā (fig. 182) shows clearly that habitation features at Kākapa are relatively small; the median floor area of 12.6 m² is well under the medians for Lapakahi, Kaloko, and Hālawā, which fall in the range 20–24.5 m². The Kākapa features are larger than those from 'Anaeho'omalū, however, where the median floor area is only 5 m². The distribution for Kākapa also indicates that larger structures are relatively rare. The distribution curve falls off rapidly by 30 m², a size at which habitation features are relatively common elsewhere except at 'Anaeho'omalū. The one very large structure, feature 226, was heavily damaged by wave action, and it is questionable whether it ever enclosed a roofed structure, or simply enclosed a yard, possibly for the heavily damaged enclosure and platform at its *makai* end.

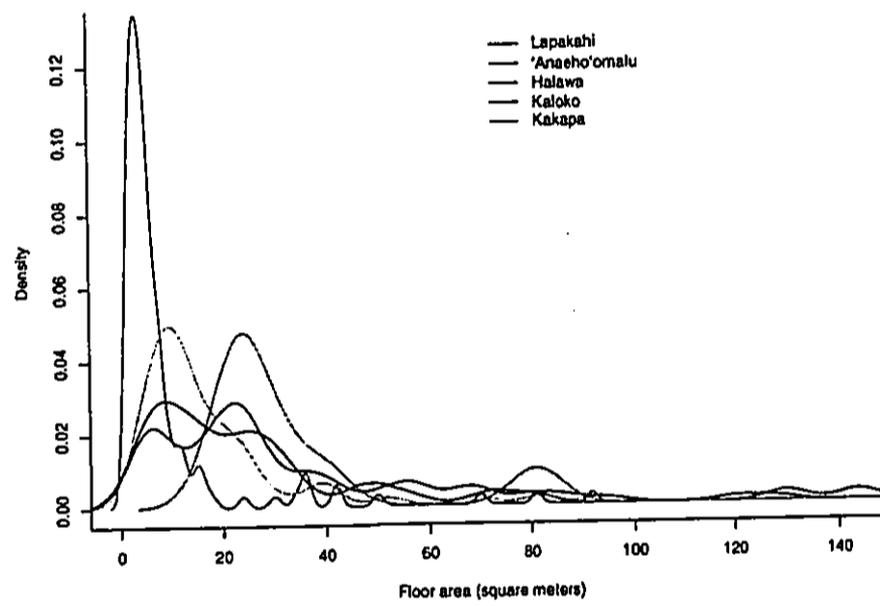


Figure 182. Comparison of habitation floor sizes at five Hawaiian settlements. See figure 6, page 33. The value of b for Kākapa is 13.3.

Chapter 7

Discussion and Significance Evaluations

Archaeological inventory survey of portions of Kekaha Kai State Park yielded information on more than 1,000 features spread unevenly over the landscape. Collection of settlement pattern data were constrained somewhat by the survey area boundaries, which followed proposed road and trail corridors in several places. Earlier reconnaissance level work fills some of these gaps, and the broad patterns of the settlement pattern are now relatively clear. This chapter pulls together the information gathered during the inventory survey to reconstruct the traditional Hawaiian mode of life along this portion of the Kekaha coast. The reconstruction should be useful to archaeologists as a source of hypotheses to test with future work, and to park managers tasked with interpreting the traditional Hawaiian landscape for park visitors.

This is followed by evaluations of site significance, which indicate which sites are eligible for listing on the Hawai'i Register of Historic Places and the qualities that make them eligible. In most contract archaeology work, significance evaluations play a large role in determining how sites will be treated before they are destroyed to make way for development. In this case, however, park development will preserve archaeological sites and the significance evaluations will be used, instead, to guide management of the sites so that they might educate and inspire visitors to the park and at the same time be preserved for the enjoyment of future generations.

The Traditional Hawaiian Mode of Life

Habitation features are most densely distributed on 'a'ā flows, which appear to have been favored habitation locales in traditional Hawaiian times. This shows very clearly at both ends of the project area, where large 'a'ā flows are the dominant landform. At Kākapa Bay, site 50-10-18-23355, habitation sites are all on 'a'ā lava; the *pāhoehoe* flow that divides the site in two supports trail site 50-10-18-16059, many *pāhoehoe* pits, and petroglyphs, but lacks enclosures, platforms, and terraces suited to habitation. Here, the preferential use of the *pāhoehoe* substrate was for transportation, art, and

creation of pits, all activities peripheral to the *kauhale*. At Awake'e Bay, site 50-10-18-23359, a similar pattern holds. Habitation features, including features occupied in historic times, are found on the 'a'ā flow at the south end of the bay. The adjacent *pāhoehoe* was very sparsely utilized, the most prominent features probably associated with historic period activities. An unusual causeway feature might be an historic trail for use by pack animals, and a large, oddly-shaped enclosure is probably a pen for animals. The other features on the *pāhoehoe* here are small temporary habitation lava tube shelters and outcrops that have been modified to create casual enclosures. None of these features yield an accumulation of material indicative of sustained habitation.

On *pāhoehoe* the tendency is toward habitation locations on the beach margin and around naturally habitable formations, in particular larger lava tubes. The habitation sites on the beach margin are remnants of a more substantial beach settlement that was present in the 1930s, when Reinecke recorded sites along the coast. White sand beaches have a fairly tenuous hold along this geologically young coast, and substantial accumulations of coral cobbles and small boulders at the inland margins of most sand beaches indicate the great effect that high waves have had. Many of the habitation features that are present along the *pāhoehoe* margin are in poor condition or partially buried by storm wave deposits. A small test excavation at one of these, enclosure feature 104 at site 50-10-18-23356, indicates that subsurface cultural deposits are present in the sand along the *pāhoehoe* margin. The deposit at feature 104 extended beneath the enclosure wall, indicating that it pre-dates construction of the surface feature. Subsurface deposits might well be present in the sand at the *pāhoehoe* margin elsewhere in the project area where sand beaches are relatively stable, regardless of the presence or absence of surface features. Back from the beach, habitation features on *pāhoehoe* are almost all associated with lava tube shelters, which appear to have been the primary loci for cultural deposition on the *pāhoehoe*. This pattern shows very clearly at the inland and southern clusters—F, G, H, and I—at Maniniōwali Bay site 50-10-18-23356 and at the south end of Kaho'iawa Bay where the features of clusters K and L are situated *makai* of several looted caves, including T-140 feature B, which was partially re-excavated as part of this project. The degree to which these natural caves attracted habitation in traditional Hawai'i is underscored by the large cave T-164 feature A, which was also re-excavated. This feature, outside the inventory survey area boundary, is located near the 'a'ā flow at the southern end of Awake'e *ahupua'a*, about 400 m from the coast. On the 'a'ā lava adjacent to the cave is site T-165, a complex of 37 habitation features (Donham 1987:84 ff.), whose detailed investigation and mapping would provide an interesting comparison to the habitation clusters at Kākapa Bay. The essentially bare *pāhoehoe* surrounding the cave site contrasts strongly with the extensively modified 'a'ā flow, reinforcing the idea that 'a'ā was a preferred substrate for habitation.

The reasons for this preference are probably to be found in characteristics of the 'a'ā substrate and the relative ease with which it is worked. Although, at first glance, the flatness of *pāhoehoe* would appear to make it preferable for habitation, in fact most sections of *pāhoehoe* are uneven and have some degree of slope. 'A'ā flows throughout the project area, on the other hand, were worked to create nearly perfectly level living surfaces. This was typically accomplished by removing cobbles and small boulders and either re-arranging the remaining pebbles and small cobbles to produce a flat surface,

or by crushing them, most likely with a water-worn basalt cobble hammerstone similar to those found throughout the project area, to achieve an even finer effect. The floors thus produced, flatter than a typical *pāhoehoe* flow, have the added benefit of being extremely well-drained, a characteristic that probably made them more comfortable during the heavy rains that fall infrequently along this coast. The plaited pandanus mats typically used as floor coverings in traditional Hawaiian houses were rugged and long-lasting, but rotted quickly if exposed to moisture for extended periods. In this respect, houses built on an 'a'ā substrate probably required much less upkeep than houses built on *pāhoehoe*. A final advantage of 'a'ā is that house-posts can be set into it with relative ease, relieving the need to construct stout walls capable of anchoring posts.

A comparison of residential feature floor areas at site 50-10-18-23355 with other sites on Hawai'i and Moloka'i Islands indicates that the houses at Kākapa Bay were relatively small (see pg. 276). This pattern was tentatively related to broad environmental factors; the largest houses are found where irrigated agriculture was practiced and the smallest houses were found where a harsh environment made agriculture impossible. As the survey and mapping progressed from north to south, however, changes in the types of habitation features were observed. In the north, the clusters of features on 'a'ā described as *kauhale* comprise a diverse range of feature types and sizes in tight spatial association. Moving south, the tendency is toward larger, rectilinear structures, relatively isolated, with few outlying structures. Some of this is undoubtedly due to differences in substrate—the 'a'ā surface, with its jumble of boulders, cobbles, and pebbles is relatively easy to modify and even small modifications leave a lasting trace. The mapping crews observed repeatedly that the longer one mapped in the 'a'ā the more features one found, most of them composed of small, subtractive components capable of having been built in a manner of minutes. The situation is different on *pāhoehoe* where subtractive components, other than the ubiquitous *pāhoehoe* pits that are not spatially associated with habitation features, are relatively rare. These observations suggest that the broad patterns in residential feature size related to environment noted above do not take into account the variability introduced by local circumstances.

Differences in substrate do not appear to explain all of the differences in habitation feature types, however. Clustering of features of different types and sizes, the pattern observed at Kākapa Bay, is one indicator of occupational stability, and is a primary characteristic of so-called permanent habitations (Cordy et al. 1991). Several independent lines of evidence point to the conclusion that the Kākapa Bay site was a central habitation location along this section of coast. The first of these is that the traditional Hawaiian settlement at Kākapa Bay was a central place in the transportation network that served the Kekaha Kai coast. The site is connected to other sites in the region by four trails. Two of these are *mauka-makai* trails, including site 50-10-18-16059, which heads north through Kūki'o 1st *ahupua'a*, and two branches of site 50-10-18-5337, which connect near Pu'u Pāpapa and head *mauka* south of Kākapa Bay. The other two are branches of the coastal trail, which connect the site to other coastal sites to the north and south. The site was also connected by sea routes up and down the coast, as indicated by the presence of one and possibly two canoe sheds, features 86 and 367. In contrast, the other coastal sites are connected to sites north and south by branches of the coastal trail and at most one *mauka-makai* trail (table 17). A single ca-

noe shed was recorded at each of the other sites, except that none was found at Awake'e Bay. In graph theory, this type of centrality, measured by the number of edges or lines incident with a node or site, is known as degree centrality and is interpreted as an index of communication activity (Hage and Harary 1996:12). In this case, the relatively great level of communication activity indicated by the centrality of site 50-10-18-23355 is interpreted as a function of the site's occupational stability. People went to Kākapa Bay more frequently than to the other sites because more people were more often there.

Table 17. Degree centrality of coastal sites

Site	Location	Trails	Halau*	Centrality
50-10-18-23355	Kākapa Bay	4	2	6
50-10-18-23356	Manini'ōwali Bay	2	1	4
50-10-18-23357	Puna'loa Point	2	1	4
50-10-18-23358	Kaho'iawa Bay	3	1	5
50-10-18-23359	Awake'e Bay	3	0	3

* Halau indicate two transportation routes, one up and one down the coast.

Another indication of the centrality of Kākapa Bay is the presence of an un-named *heiau* ascribed to Kamehameha I, one of the great ruling *ali'i* of the island. This *heiau* is the most massive structure in the survey area, and the level of effort expended in its construction is one or two orders of magnitude greater than any other structure. Most of the 57 features interpreted as shrines or as components of shrines elsewhere in the survey area have areas less than 20 m², and the largest shrine, feature 1 at site 50-10-18-23356, an enclosure surrounding a red boulder at the topographically highest point of the site, is just under 60 m². In contrast, the platform of the *heiau* is almost 120 m² and stands more than a meter high. Its size clearly sets it apart from other religious structures along this portion of the Kekaha coast, and indicates the Kākapa community's participation in regional social and political activities. The suggestion, apparently first made by Sinoto and Pantaleo (1990), that the plan of the *heiau* is notched in the Maui Island style and is unique on Hawai'i Island, would underscore the site's centrality by bringing Maui Island into its sphere of communication and influence. This suggestion is probably a red herring, however, for two reasons. The first is that *heiau* sites with plans that might be classified as notched, although not plentiful on Hawai'i Island, are present. Examples in Kona include Pa'ikapahu at Kealakekua and Hāhāpō at Keālia, and in Ka'u include Kukuiohaloko or Kanaha at Kawela and Lanipao at Punalu'u (Stokes 1991). Thus, the presence of a notch in the plan of a Hawai'i Island *heiau* isn't so unusual that it must indicate, *a priori*, a connection to Maui Island. Second, the notch in the *heiau* at Kākapa appears to be present not so much as a feature of the structure's design, but rather as a pragmatic response to avoid building against a large outcrop at this corner of the structure.

In comparison to the Kākapa Bay site, the numerous features of site 50-10-18-23356 at Manini'ōwali Bay are dispersed over a large area. Portions of the site have been disrupted by bulldozing, four-wheel drive vehicles, and the numerous campers and beach-goers, making it somewhat more difficult to characterize. The primary focus of the site appears to have been the 'a'ā flow at the north end, with features set on all sides of the anchialine pond at its base. A secondary focus at the south end of the site

centered on a series of habitable lava tubes. An inland cluster was built around a lava tube cave open at both ends, with only a thin deposit of living debris. The lack of an obvious *mauka-makai* trail to the site is somewhat puzzling, and it might be that the road bulldozed from the highway to the bay obliterated it (see pg. 18). The settlements at Punaloa Point and Kaho'iawa Bay were on a much smaller scale. At Awake'e, settlement during the historic period makes interpretation of the traditional Hawaiian pattern difficult. The substantial habitation cluster associated with site T-164 feature A, located farther from the ocean than most other settlements along the Kona coast, might indicate relatively intensive use of the coast and the anchialine ponds located there.

The network of trails that ties these sites and the clusters of features within them together extends beyond the survey area boundaries, connecting project area sites to other sites up and down the coast and inland. The backbone of this network in the project area is the *alaloa* or coastal trail, site 50-10-18-23360. Branches of the *alaloa* extend into the habitation sites, emphasizing the degree to which the trail played a role in daily life. The coastal nature of the survey meant that the *mauka-makai* trails, used to transport people and materials between upland agricultural fields and the fishing villages at the coast, were not recorded for great lengths; earlier reconnaissance and inventory surveys establish their positions *makai* of Queen Ka'ahumanu Highway, but little is known of them farther *mauka*. A characteristic of all the major trails is the large number of small features associated with them as they pass through uninhabited areas. Most of these features are pits. On *pāhoehoe*, the pits tend to be relatively large and shallow; those on 'a'ā are smaller and deeper and are often excavated at the base of a large boulder where they receive shade for part of the day. It is not known why these pits were created or the uses to which they were put. The most common explanation in the literature is that they functioned as sweet potato planters, but this is almost certainly false. The environment along the coast here, away from the fresh water of the anchialine ponds, is hostile to plant growth. The few plants that have established themselves almost never grow in the pits, reinforcing the impression gained by observing several hundreds of them that they don't provide an edaphic medium suited to plant growth. Hypotheses of pit function are discussed at length elsewhere (Dye 2002), and need not concern us unduly here. However they might have functioned, their large numbers and ubiquity around the trails indicate that the trails were not always used as roads are today, to get from one place to another. Rather, travel along trails must have involved numerous excursions off the main path to tend to whatever activities the pits belonged. Some idea of the relatively great value attached to these activities is revealed by the broken petroglyph along trail site 50-10-18-16058 (see pg. 48), which was removed to make way for a *pāhoehoe* pit of no apparent distinction. In the 'a'ā lava, pits and other small features are often found around the bases of boulders that have been bashed to expose rosy, red interior lava, a feature that we believe had religious connotations in certain circumstances, as discussed below.

The ¹⁴C dating results from the project are consistent with the assessment that initial settlement of the coast here took place around A.D. 1400 (Cordy et al. 1991). Thirteen dates on short-lived materials all yielded recent ages; the oldest date yields a calibrated age range of A.D. 1453-1642, and most of the others date to later than A.D. 1650. It is important here to note that the settlement date of A.D. 1400 is based on a somewhat impressionistic evaluation of volcanic glass dates and ¹⁴C dates on

unidentified material. Volcanic glass dates are known to be unreliable and ^{14}C dates on unidentified material potentially include an in-built age up to 200 years. These two potential sources of error might have led to an overestimate of the age of settlement. The dates from the project would also be consistent with initial occupation of the area about A.D. 1600. In fact, the earliest cultural deposit in the stratified dune at Manini'ōwali, which dates to A.D. 1519–1794, some 100–400 years after the posited initial occupation of the coast, appears at first glance to provide support for the later chronology. Although the dune here presents an attractive location for settlement and fronts the core of the traditional Hawaiian settlement at Manini'ōwali Bay, the mobile nature of dunes makes it impossible to be certain that it was in place and stable by A.D. 1400. It is possible that early cultural deposits on the dune eroded away and were later replaced by the deposits identified and dated during inventory survey. Still, future archaeological work along the coast should be alive to the possibility of a relatively late date for initial occupation and should work, wherever possible, to obtain solid dating evidence on short-lived materials.

Given the challenges of estimating occupation duration from materials recovered from looted deposits, estimates derived for the three cave sites must be considered first approximations, subject to unknown errors. Cave site T-140 feature B behind Kaho'iawa Bay yielded the longest range, 200–467 years. The other two caves yielded much shorter ranges; the feature 23 cave at Kākapa was occupied 26–188 years and the large cave site T-164 feature A at Awake'e was occupied 8–126 years. In the absence of stratigraphy at the looted cave sites, these ranges depend entirely on the ^{14}C ages returned by the dating laboratory for a limited number of samples; new information might change the estimates, perhaps dramatically.

Analysis of excavated materials indicates that the economy was very strongly oriented toward the sea. Artifacts left behind by looters are overwhelmingly associated with fishing and belong exclusively to the traditional Hawaiian period. They include small, finely wrought fishhooks that must have passed unnoticed through the looters' sieves, small caches of bone and shell suitable for manufacturing fishhooks, more than 250 abraders that were a primary tool in fishhook manufacture, cowry shell octopus lures, and stone sinkers. In contrast, woodworking appears to have been relatively rare; only three small adze fragments, in addition to the one fortuitous surface find of a complete adze, were recovered. It is difficult to know what looters took away from the cave sites in the project area, and it might be that evidence for woodworking was once present but is now gone. This seems unlikely, however, because the caves yielded only 15 basalt flakes. Many more of these would be expected from the constant adze re-working and sharpening that accompanied woodworking with traditional tools. The stone tools produced in the greatest numbers at the caves are volcanic glass flakes, which have short, but extremely sharp, cutting edges. These tools might conceivably have been useful in fishhook manufacture or woodworking, and several pieces of bone show cut marks that could have been made with volcanic glass flakes. Evidence of use-wear on the flakes, consistent with having worked on a hard material such as bone or wood, is scant, however, and it is likely that they were used to cut softer materials. Large-scale excavations in North Hālawala Valley on O'ahu Island indicate that volcanic glass is associated with *imu* and firepits (Olszewski 1998), suggesting a role in the preparation of cooked food.

Wood charcoal identifications indicate that cooking fires were made primarily from several shrubs that likely grew at or near the coast. These include 'a'ali'i, 'akoko, 'āheahea, pilo, and ko'oko'olau. Fires from these woods must typically have been short and hot, suited for roasting small items, but requiring care and feeding for cooking large items or foods that require long cooking times. Small quantities of wood from two coastal trees, kamani and niu, were also identified in the wood charcoal, but most of the trees that contributed firewood grew well inland where rainfall is more plentiful. These include the Polynesian introductions ki, kukui, and 'ulu and a long list of native trees set out and described in appendix F. The connection between the coastal sites and sites in the upland field system show clearly in the identified wood charcoal, testament to the frequency and degree of interaction in traditional Hawaiian times. Historically introduced plants were not identified in the wood charcoal, bolstering other lines of evidence that the caves were inhabited solely during the traditional Hawaiian period.

The traditional Hawaiian diet of the cave inhabitants, as indicated by the excavated faunal remains, was dominated by fish and shellfish, augmented by a few seabirds. Chicken bones were recovered only from the cave feature at Kākapa Bay. Pigs and dogs were rarely, if ever, eaten here; the few pieces of bone from these animals in the caves appear to be raw materials for fishhook manufacture rather than food refuse. The reliance on fish in the diet contrasts with the south Kohala coast, where seabirds played a larger role, and with sites in the agricultural field system, where pigs and dogs were consumed. Fish eaten and discarded at the sites are dominated by small inshore varieties, although identification of some larger, pelagic fish probably indicates occasional use of canoes in fishing. Hawaiian fishermen at Kekaha appear to have pursued a range of fishing strategies and to have taken most food fishes in rough proportion to their abundance offshore. An exception to this generalization is the āholehole, a fine food fish that is abundant offshore but is absent from the vertebrate faunal collections. Its absence is puzzling and not easily explained. One possibility, albeit unlikely, is that āholehole were not abundant offshore in traditional Hawaiian times, whether for unknown natural reasons or because fishing had already reduced their numbers substantially by the time the caves were occupied. Another is that the fish were highly valued as food and were eaten at the beach before they could be transported the short distance inland to the habitation caves. Āholehole are a delicious fish when eaten raw. In a modern preparation

the fish is scaled; the belly is cut open; the organs are not removed, but the bile is carefully squeezed out of the intestines. The fish is then scored and rubbed with Hawaiian salt and kukui nut. It is then eaten raw, complete with intestinal organs (Wyban 1992:31–32).

They are also delicious when cooked, however, and it is difficult to imagine a casual cultural filter such as this working to keep āholehole bones out of the caves with 100% effectiveness. A third possibility, and the explanation that seems most plausible, is that fishermen labored under a kapu against the capture and/or consumption of āholehole. Such kapu are believed to have operated in traditional Hawaiian times as part of the land system of old Hawai'i; they have survived into modern times and are now known as konohiki fishing rights (Kosaki 1954). The traditional practice was formalized by Kamehameha III in 1839 and incorporated, with some changes, in the Laws of 1840.

The sea within a mile of shore, or to the edge of the reef, if present, was the private fishery of the *konohiki*. Fishing within the private fishery was restricted to the *konohiki* and the tenants of the *ahupua'a*; others were prohibited. *Konohiki* were given the right to regulate fishing within the fishery. They could do this in one of two ways. The first was to place a *kapu* on one kind of fish, whose use and enjoyment was reserved for the *konohiki*. The penalty for breaking this *kapu* was to be prohibited from fishing on any fishing ground for a period of two years. The second was to prohibit fishing for the *kapu* fish for a part of the year and then, during the proper fishing season, collect two-thirds of the catch from each fisherman. Fisheries along the Kona coast were not among the approximately 100 fisheries registered after Hawai'i became a Territory of the United States in 1900 (Kosaki 1954:39), and we know of no information on the kind of fish, if any, that was *kapu* in the historic period. The first of the methods used by *konohiki* to regulate fisheries would, if applied to the *āholehole* and followed strictly, produce fish bone collections like those recovered from the three looted cave sites.

The *āholehole* is a good candidate for *kapu*, noted by chiefs, and with a role in traditional Hawaiian religion. A fine food fish, the *āholehole* "was considered a dainty, and often craved by the chiefs" (Titcomb 1972:60). Along with three or four other fish, they were considered "sea pigs" and could be substituted for pigs in certain religious sacrifices (Valeri 1985:45). They were considered attributes of the gods Kāne and Kanaloa (Valeri 1985:15) associated with fishponds (Beckwith 1970:63), where *āholehole* are raised and harvested.

Accepting *kapu* as an explanation for the lack of *āholehole* bones identified in the vertebrate faunal collections raises questions, however. If a *kapu* were in effect, is it reasonable to believe that it was in force for the entire history of cave occupation? As noted above, estimates of occupation duration at the caves based on ^{14}C dates are first approximations, with much room for error. At two of the caves, sites T-140 feature B and T-164 feature A, they do not distinguish between a short period of occupation measured in decades and a longer period measured in centuries. Only at the feature 23 cave at Kākapa does a longer occupation period seem assured, this one on the order of 200–400 years. This longer period of occupation is what one would expect, given the widely accepted estimate of A.D. 1400 for initial occupation of the Kekaha coast, but as also noted above this estimate is subject to uncontrolled errors that might place it too early in time. In the context of all this uncertainty, perhaps the only conclusion that might be drawn is that a *kapu* on *āholehole* is unlikely to have lasted several hundred years, and that, to the extent it has any bearing on cave or regional chronology, it supports the idea that caves were occupied for a relatively short period, perhaps at the end of the traditional Hawaiian period when the power of the *ali'i* was at its height.

On the other hand, it is possible to argue that a *kapu* on *āholehole* would have been long-lasting. *Āholehole* tolerate a wide salinity range and frequent both fresh and salt water. They are an important pond fish, and their value to the Kona *ali'i* might have been connected to their investments in fishponds along the coast. Like many other pond fish, *āholehole* spawn in the ocean, and a *kapu* on their capture would protect breeding stocks potentially important for the fishponds. This importance would have out-lived individual *konohiki*, thus accounting for the long life of the *kapu*.

These problems with the *kapu* hypothesis relate to uncertainties in the archaeological record as it is known through the imperfect lens of an inventory level survey. None

of the problems call into question the basic datum—that *āholehole* bones are absent from the cultural deposits in the caves. Although it is not possible to prove the hypothesis in any rigorous sense, the existence of a cultural mechanism capable of creating the observed phenomenon certainly indicates its plausibility. Beyond this, the hypothesis is useful for future research because it aids the formulation of directly testable propositions. For example, assuming the hypothesis is true, and *āholehole* were *kapu* for the *konohiki*, then one would expect that *āholehole* bones will be found in relatively few sites, associated either with indications of high status such as a *konohiki* might have commanded or with evidence of ritual sacrifice.

This picture of a series of small coastal fishing communities, carrying out their work within the constraints of a *kapu* imposed by powerful *ali'i*, sets the context for the interpretation of the most enigmatic features of the cultural landscape, the many large boulders and lava slabs whose surfaces have been worked to expose red lava. Several observations indicate that the exposed red lava was considered important. The effort expended to create these red surfaces was often considerable. Perhaps the best example of this is the large slab, feature 351 at Kākapa Bay (see pg. 84). Here, creation of a red surface about 25 m² left a large mound of detritus at the base of the slab, upon which are the water-worn basalt cobble hammerstones presumably used to do the work. There is also evidence that care was exercised in this work, more than might be inferred from the common presence of cobble hammerstones. At feature 48 of site 50-10-18-23356, at the north end of Manini'ōwali Bay, an extensively worked boulder with a unique exposure of black, brown, white, and red appears to have been worked with a pebble hammerstone (see pg. 96), presumably to reveal fine details of the boulder's interior. Although it is not possible to know what effect the artisan hoped to achieve, the fine work indicates the importance placed on the final result. There can be little doubt that at least some of the red boulders functioned as shrines, suggesting that the care lavished on the work had as its basis an effort to please the *akua*. Features 269 and 270 at site 50-10-18-23355 on the 'a'a bluff above the *heiau* clearly incorporate a red boulder in a shrine (see pg. 77). The enclosure at the base of the boulder is too small to have served some residential purpose, and the waterworn 'a'a cobbles and coral on its surface appear to have been left as offerings.

akua

It is more difficult to determine why the red boulders were important. We believe that consideration of their characteristics indicates that the red rocks are manifestations of *kū'ula*, the god of fishermen. In form, the boulders clearly fit the definition of *kū'ula* as

“[a]ny stone god used to attract fish, whether tiny or enormous, carved or natural, named for the god of fishermen; *heiau* near the sea for worship of fish gods; hut where fish gear was kept with *kū'ula* images so that gear might be impregnated with *kū'ula mana*, usually inland and very taboo”
Pukui and Elbert (1986).

They also evoke several qualities of the god Kū (Valeri 1985). They stand out from and often above the surrounding landscape, in often striking ways, evoking the Kū quality of erectness. Their large size and imposing bulk evoke the Kū quality of strength. Their red color, achieved through considerable labor, brought out a third attribute of the god, one called out explicitly in the name *kū'ula*, “Kū the red one.” Thus, our

interpretation of the red boulders is that they are *ko'a*, shrines used in ceremonies to make fish multiply and symbols of the authority of *ali'i*, whose connection to the *akua* made the shrines efficacious.

Significance Evaluations

Ten site numbers were assigned during the inventory survey to six large coastal sites, including five habitation settlements and one trail, and four smaller sites inland. The coastal habitation site boundaries were drawn, so far as possible given the constraints of the survey areas, to encompass entire settlements, and the coastal trail was treated as a single unit. The four smaller inland sites include two probable burials and two sites of convenience, drawn to include unrelated features that happened to fall within the survey's purview.

Significance is evaluated according to SHPD draft rules §13-284-6, *Evaluation of significance*. Significant sites "possess integrity of location, design, setting, materials, workmanship, feeling, and association." In addition, they meet one or more of the significance criteria. A significant site shall:

- A. be associated with events that have made an important contribution to the broad patterns of our history;
- B. be associated with the lives of persons important in our past;
- C. embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- D. have yielded, or be likely to yield, information important for research on prehistory or history; or
- E. have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

The significance evaluations are set out in table 18.

Site 50-10-18-23355 at Kākapa Bay is an outstanding example of a traditional Hawaiian coastal village constructed preferentially on 'a'a lava. It contains a wide variety of feature types and is well-preserved. The site has contributed information on traditional Hawaiian settlement pattern at the regional and local scales. The looted deposits from caves there have yielded information on chronology, the nature of interaction between the coast and upland communities, and the economy. Future investigations at the site can be expected to yield additional information on these topics. The site contains a *heiau*, several shrines interpreted as *ko'a*, and a portion of a cemetery shown on U.S.G.S. quadrangle maps. All of these features have a value to native Hawaiian people and are important to their cultural identity. This site has outstanding interpretive value; the relationship of *kauhale* to one another and to coastal and *mauka-makai* trails

Table 18. Significance evaluations

50-10-18-	Criteria	Justification
23355	C, D, E	A well-preserved example of a traditional Hawaiian coastal settlement constructed preferentially on 'a'ā lava. Site includes portions of a known cemetery, a <i>heiau</i> , and several smaller shrines.
23356	D, E	Substantially disturbed remnants of a traditional Hawaiian coastal settlement on 'a'ā and <i>pāhoehoe</i> . Includes one known and several possible burial features and several shrines.
23357	D, E	Disturbed remains of scattered traditional Hawaiian settlement along the coastal trail include two possible burial features and the badly damaged remnants of a possible <i>heiau</i> . Additional features <i>mauka</i> , outside survey boundaries.
23358	D, E	Disturbed remains of traditional Hawaiian settlement include two possible burial features.
23359	D, E	Disturbed remains of traditional Hawaiian and historic-era settlement include several possible burial features.
23360	D, E	The coastal trail and associated features include one possible burial and several shrines. The trail was an important transportation route.
23635	E	Probable burial site.
23636	E	Possible burial site.
23637	D, E	Scattered small features include a burial with secondary interments.
23638	D, E	Scattered small features include a possible burial.

is readily apparent. Its *heiau*, although damaged and partially restored, is impressive. The site also includes two red rock *ko'a* evocative of the traditional religious system and its role in promoting fertility.

Site 50-10-18-23356 at Manini'ōwali Bay is a coastal village, portions of which have been disturbed by bulldozing, four-wheel drive vehicles, campers, and beachgoers. The site as a whole maintains its integrity, although the interpretive value of several parts of the site is diminished. The site includes one known human burial, located in a crack in a boulder near a camp site and in danger of being disturbed by camping activities, and several possible burials. It also contains numerous shrine features. The burial and shrine features have an important value to the native Hawaiian people. The site has yielded information on settlement pattern at both the regional and local levels and local chronology. It contains several looted deposits that are rich in information on economy and chronology, and cultural deposits buried in sand at the inland edge of the beach. These buried deposits potentially contain important information on the history of traditional Hawaiian settlement and appear to be a unique resource in this section of the park. Portions of the site with the greatest interpretive potential are the red boulders at the north end of the site, the shrine enclosure around the red boulder at the highest point of the site in the north, and cluster I at the inland end of the site. Cluster I includes an enclosure with upright slabs of whitish *pāhoehoe* and a shrine with several waterworn boulders, including one that vaguely resembles a face.

Site 50-10-18-23357 at Punaloa Point represents a small settlement along the coastal trail, only a portion of which was within the survey bounds. Although the site has been disturbed by campers, it retains sufficient integrity to be listed on the Hawaii Register of Historic Places. Two possible burials and the disturbed remains of a possi-

ble *heiau* potentially have an important value to native Hawaiian people. The site has yielded information on traditional Hawaiian settlement pattern and can be expected to yield more information along these lines when the portion *mauka* of the coastal trail is investigated. This site appears to have minimal interpretive value.

Site 50-10-18-23358 at Kaho'iawa Bay represents a small settlement that has been severely impacted by modern use for fishing and camping. The site has yielded information on settlement pattern at the regional scale and from the looted deposits at site T-140 feature B, information on chronology, economy, and the nature of interactions between the coast and upland communities. It has the potential to yield additional information along these lines. The site has two possible burials with potential important value to the native Hawaiian people. The interpretive value of the site is *minimal* owing to the extensive disturbance of its traditional Hawaiian features.

Site 50-10-18-23359 at Awake'e Bay represents a traditional Hawaiian and early historic settlement, portions of which have been disturbed by campers and construction of a four-wheel drive road to Makalawena. The survey boundaries included only a portion of the settlement here; a *mauka* extension of the settlement, centered on the large cave site T-164 feature A, is somewhat unusual for the Kekaha coast. It should be surveyed and mapped so the settlement pattern information it contains is preserved. The site has yielded information on settlement pattern at the regional and local scales, and from the looted deposits at site T-164 feature A information on local chronology, economy, and interactions between the coast and upland communities. Four possible burials might have an important value to the native Hawaiian people. The interpretive potential of the site is high. Its location near the anchialine ponds, the historic period features associated with the historic settlement at Makalawena, and the well-preserved and impressive traditional Hawaiian features on the 'a'a flow are all points of potential interest.

Site 50-10-18-23360, the coastal trail, has an important value to the native Hawaiian people as a transportation route that facilitates access to rich inshore fishing grounds along the coast. Features associated with the trail include a possible burial that might also have an important value to the native Hawaiian people. The site has yielded information on settlement pattern at the regional scale.

Sites 50-10-18-23635 and 50-10-18-23636 are both possible burial sites that potentially have an important value to the native Hawaiian people. These sites lack interpretive value.

Site 50-10-18-23637 includes several scattered features discovered during survey of a proposed road corridor. One feature is a human burial with what appears to be the remains of three individuals. This feature has an important value to the native Hawaiian people. The other features of the site have the potential to yield information on settlement pattern; this information will be yielded when they have been investigated in the context of a survey that takes in the surrounding terrain. The features of this site lack interpretive value.

Site 50-10-18-23368 also includes several scattered features discovered during survey of a proposed road corridor. One feature is possibly a human burial; it might have important value to the native Hawaiian people. The other features have the potential to yield information on settlement pattern; this information will be yielded when they have been investigated in the context of a survey that takes in the surrounding

terrain. The features of this site lack interpretive value.

Appendix A

Feature Descriptions

Table 19. Feature descriptions

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
5337	1	path	trail		0.7		Primary trail <i>mauka</i> from Kākapa <i>heiau</i> ; <i>pāhoehoe</i> slab pavers on most of the <i>heiau</i> cluster area; BPBM has associated features designated site 50-10-18-5338.
5337	2	path	trail		0.7		Secondary branch splits from site 50-10-18-5337, feature 1 <i>mauka</i> of project area, heads to Kākapa Bay site 50-10-18-23355.
5337	3	path	trail	30.0	0.7		Tertiary branch splits from site 50-10-18-5337, feature 2, and heads into site 50-10-18-23355 cluster D.
5337	4	path	trail	32.0	0.7		Quaternary branch splits from site 50-10-18-5337, feature 3, skirts <i>mauka</i> edge of site 50-10-18-23355 cluster D, and heads <i>mauka</i> ; may be longer than mapped.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
5337	5	alignment	trail	23.0	0.7		Alternate trail parallels site 50-10-18-5337, feature 2 from the center of site 50-10-18-23355 cluster D to <i>makai</i> ; many water-worn basalt pavers.
5337	6	path	trail	14.0	0.7		Tertiary branch splits from site 50-10-18-5337, feature 5, heads downslope from site 50-10-18-23355 cluster D to hole feature 83.
5337	7	path	trail	40.0	1.0		Alternate to site 50-10-18-5337, feature 2 goes down to beach <i>kauhale</i> , cluster A, from west side of cluster D.
5337	8	path	trail	30.0	0.7		Alternate to site 50-10-18-5337, feature 7.
5337	9	path	trail		0.7		Tertiary branch splits from site 50-10-18-5337, feature 10, connecting <i>heiau</i> cluster at feature 250 to feature 41 by cluster D.
5337	10	path	trail	90.0	1.0		Secondary branch splits from site 50-10-18-5337, feature 1 at <i>mauka</i> edge of <i>heiau</i> complex, cuts through complex to north, goes down slope to <i>heiau</i> at feature 250; many <i>pāhoehoe</i> slab pavers at <i>mauka</i> portion.
5337	11	path	trail		0.7		Secondary branch splits from site 50-10-18-5337, feature 1 at east edge of <i>heiau</i> complex, heading toward Manini'ōwali Bay.
5337	12	path	trail	20.0	0.7		Secondary branch splits from site 50-10-18-5337, feature 1 at edge of bluff, <i>mauka</i> of the caves; disappears at slope.
5337	13	path	trail		0.7		Tertiary branch splits from site 50-10-18-5337, feature 12, heads through feature 266 and disappears at edge of bluff.
5337	14	lined pit	shrine?	1.6	0.7	0.9	Partially beneath boulder, water-worn cobble within.
16059	1	path	trail	600.0	0.7		Main trail, goes <i>mauka</i> to meet site 50-10-18-1193.
16059	2	boulder <i>ahu</i>	trail marker	1.4	1.3	1.1	

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
16059	3	<i>pāhoehoe</i> pit	undetermined	0.7	0.6	1.1	Coral cobble fill at base.
16059	4	<i>pāhoehoe</i> pit	undetermined	1.9	1.5	1.0	
16059	5	<i>pāhoehoe</i> pit	undetermined	1.1	0.4	0.3	
16059	6	<i>pāhoehoe</i> pit	undetermined	0.6	0.5	0.3	
16059	7	<i>pāhoehoe</i> pit	undetermined	1.4	0.8	0.6	
16059	8	<i>pāhoehoe</i> pit	undetermined	1.1	0.9	0.3	
16059	9	<i>pāhoehoe</i> pit	undetermined	1.1	0.4	0.3	
16059	10	<i>pāhoehoe</i> pit	undetermined	1.5	1.0	0.6	
16059	11	<i>pāhoehoe</i> pit	undetermined	0.9	0.7	0.3	
16059	12	<i>pāhoehoe</i> pit	undetermined	2.1	0.5	0.5	
16059	13	petroglyph	undetermined	1.3	0.9		
16059	14	<i>pāhoehoe</i> pit	undetermined	1.0	0.9	0.3	
16059	15	<i>pāhoehoe</i> pit	undetermined	1.7	0.9	0.3	
16059	16	<i>pāhoehoe</i> pit	undetermined	1.4	1.2	0.3	
16059	17	<i>pāhoehoe</i> pit	undetermined	1.0	0.8	0.3	
16059	18	wall	undetermined	3.6	0.9	0.3	Connects pit features 120 and 122, single course high.
16059	19	<i>pāhoehoe</i> pit	undetermined	1.0	0.9	0.3	
16059	20	<i>pāhoehoe</i> pit	undetermined	0.6	0.5	0.3	
16059	21	<i>pāhoehoe</i> pit	undetermined	5.8	1.5	0.3	Width widely variable from 0.8–2.2 m.
16059	22	wall	undetermined	3.3	0.6	0.3	Single course high.
16059	23	<i>pāhoehoe</i> pit	undetermined	1.9	1.0	0.5	Loose <i>pāhoehoe</i> stone by this feature has a human form petroglyph.
16059	24	<i>pāhoehoe</i> pit	undetermined	1.1	0.5	0.5	
16059	25	<i>pāhoehoe</i> pit	undetermined	0.6	0.4	0.5	
16059	26	<i>pāhoehoe</i> pit	undetermined	4.0	0.9	0.3	Water-worn basalt inside, pit is on the crest of a small rise.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
16059	27	<i>pāhoehoe</i> pit	undetermined	2.7	0.7	0.8	Nearly filled.
16059	28	<i>pāhoehoe</i> pit	undetermined	0.8	0.5	0.5	Connected to feature 126 by a mini-tube, but located closer to feature 127.
16059	29	<i>pāhoehoe</i> pit	undetermined	5.0	1.8	0.7	
16059	30	shelter	undetermined	4.7	1.1	0.7	Slab pavement and roof, form is basically a tunnel with one natural wall and one stacked wall.
16059	31	<i>pāhoehoe</i> pit	undetermined	1.4	0.6	0.3	
16059	32	<i>pāhoehoe</i> pit	undetermined	2.7	1.5	0.3	
16059	33	petroglyph	undetermined	8.4	3.3		Largest field of figures in the site.
16059	34	wall	undetermined	4.8	0.5	0.5	Discontinuous along southwest side of feature 130 petroglyphs, east end terminates at worn trail.
16059	35	<i>pāhoehoe</i> pit	undetermined	2.0	1.0	0.3	
16059	36	<i>pāhoehoe</i> pit	undetermined	2.1	1.6	0.3	Nearly filled.
16059	37	<i>pāhoehoe</i> pit	undetermined	2.2	1.8	0.4	South edge filled with stacked wall forming edge of trail.
16059	38	<i>pāhoehoe</i> pit	undetermined	3.3	1.0	0.3	Nearly filled.
16059	39	<i>pāhoehoe</i> pit	undetermined	2.0	1.1	0.3	Nearly filled.
16059	40	wall	undetermined	5.5	0.4	0.5	Similar in orientation and dimensions to feature 130.1.
16059	41	wall	undetermined	3.9	0.5	0.6	Roughly stacked wall delineates a small lobe of <i>pāhoehoe</i> surrounded on other sides by higher 'a'ā flow.
16059	42	<i>pāhoehoe</i> pit	undetermined	0.7	0.5	0.3	
16059	43	<i>pāhoehoe</i> pit	undetermined	3.5	1.6	0.3	Half filled, half empty.
16059	44	petroglyph	undetermined	0.4	0.4		Single human figure.
16059	45	<i>pāhoehoe</i> pit	undetermined	1.2	0.7	0.3	Nearly filled, a few water-worn basalt stones.
16059	46	overhang shelter	undetermined	1.9	3.3		Half of area is open air pit, half natural blister shelter.
16059	47	<i>pāhoehoe</i> pit	undetermined	2.8	2.4	0.3	

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
16059	48	<i>pāhoehoe</i> pit	undetermined	3.0	0.8	0.3	Coral and calcified stone inside.
16059	49	<i>pāhoehoe</i> pit	water source	4.0	2.2	0.3	Has water at high tide, coral, calcified, and water-worn basalt inside.
16059	50	<i>pāhoehoe</i> pit	undetermined	1.0	0.7	0.5	
16059	51	enclosure	undetermined	1.4	1.1		Ring of stones around feature 144 opening.
16059	52	<i>pāhoehoe</i> pit	undetermined	3.1	1.2	0.5	
16059	53	alignment	undetermined	1.5	0.3	0.3	Borders east side of feature 145.
16059	54	<i>pāhoehoe</i> pit	undetermined	0.5	0.4		Filled.
16059	55	<i>pāhoehoe</i> pit	undetermined	0.7	0.6	0.3	
16059	56	<i>pāhoehoe</i> pit	undetermined	0.9	0.7		Filled with water-worn coral, basalt, and calcified stone.
16059	57	petroglyph	undetermined	0.6	0.4		Circular motif.
16059	58	<i>pāhoehoe</i> pit	undetermined	2.6	1.0	0.3	North side lined with stone.
16059	59	<i>pāhoehoe</i> pit	undetermined	0.5	0.3	0.3	Small opening to small lava tube connected to feature 150.
16059	60	<i>pāhoehoe</i> pit	undetermined	0.9	0.3	0.3	
16059	61	cave	undetermined	1.3	2.7		No cultural deposit.
16059	62	enclosed shelter	burial?	3.0	5.2		Roughly stacked exterior wall. Nicely stacked interior wall seals side tube that may contain burial.
16059	63	<i>pāhoehoe</i> pit	undetermined	1.6	1.1		Filled, possibly by wave deposit, just behind beach.
16059	64	<i>pāhoehoe</i> pit	undetermined	0.7	0.4	0.3	
16059	65	<i>pāhoehoe</i> pit	undetermined	0.8	0.5	0.3	
16059	66	mound	undetermined	1.8	0.9	0.3	
16059	67	cave	undetermined	1.7	3.4	0.6	
16059	68	alignment	undetermined	1.5	0.3	0.3	
16059	69	<i>pāhoehoe</i> pit	undetermined	1.1	0.9	0.3	
16059	70	<i>pāhoehoe</i> pit	undetermined	6.0	1.5	0.3	
16059	71	alignment	undetermined	1.1	0.5	0.5	Southeast side partially filled.
16059	72	<i>pāhoehoe</i> pit	undetermined	1.8	0.8	0.3	

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
16059	73	<i>pāhoehoe</i> pit	undetermined	0.7	0.5	0.3	
16059	74	<i>pāhoehoe</i> pit	undetermined	3.4	0.9	0.3	Partially filled.
16059	75	<i>pāhoehoe</i> pit	undetermined	2.0	1.9		Filled.
16059	76	<i>pāhoehoe</i> pit	undetermined	2.0	1.5	0.3	Stacked stone at south end.
16059	77	<i>pāhoehoe</i> pit	undetermined	3.6	1.7		Filled.
16059	78	berm	undetermined	3.3	0.5		Piled <i>pāhoehoe</i> stone, this feature and feature 167 flank a worn trail. Piled <i>pāhoehoe</i> stone.
16059	79	berm	undetermined	5.2	0.4		Filled.
16059	80	<i>pāhoehoe</i> pit	undetermined	2.4	1.9		
16059	81	petroglyph	undetermined	0.7	0.6		Two paddle-wielding, triangular-bodied figures.
16059	82	<i>pāhoehoe</i> pit	undetermined	2.1	0.8	0.3	
16059	83	<i>pāhoehoe</i> pit	undetermined	0.6	0.5	0.3	
16059	84	<i>pāhoehoe</i> pit	undetermined	1.0	0.8	0.3	
16059	85	<i>pāhoehoe</i> pit	undetermined	2.2	0.8	0.3	
16059	86	<i>pāhoehoe</i> pit	undetermined	1.4	0.9	0.3	
16059	87	<i>pāhoehoe</i> pit	undetermined	1.0	0.6	0.3	
16059	88	<i>pāhoehoe</i> pit	undetermined	1.9	1.5	0.3	
16059	89	<i>pāhoehoe</i> pit	undetermined	1.4	1.0		Filled.
16059	90	<i>pāhoehoe</i> pit	undetermined	3.2	1.0		Filled.
16059	91	<i>pāhoehoe</i> pit	undetermined	3.4	0.8		Filled.
16059	92	alignment	undetermined	0.8	0.3	0.3	
16059	93	<i>pāhoehoe</i> pit	undetermined	0.7	0.5	0.3	
16059	94	<i>pāhoehoe</i> pit	undetermined	1.5	0.7	0.3	
16059	95	<i>pāhoehoe</i> pit	undetermined	4.0	3.0	0.3	Partially filled, occupies lobe of <i>pāhoehoe</i> surrounded by higher 'a'ā.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
16059	96	wall	undetermined	1.9	0.5		Defines north edge of feature 181, nearly completing natural enclosure formed by 'a'ā.
16059	97	<i>pāhoehoe</i> pit	undetermined	1.0	0.9	0.3	
16059	98	enclosure	undetermined	1.5	1.2		Surrounds feature 181.2.
16059	99	<i>pāhoehoe</i> pit	undetermined	2.4	0.6	0.3	
23355	1	terrace	trail	11.5	2.0	0.7	Retaining wall for trail site 50-10-18-5337, feature 7 descending slope.
23355	2	'a'ā pit	undetermined	0.7	0.7	0.8	Located in a ravine.
23355	3	pavement	special activity	1.2	1.1		Located in a ravine.
23355	4	cave	cupboard	1.8	2.0	0.7	
23355	5	cave	cupboard	1.3	2.3	0.7	
23355	6	mound	trail marker	1.4	1.0	0.5	
23355	7	pavement	habitation	6.5	4.2		
23355	8	terrace	habitation/trail	8.5	2.7	0.4	
23355	9	pavement	special activity	1.7	1.5		
23355	10	mound	trail marker	1.9	1.3	0.6	
23355	11	pavement	special activity	4.2	1.8		Possible lookout.
23355	12	terrace	special activity	4.5	4.2	0.7	Possible lookout.
23355	13	terrace	special activity	7.0	2.5	0.5	
23355	14	wall	shrine/burial?	4.7	1.0	0.7	Branch coral and red rock.
23355	15	terrace	shrine/burial?	2.5	2.4	0.4	Branch coral and red rock.
23355	16	shelter	shrine	0.9	1.0	0.5	Offerings of whole <i>wana</i> bodies, branch coral, and <i>alā</i> .
23355	17	terrace	burial?	3.7	1.8	0.3	
23355	18	pavement	special activity	3.1	1.7		
23355	19	pavement	undetermined	2.5	2.3		Filled, rough surface.
23355	20	mound	trail marker/burial?	2.9	2.0	0.6	
23355	21	terrace	habitation	6.5	5.0	0.5	High core-filled back wall, remainder unwallled terrace.
23355	22	overhang shelter	habitation/discard	2.1	0.6	0.9	
23355	23	overhang shelter	habitation	3.4	3.0	1.0	
23355	24	wall	habitation	2.3	0.7	0.7	Exterior wall associated with feature 23.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	25	overhang shelter	habitation	2.2	1.1	0.8	Some stacked stone around entry.
23355	26	pavement	general activity	31.0	10.0		Common area amid habitation structures.
23355	27	enclosure	special activity	4.0	2.5	1.1	No entry, attached to feature 29.
23355	28	terrace enclosure	habitation	2.7	2.7	0.7	
23355	29	terrace	habitation	3.0	4.3	1.1	Fireplace.
23355	30	terrace enclosure	habitation	3.2	4.2	0.8	
23355	31	terrace	general activity	4.6	7.4	0.5	
23355	32	pavement	general activity	10.5	5.5		
23355	33	shelter	cupboard	1.3	2.8	0.9	
23355	34	terrace	habitation	3.2	3.0	0.7	
23355	35	enclosure	habitation	6.5	6.0	0.8	
23355	36	terrace	habitation	3.1	2.7	0.4	
23355	37	clearing enclosure	general activity	8.6	4.4	0.3	
23355	38	boulder	shrine	4.2	3.5	1.2	Battered boulder with cobble wall on top.
23355	39	terrace	general activity	9.4	3.4	0.6	Lānai to feature 35?
23355	40	terrace	retaining wall	3.5	1.5	0.8	Buttresses feature 39.
23355	41	'a'ā pit	burial crypt?	1.6	1.0	0.9	Opened and looted?
23355	42	overhang shelter	undetermined	2.8	1.6	0.8	Poor condition due to goats.
23355	43	clearing enclosure	undetermined	9.4	3.5	0.4	
23355	44	clearing enclosure	undetermined	7.5	4.0	0.5	
23355	45	cave	cupboard	0.9	0.8	0.5	
23355	46	'a'ā pit	storage	0.9	1.1	0.6	stacked stone lining.
23355	47	pavement	undetermined	3.5	1.7		
23355	48	clearing enclosure	undetermined	2.7	1.8	0.3	
23355	49	mound	modern trail marker	0.8	0.8	0.6	
23355	50	enclosure	special activity	4.5	3.4	0.5	
23355	51	clearing enclosure	special activity	1.8	1.5	0.3	
23355	52	boulder ahu	boundary marker	2.7	1.8	1.8	

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	53	enclosure	habitation	6.7	6.0	0.8	
23355	54	enclosure	habitation	6.5	3.0	0.8	
23355	55	pavement	general activity	5.5	3.2		<i>Lānai</i> to feature 54.
23355	56	terrace	habitation	4.0	3.3	0.6	
23355	57	enclosure	modern campfire	0.9	0.9	0.2	Water-worn basalt cobble fire ring.
23355	58	terrace	undetermined	4.9	3.0	0.8	Surface not really paved, filled. Burial?
23355	59	shelter	storage	1.3	1.5	0.8	Substantial stacked walls form a terrace platform.
23355	60	mound	trail marker	1.6	1.1	0.6	
23355	61	terrace	undetermined	3.2	1.3	0.6	Filled, rough surface.
23355	62	clearing enclosure	undetermined	4.2	2.9	0.5	Below surface.
23355	63	boulder <i>ahu</i>	trail marker	1.5	0.7	1.1	
23355	64	terrace enclosure	habitation	5.6	3.4	0.6	Top edge of flow, cuts into surface.
23355	65	enclosure	storage?	2.2	1.7	0.4	Possibly a collapsed cupboard.
23355	66	terrace	general activity	6.3	2.6	0.5	Side yard of feature 53.
23355	67	clearing enclosure	undetermined	3.5	1.8	1.2	Located in ravine with large boulders.
23355	68	clearing enclosure	undetermined	3.2	2.4	0.4	
23355	69	enclosure	special activity	4.4	2.5	0.6	Double roomed, entry via trail from feature 56.
23355	70	clearing enclosure	undetermined	5.0	2.1	0.4	
23355	71	boulder <i>ahu</i>	trail marker/shrine?	2.3	1.3	1.6	collapsed cupboard on one side, upright paired with feature 72.
23355	72	boulder <i>ahu</i>	trail marker/shrine?	1.8	0.4	1.3	Cobbles atop upright.
23355	73	clearing enclosure	habitation/special activity	4.0	3.0	0.5	Pavement west of feature 71 and 72 uprights.
23355	74	clearing enclosure	special activity	2.6	2.8	0.5	
23355	75	terrace enclosure	special activity	3.2	3.3	0.6	Core-filled wall on two sides.
23355	76	clearing enclosure	undetermined	3.2	2.6	0.6	
23355	77	terrace	<i>ko'a</i>	3.7	2.4	0.5	Large slab upright behind.
23355	78	mound	remnant	3.0	2.2	0.8	Irregular pile.
23355	79	wall	retaining wall	8.0	0.8	0.7	Core-filled wall on two sides.
23355	80	terrace	retaining wall	5.2	0.8	0.5	Edge of pond.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	81	terrace	retaining wall	3.5	0.4	0.7	Edge of pond.
23355	82	terrace	retaining wall	4.2	0.4	0.6	Edge of pond.
23355	83	open hole	undetermined	6.5	1.9	1.0	Trail from this feature up to cluster C.
23355	84	mound	burial?	1.7	1.3	1.5	
23355	85	platform	burial?	3.7	2.8	0.4	
23355	86	wall	canoe shed remnant?	12.2	3.2	0.7	
23355	87	enclosure	shrine	4.8	2.8	1.0	L-shaped wall open to <i>makai</i> with coral water-worn interior pavement, some branch coral present.
23355	87.1	shelter	shrine/cupboard	0.8	1.3	0.7	Stacked lining to open pit that accesses 1 m deep cupboard, triton shell fragments inside.
23355	88	enclosure	special activity	4.3	3.3	1.1	
23355	89	enclosure	special activity	3.2	3.0	0.4	
23355	90	mound	boundary?	1.8	1.8	2.0	
23355	91	clearing enclosure	special activity	3.5	1.9	0.6	Below surface, one wall stacked, and may be edge of feature 92.
23355	92	pavement	general activity	6.2	5.5		Not well defined based on surface visibility.
23355	93	terrace enclosure	habitation	11.0	8.5	0.7	<i>hale mua?</i>
23355	94	remnant	undetermined	7.7	3.5	0.2	Impacted and obscured by wave action.
23355	95	remnant	undetermined				Impacted and obscured by wave action.
23355	96	terrace enclosure	habitation	6.0	11.5	0.4	Walls collapsed, need excavation to determine actual size.
23355	97	terrace enclosure	habitation	8.5	9.6	0.6	Core-filled wall back and part of sides, possibly partially dismantled.
23355	98	terrace enclosure	habitation	7.6	6.8	0.5	Core-filled back wall, fireplace in center.
23355	99	terrace	general activity	11.5	3.0	0.2	<i>Lānai</i> to features 98 and 100.
23355	100	terrace	special activity	3.3	3.0	0.5	Terrace facing <i>mauka</i> .
23355	101	terrace enclosure	special activity	4.8	4.6	0.7	
23355	102	'a'ā pit	undetermined	0.4	0.4	0.5	Four water-worn coral pieces inside.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	103	shelter	habitation	3.5	1.8	0.6	
23355	104	clearing enclosure	habitation	3.5	3.5	0.4	Below surface, above feature 103 level.
23355	105	clearing enclosure	habitation	2.0	2.0		
23355	106	'a'ā pit	undetermined	0.8	0.8	0.6	Stacked stone lining. Note: feature numbers 107–181 taken out of this site, moved to site 50–10–18–16059.
23355	182	mound	boundary	1.8	1.5	1.1	Built on raised boulder, possible cupboard in base.
23355	183	<i>pāhoehoe</i> pit	quarry	1.2	0.7	1.5	Stone possibly used for <i>ahu</i> feature 182.
23355	184	alignment	quarry	1.8	0.5	0.3	<i>Pāhoehoe</i> cobbles from pit feature 183.
23355	185	<i>pāhoehoe</i> pit	quarry	1.2	0.5	0.8	Stone possibly used for <i>ahu</i> feature 182.
23355	186	<i>pāhoehoe</i> pit	quarry	0.7	0.4	0.7	Stone possibly used for <i>ahu</i> feature 182.
23355	187	<i>pāhoehoe</i> pit	quarry	1.2	0.6	0.9	Stone possibly used for <i>ahu</i> feature 182.
23355	188	enclosure	shrine	3.3	2.6	1.1	Four <i>alā</i> uprights inside, 2 m high boulder with smooth surface in southeast corner, overhang/cupboard in northeast corner.
23355	188.1	path	trail	19.0	0.7		Trail from <i>pāhoehoe</i> to shrine feature 188, mostly paved with <i>pāhoehoe</i> slabs.
23355	189	mound	undetermined	0.9	0.7	0.5	Stones stacked three high on natural high spot, possibly marks features 190 and 191.
23355	190	<i>pāhoehoe</i> pit	quarry?	1.3	0.9	0.7	
23355	191	<i>pāhoehoe</i> pit	quarry?	3.5	1.8		Filled.
23355	191.1	cave	cupboard	0.4	0.5	0.4	
23355	191.2	cave	cupboard	0.6	2.5	0.5	
23355	191.3	cave	cupboard	0.4	0.3	0.3	
23355	192	<i>pāhoehoe</i> pit	undetermined	1.0	0.6	0.3	
23355	193	pavement	activity area	4.3	3.4		
23355	193.1	path	trail	15.0	0.7		<i>Pāhoehoe</i> slab pavers and cleared path from shrine feature 188 to feature 193 clearing, possibly continues <i>makai</i> .

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	194	<i>pāhoehoe</i> pit	undetermined	0.6	0.4	0.6	
23355	195	<i>pāhoehoe</i> pit	undetermined	1.6	0.7	0.9	
23355	195.1	path	trail	11.0	0.7		<i>P=ahoehoe</i> slab pavers and cleared path going from feature 195 to <i>mauka</i> /east.
23355	196	<i>pāhoehoe</i> pit	undetermined	2.5	1.2	0.9	Cowrie shell inside.
23355	197	<i>pāhoehoe</i> pit	undetermined	1.0	0.7	0.8	
23355	198	<i>pāhoehoe</i> pit	undetermined	0.8	0.6	0.6	
23355	199	cave	cupboard	0.3	0.4	0.3	
23355	200	<i>pāhoehoe</i> pit	undetermined	0.6	0.5	0.6	
23355	201	<i>pāhoehoe</i> pit	undetermined	1.3	0.6	0.7	
23355	202	<i>pāhoehoe</i> pit	undetermined	0.8	0.6	0.5	
23355	203	mound	boundary	1.7	1.5	0.9	Mound is atop raised boulder, connect to feature 182.
23355	203.1	clearing enclosure	habitation	2.5	2.0	0.3	
23355	203.2	path	trail	24.0	0.7		Branch from feature 195.1 goes around feature 203 and ends at feature 205.
23355	204	clearing enclosure	habitation	5.8	3.0	0.6	Water-worn basalt cobbles inside.
23355	204.1	path	trail	8.5	0.7		Connects features 204 and 220.
23355	204.2	cave	cupboard	0.5	0.9	0.5	Northeast corner of feature 204 interior.
23355	205	clearing enclosure	habitation	4.0	3.6	0.8	Large boulder outline, water-worn coral cobbles inside.
23355	205.1	cave	cupboard	0.5	0.6	0.3	Northwest corner of feature 205 interior.
23355	205.2	cave	cupboard	0.4	0.5	0.5	Southeast corner of feature 205 interior.
23355	206	<i>pāhoehoe</i> pit	undetermined	0.4	0.4	0.4	
23355	207	<i>pāhoehoe</i> pit	undetermined	0.7	0.4	0.7	
23355	208	<i>pāhoehoe</i> pit	undetermined	0.6	0.4	0.5	
23355	209	<i>pāhoehoe</i> pit	undetermined	0.7	0.6	0.6	
23355	210	<i>pāhoehoe</i> pit	undetermined	0.7	0.3	0.4	

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	211	<i>pāhoehoe</i> pit	undetermined	1.2	0.9	0.7	
23355	212	<i>pāhoehoe</i> pit	undetermined	1.9	1.0	0.5	
23355	213	<i>pāhoehoe</i> pit	undetermined	0.7	0.6	1.0	
23355	214	<i>pāhoehoe</i> pit	undetermined	1.3	1.2	1.1	
23355	215	clearing enclosure	habitation	3.0	2.4	0.3	Attached to the <i>mauka</i> side of feature 216.
23355	216	<i>C-shape</i> enclosure	habitation	5.2	5.0	0.6	Sand floor.
23355	216.1	path	trail	3.5	1.1		Leads from the front of feature 216 to the beach.
23355	216.2	path	trail	29.0	0.8		Leads from the side of feature 216 to the north, terminates at a disturbed area, but would have led to feature 226, about 35 m from feature 216.
23355	217	<i>C-shape</i> enclosure	habitation	4.0	4.0	9.0	Oriented north, midden interior.
23355	217.1	cave	cupboard	1.2	1.1	0.6	Under east wall.
23355	218	terrace	habitation	3.8	3.0	0.4	Might have been twice this length, wave damaged. Two courses of stone facing.
23355	219	terrace	habitation	5.9	4.0	0.5	Located adjacent to feature 218, juts out and built up more.
23355	220	terrace	habitation	4.5	3.2	0.5	Very disturbed, possibly due to looting. Back wall or <i>C-shape</i> may have been present. Midden on surface.
23355	221	<i>pāhoehoe</i> pit	storage	0.8	0.7	0.6	Behind feature 220. Unclear if it was located inside, beneath wall, or outside.
23355	222	clearing enclosure	habitation	4.2	2.4	0.7	
23355	223	mound	undetermined	1.6	1.3	1.0	
23355	224	pavement	shrine?	3.8	3.0		One very large slab set in place with numerous small slabs to the west, near shrine feature 188.
23355	224.1	path	trail	8.5	0.7		Cleared path and some slab pavers from feature 224 to northeast, cut off by road.
23355	225	<i>pāhoehoe</i> pit	undetermined	1.0	0.9	0.8	
23355	226	enclosure	habitation	15.0	12.0		Heavily damaged by wave action; back wall is terrace-faced outcrop.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	226.1	enclosure	habitation	4.4	1.2		Possibly back half of feature 228.
23355	226.2	platform	habitation	6.5	2.8		Damaged.
23355	227	enclosure	shrine?	2.9	1.4		Abuts very large boulder. Interior is below surrounding surface.
23355	228	enclosure	habitation	5.7	4.1		One good wall segment, damaged by waves
23355	229	enclosure	<i>heiau</i>	13.5	8.8	1.3	This is Reinecke's site 113, and Cordy's site 50-Ha-D21-32.
23355	229.1	'a'ā pit	<i>heiau</i>	0.7	0.5	0.4	
23355	229.2	'a'ā pit	<i>heiau</i>	2.1	0.9	0.6	
23355	229.3	'a'ā pit	<i>heiau</i>	0.6	0.6	0.5	
23355	229.4	'a'ā pit	<i>heiau</i>	1.0	1.0	0.2	
23355	229.5	'a'ā pit	<i>heiau</i>	1.5	1.2	0.4	
23355	229.6	cave	<i>heiau</i>	0.5	0.7	0.4	Next to southwest wall of feature 229.
23355	230	terrace	habitation	5.5	1.8		Possible priest's house.
23355	230.1	overhang shelter	habitation	2.0	2.5	0.6	Attached to feature 230.
23355	231	C-shape enclosure	fishing camp?	2.1	1.8	0.4	Adjacent to coastal trail.
23355	232	'a'ā pit	undetermined	0.7	0.6		Contains water-worn basalt.
23355	233	'a'ā pit	undetermined	0.5	0.3		Located at base of boulder, several coral water-worn cobbles around.
23355	234	overhang shelter	habitation	4.0	5.0	0.7	Located on beginning of slope above coastal trail, heavily impacted by looters.
23355	235	C-shape enclosure	habitation	2.2	2.7	0.5	Built into slope with massive boulder walls, small interior.
23355	236	terrace	habitation	5.2	3.9	0.4	
23355	236.1	C-shape enclosure	habitation	3.4	3.0	0.5	
23355	237	platform	burial	3.7	3.6	1.2	
23355	238	terrace	habitation	3.5	3.5	0.4	
23355	239	terrace	habitation/shrine	5.4	4.4	0.2	Facing not well defined by a discontinuous line of boulders.
23355	240	cave	cupboard	0.5	1.6	0.5	
23355	241	clearing	habitation	2.0	1.0		
23355	242	boulder	shrine?	3.0	1.5		Two accretional boulders with caches of water-worn coral and basalt, and branch coral, isolated from everything else.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	243	mound	undetermined	1.7	1.6		Gravel mound amid 'a'ā flow, behind feature 250.
23355	244	clearing enclosure	undetermined	4.0	2.2	0.2	
23355	245	wall	undetermined	2.2	0.8	1.2	
23355	246	enclosure	burial?	3.2	1.8	1.3	
23355	247	mound	burial?	2.5	1.5	0.8	
23355	249	overhang shelter	cupboard	1.3	2.0		
23355	250	terrace enclosure	habitation	6.8	5.8	0.5	Walled on back and sides. Trail site 50-10-18-5337, feature 10 passes just below and turns <i>makai</i> at north corner.
23355	251	clearing	trail	7.5	1.0		probably Site 5337:10, hard to show continuity because of separate map sheets
23355	252	terrace	undetermined	3.8	1.5	0.5	
23355	253	boulder	shrine?	5.5	3.8		Water-worn cobble hammerstone and removed chunks present, multiple surfaces bashed to reveal red ropy rock.
23355	254	boulder	shrine?	6.8	5.4		Multiple surfaces bashed, adjacent to trail site 50-10-18-5337, feature 9 that goes to cluster D.
23355	254.1	'a'ā pit	shrine?	0.5	0.4		Located against the base of feature 254 boulder, surrounded by water-worn coral cobbles.
23355	254.2	'a'ā pit	shrine?	0.8	0.6		Located against the base of feature 254 boulder.
23355	255	overhang shelter	shrine?	3.8	1.6		Located against the base of feature 254 boulder, paved, with a wall segment at the southeast end.
23355	256	'a'ā pit	undetermined	0.5	0.4		
23355	257	'a'ā pit	undetermined	0.6	0.5		
23355	258	wall	undetermined	2.0	0.5		
23355	258.1	platform	burial	3.0	2.2	1.2	
23355	259	'a'ā pit	undetermined	0.7	0.7	1.0	
23355	260	boulder	shrine?	4.0	3.5	2.0	Bashed.
23355	261	'a'ā pit	undetermined	0.9	0.6	0.8	
23355	262	overhang shelter	cupboard	0.8	0.9	0.7	
23355	263	boulder	shrine complex	5.0	2.2	2.5	Bashed.
23355	263.1	clearing	shrine complex	2.0	2.4		

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	264	'a'ā pit	shrine complex	0.9	0.7	0.6	
23355	265	boulder	shrine complex	5.0	3.5	3.0	Bashed.
23355	266	clearing enclosure	shrine complex	7.0	3.9	0.3	
23355	267	lined pit	shrine complex	1.3	1.1	0.8	Nicely faced interior, filled area of equal size north between this pit and a large boulder.
23355	267.1	fill	shrine complex	2.0	1.0	0.8	
23355	268	clearing enclosure	shrine complex	2.5	4.7	0.78	Stacked south wall, remainder roughly piled.
23355	269	terrace enclosure	shrine complex	1.6	1.6	0.3	Nicely faced square, opens over terrace <i>makai</i> , back is against boulder feature 270.
23355	270	boulder	shrine complex	3.4	2.6	3.0	Highest boulder, bashed shelf high on northwest side, multiple bashed surfaces, but not as beat up as some others here; features at base.
23355	271	enclosure	shrine complex	2.5	1.6	1.1	Stacked wall around pebble pavement with an <i>alā</i> upright, back of feature 270 boulder, slightly hollowed to overhang pavement.
23355	272	'a'ā pit	shrine complex	0.5	0.3	0.8	Contains two water-worn coral and one basalt cobbles.
23355	273	'a'ā pit	undetermined	1.7	1.5	0.8	Roughly lined.
23355	274	terrace	shrine trail	13.3	1.7	0.6	Segment of site 50-10-18-5337, feature 10, but extends south past trail.
23355	275	boulder	shrine complex	3.5	2.0	2.5	<i>Makai</i> face bashed, feature 276 at base.
23355	275.1	cave	shrine complex	0.5	0.7	0.4	Cupboard under base of boulder.
23355	275.2	berm	shrine complex	2.5	0.8		Trail to feature 275.1.
23355	276	enclosure	shrine complex	2.4	1.7	0.7	Triangular; <i>alā</i> uprights in wall niche, against feature 275 upright boulder, feature 274 trail and feature 277 enclosure; below surrounding surface.
23355	277	terrace	shrine complex	2.5	2.2	0.5	Below feature 274 trail, above features 276 and 278.1.
23355	278	boulder	shrine complex	2.7	2.6	4.0	<i>Makai</i> face bashed parallel to feature 276 face. Feature 278.1 at base.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	278.1	lined pit	shrine complex	1.5	1.0	0.7	Located against base of feature 278 boulder.
23355	279	boulder	shrine complex	2.0	1.7	2.0	Surrounded by feature 279.1 pavement, cobbles piled on top.
23355	279.1	clearing enclosure	shrine complex	4.4	4.2	0.8	Paved enclosure surrounding feature 279 boulder.
23355	279.2	terrace	shrine complex	3.2	2.0	0.5	Triangular paved terrace above feature 279.1 level.
23355	279.3	terrace	shrine complex	2.5	3.5	0.8	Paved terrace/trail from site 50-10-18-5377, feature 10 to feature 279; above features 279.2 and 279.1.
23355	280	boulder	shrine complex	2.0	1.1	2.0	Vertical red face bashed on southwest side, feature 280.1 at base.
23355	280.1	'a'ā pit	shrine complex	2.0	1.3	0.7	Rough pit with water-worn cobble hammerstone.
23355	281	'a'ā pit	shrine complex	0.7	0.5	0.6	
23355	289	clearing enclosure	shrine complex	2.7	1.6		Triangular clearing with cobble pavement against boulder feature 280.
23355	290	boulder	shrine complex	5.0	2.2	2.5	Bashed on top, coral cobbles at <i>makai</i> base, pit feature 281 at <i>mauka</i> base.
23355	291	boulder	shrine complex?	4.7	3.8	3.0	East face red bashed, pavement feature 292 at base, opposite main trail from remainder of shrine complex.
23355	291.1	clearing enclosure	shrine complex?	3.4	2.5	0.4	Behind feature 291 boulder, lots of water-worn coral on the surface with a few basalt 'ili'ili.
23355	292	clearing	shrine complex?	7.0	2.0		
23355	293	'a'ā pit	undetermined	1.0	0.4	0.7	At base of boulder.
23355	294	'a'ā pit	undetermined	0.9	0.7	0.5	Surrounded by red outcrop.
23355	295	boulder	shrine complex?	2.5	2.0	2.0	Bashed on <i>mauka</i> and <i>makai</i> sides, pile of cobbles on top.
23355	296	overhang shelter	habitation	2.5	2.2	1.7	Completely looted cave shelter on brow of slope above <i>heiau</i> , probably partially formed by excavation.
23355	297	clearing	habitation	1.5	1.4		Midden/pebble surface.
23355	298	terrace	habitation	2.8	2.4	0.8	Has 1 m high back retaining wall, pebble-cobble surface with midden.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	299	cave	cupboard	1.5	1.0	0.5	Arch of natural bedrock.
23355	300	berm	undetermined	8.0	0.9	0.5	Might be a looter pile or a disturbed terrace facing, located on brow of slope.
23355	301	C-shape enclosure	habitation	3.2	2.2	1.0	Located on brow of slope, but opening <i>mauka</i> , pebble pavement with midden.
23355	302	petroglyph	<i>papumū</i>	0.1	0.8		
23355	303	C-shape enclosure	habitation	3.0	2.5	1.3	Looted; upright in back wall above feature 304 cave, midden and cobble-pebble pavement inside.
23355	304	cave	habitation	1.3	1.7	0.7	Looted.
23355	305	cave	cupboard	0.8	1.5	0.8	Looted.
23355	306	cave	cupboard	0.5	0.3	0.3	
23355	306.1	pavement	burial?	2.2	1.8	1.0	Upright stone and filled-in area.
23355	307	enclosure	canoe shed	12.5	5.8	1.2	
23355	308	'a'ā pit	habitation	1.5	1.0		
23355	309	C-shape enclosure	undetermined	2.5	1.8	1.0	Sits on terrace feature 310.
23355	310	terrace	habitation	4.8	3.6	1.1	Cobble-pebble pavement.
23355	311	depression	undetermined	3.2	2.0	0.4	Faced on southwest edge, boulders on northwest, remainder is sloping wall.
23355	312	mound	undetermined	1.1	0.7	0.6	
23355	313	'a'ā pit	undetermined	0.5	0.5	0.7	Water-worn coral inside.
23355	314	enclosure	habitation	5.0	4.2	0.8	Faced up to ground surface on east, core-filled wall on west, boulders form south side. One big <i>pāhoehoe</i> slab used in construction.
23355	315	shelter	cupboard	0.4	0.7	0.6	Stacked cobble roof augments boulder overhang, contains water-worn basalt and coral.
23355	316	enclosure	habitation	3.2	2.5	0.7	Walls just one stone thick, stacked between existing boulders, one of which is big red boulder. Possibly an animal pen.
23355	317	shelter	cupboard	0.8	1.0		Dug out below boulder base.
23355	318	terrace	habitation	10.5	2.5	0.8	Part is now a retaining wall for the current trail, but appears to have buttressed yard and possibly terraces for <i>kauhale</i> from features 314 to 309.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht/Depth	Comments
23355	319	wall	habitation	3.8	0.8	0.6	This feature and feature 321 are possibly opposite sides of a former platform.
23355	319.1	clearing	habitation	3.0	1.7		Cobble and pebble pavement by feature 319, west side not defined by any construction.
23355	320	alignment	habitation	3.0	0.6	0.5	Might be a foundation of a dismantled wall, with stone taken away to reinforce the modern trail.
23355	321	terrace	habitation	3.9	2.5	0.4	Parallel to modern trail, but with feature 319 may have been earlier habitation feature.
23355	322	terrace enclosure	burial	2.2	1.4	0.3	Looks like a historic burial; pebble paved, surrounded by alignment, terraced down to <i>makai</i> .
23355	323	platform	shrine?	2.3	1.8	1.0	Forms the corner of a large platform, one water-worn basalt and one branch coral present.
23355	324	'a'ā pit	undetermined	0.6	0.4	0.7	Next to red boulder embedded in feature 326 surface.
23355	325	'a'ā pit	undetermined	0.5	0.4	0.5	Next to red boulder embedded in feature 326 surface; reveals buried pavement in feature 326.
23355	326	terrace	men's house	10.0	6.2	0.7	South face terraced with boulders, west and north with stacked smaller boulders, east half melds into outcrop; paved with cobbles and pebbles on the west and pebbles and cobbles on the east; multi-phase construction.
23355	326.1	shelter	cupboard	0.5	0.4	0.7	This feature below feature 326 floor has a slab roof, and is located next to a red boulder.
23355	327	enclosure	habitation	4.4	2.8	0.6	Abuts feature 326, is pebble and cobble paved, and incorporates many boulders.
23355	328	shelter	cupboard	0.6	1.0	0.8	Boulder overhang is augmented with stacked stone.
23355	329	shelter	cupboard	1.0	0.5	0.5	Little stacking at a mostly natural overhang.
23355	330	clearing enclosure	habitation	5.0	2.0	0.5	There is a smaller paving on north, cobbles only on south.
23355	330.1	cave	cupboard	0.6	0.4	0.4	Overhang hollowed beneath boulder embedded in feature 330 floor.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	331	clearing enclosure	habitation	3.5	2.8	0.5	A pebble, 'ili'ili, and coral pebble pavement; below ground to southwest, but above to northeast, contiguous with features 330 and 332.
23355	332	clearing enclosure	habitation	4.1	2.2	0.4	Pebble and cobble paved.
23355	333	boulder ahu	undetermined	5.0	5.0	2.0	Very similar to feature 38. A large flat boulder with cobbles on top forming a partial enclosure; some hammering of top surface.
23355	334	'a'ā pit	undetermined	0.4	0.3	0.4	
23355	335	overhang shelter	cupboard	0.6	1.4	0.5	Alignment wall stacked outside on <i>makai</i> side acts as a windbreak, overhang area only about .25 m ² area.
23355	336	'a'ā pit	undetermined	0.7	0.7	0.4	Stacked roof covers this pit.
23355	337	lined pit	cupboard	0.8	0.4	0.5	Located against boulder base.
23355	338	overhang shelter	habitation	1.5	3.0	0.6	Single slab roof with excavated hollow beneath large enough to sit in, exterior wall is faced pit below surrounding terrain and floor of pebbles and cobbles.
23355	339	overhang shelter	habitation	2.0	2.8	1.0	Stacked slab and cobble roof only remains over about 1.25 m ² area, exterior like feature 338 with pebble, cobble, and coral pavement.
23355	340	terrace	habitation	1.6	1.5	0.8	Creates small level fill area.
23355	341	C-shape enclosure	habitation	1.5	2.9	1.1	Very narrow interior, <i>makai</i> end eroded away, back wall hard to discern from rock fill area.
23355	342	pavement	habitation	3.2	2.5		Sandy surface paved with 'ili'ili, coral, and cobbles.
23355	342.1	pavement	habitation	4.0	1.5		Cobble and pebble pavement—basically the narrow space left between features 338, 339, and 341.
23355	342.2	cave	cupboard	0.9	0.5	0.4	There is a sand covered floor in this boulder overhang, but it could be a natural wave deposit.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23355	343	mound	undetermined	1.5	0.8	0.6	A rough mound of mixed materials where natural level gives way to coastal slope, <i>makai</i> of this is eroded, but a small section of waterworks-paved coast trail remains.
23355	344	boulder	undetermined	4.0	2.0	0.0	Bashed to expose ropy, red interior lava.
23355	345	boulder	undetermined	2.5	2.0	1.0	Bashed to expose ropy, red interior lava.
23355	346	boulder	undetermined	4.0	3.5	0.0	Bashed to expose ropy, red interior lava.
23355	347	overhang shelter	habitation	0.0	0.0	0.0	Three small overhang shelters under a 6 m diameter boulder.
23355	348	overhang shelter	habitation	0.0	0.0	0.0	A small overhang shelter with associated paving at a large boulder with stones on top.
23355	349	boulder	habitation	0.0	0.0	0.0	Complex of modifications, including a petroglyph, an enclosure, and a clearing. Part of the boulder has been bashed to expose ropy red lava.
23355	350	overhang shelter	habitation	2.2	1.7	0.5	Roughly stacked semi-circular wall in front of shelter.
23355	351	boulder	undetermined	6.9	3.6	0.0	Massive slab of lava bashed all over to expose red interior lava.
23355	367	enclosure	canoe shed	12.5	4.5	1.3	North/ <i>makai</i> wall obliterated, remainder nicely core-filled.
23356	1	boulder	shrine	3.7	3.5	3.0	Hammered on east and northwest sides. Spike in top center might be a benchmark.
23356	1.1	terrace enclosure	shrine	8.0	7.2	0.7	Wall best defined on downslope sides, angular upright in east wall, pebble-cobble pavement south and west, red cobble and pebble pavement north and east. Large boulder in center of platform.
23356	1.2	overhang shelter	shrine	0.7	0.5	0.7	Cupboard hollowed under feature 1 boulder.
23356	1.3	overhang shelter	cupboard	0.9	0.7	0.4	Accessible from feature 6.1.
23356	2	mound	shrine	1.0	0.8	0.5	Located at end of feature 1.1 enclosure wall.
23356	3	pit	undetermined	1.5	0.8	1.0	Against base of unmodified boulder.
23356	4	pit	undetermined	0.7	0.5	1.2	Against base of unmodified boulder.

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APPENDIX A. FEATURE DESCRIPTIONS

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	5	pit	undetermined	0.7	0.3	0.8	Against base of unmodified boulder, red rocks on north edge.
23356	6	boulder	burial	0.9	0.8	0.7	Located in center of feature 6.1, has battered red and black surfaces.
23356	6.1	platform	burial	3.3	3.1	0.4	Highest point on site, boulder .7 m high in center is feature 6.
23356	6.2	terrace	burial?	6.1	2.3	0.6	Rough cobble fill surface, boulder facing.
23356	7	pit	undetermined	0.6	0.6	0.6	Against base of unmodified boulder.
23356	8	mound	undetermined	1.4	1.1	0.6	Looks higher than it is because it is atop some small boulders.
23356	9	depression	undetermined	3.0	2.1	0.8	Rough depression, fractured cobbles inside. Feature 9.1 is at south end.
23356	9.1	overhang shelter	shrine?	1.9	0.8	0.8	
23356	10	cave	cupboard	0.5	0.4	0.4	Under same boulder as feature 9.
23356	11	clearing	shrine?	7.0	2.5	0.7	Fewer than ten cobbles atop boulder.
23356	11.1	boulder	undetermined	1.1	1.3	0.6	Located between boulders.
23356	12	pit	undetermined	0.6	0.5	0.6	Located against boulder that is outside edge of feature 14.1.
23356	13	pit	undetermined	0.5	0.3	0.4	Bashed on southwest and northeast sides. Northeast is overhang of feature 14.1.
23356	14	boulder	shrine?	3.6	2.6	0.4	Mostly outside, a third covered by battered overhang of feature 14.
23356	14.1	overhang shelter	shrine?	1.9	1.4	0.6	Abuts unmodified boulder.
23356	15	terrace	undetermined	1.1	0.6	0.6	Located amid rough 'a'a.
23356	16	pit	undetermined	0.5	0.5	0.5	Stacked <i>mauka</i> wall, boulders elsewhere are higher. Has a cobble floor.
23356	17	clearing enclosure	habitation?	4.2	3.0	0.6	Bones from entire fish inside.
23356	17.1	overhang shelter	cupboard	0.5	1.0	0.6	
23356	18	clearing	habitation?	3.2	1.5	0.8	Triangular pavement, leftover area between features 17 and 19.
23356	19	enclosure	habitation?	4.0	3.2	0.8	North and south walls collapsed, interior obscured by collapsed stone.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht/Depth	Comments
23356	19.1	clearing	habitation?	1.4	3.0		Cobble pebble pavement <i>mauka</i> of feature 19, triangular space.
23356	20	overhang shelter	cupboard	0.4	0.7	0.4	Slab and stacked cobble roof.
23356	21	terrace	habitation?	2.4	0.8	0.3	Retains slope below feature 19, back edge unclear due to collapse.
23356	22	overhang shelter	habitation?	2.3	1.1	0.9	Overhang of large boulder on slope with one stacked wall.
23356	23	terrace	habitation?	4.3	1.2	0.4	Retaining wall below feature 21, one large water-worn boulder in facing.
23356	24	terrace	habitation?	5.2	7.3	0.8	Pebble, cobble, and coral paved terrace, very prominent above pond. Possibly a high status habitation or religious structure.
23356	24.1	boulder <i>ahu</i>	undetermined	1.2	1.2	1.6	Located at corner of feature 24, cobbles atop boulder.
23356	25	terrace	habitation?	3.0	0.9	1.8	Reinforces feature 26.
23356	26	terrace	habitation?	2.3	1.5	0.8	Reinforces corner of feature 24.
23356	27	wall	habitation?	3.2	0.8	0.7	Wall parallel and outside of feature 24 south wall, appears to be remnant possibly robbed of material.
23356	30	clearing	trail	6.0	0.7		Connects shrine area with habitation terraces.
23356	31	wall	undetermined	3.2	0.5	0.5	Wall remnant. Big, blocky, red rock behind in depression without any trace of paving, at edge of bulldozed area, but does not appear pushed.
23356	32	pit	undetermined	0.8	0.7	0.5	Boulder at either end with stacked lining on sides.
23356	33	pit	undetermined	0.6	0.4	0.4	
23356	34	pit	undetermined	1.0	0.7	0.6	
23356	35	pit	undetermined	0.6	0.3		
23356	36	boulder	undetermined	3.1	2.2		Red ropy exposure.
23356	36.1	pit	undetermined	0.7	0.7	0.7	Located at base of boulder and partially beneath it.
23356	37	pit	undetermined	0.7	0.6	0.5	
23356	38	pit	undetermined	0.5	0.3		
23356	39	berm	undetermined	4.6	1.2		
23356	39.1	clearing	trail	3.8	0.7		Trail segment, but not clear where it goes.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	40	pit	undetermined	0.7	0.6	0.3	Located against boulder, squarish plan.
23356	41	boulder	undetermined	2.0	1.7	1.6	South face bashed vertical.
23356	41.1	pavement	undetermined	3.0	0.7		Located at base of feature 41 boulder.
23356	42	pit	undetermined	0.6	0.5		Located at base of boulder and partially beneath it.
23356	43	boulder	undetermined	3.1	1.4	1.0	West side hammered, creating concave face.
23356	43.1	pit	undetermined	0.9	0.8		Contains cowrie shell.
23356	44	overhang shelter	undetermined	2.0	1.3		Boulder overhang with stacked side facings, floor below surrounding ground and paved with cobbles.
23356	45	boulder	undetermined	4.2	2.9	3.0	Several areas hammered, coral and other cobbles on top.
23356	46	boulder	undetermined	3.6	1.8		Northwest face bashed vertical, next to trail.
23356	46.1	pavement	undetermined	3.0	1.2		Located between trail and boulder 46.
23356	47	terrace	undetermined	3.5	0.5	0.9	Connects large boulders and acts as retaining wall, but no level surface large enough to use.
23356	48	boulder	undetermined	7.0	5.0	5.1	Long red face exposed on northeast <i>mauka</i> side, some bashing on top, small hammerstone present.
23356	49	terrace	undetermined	1.3	0.5	0.3	Small modification not large enough to create a living space.
23356	50	pit	quarry	2.0	0.7		Fine-grained basalt vein with water-worn large hammerstone.
23356	51	terrace	habitation/resting place	3.2	1.5	0.7	Possibly associated with coastal trail.
23356	53	boulder	undetermined	3.0	2.3	2.0	Possible boundary marker. Cobbles on top.
23356	54	pit	undetermined	1.0	0.3	0.4	Located at base of boulder, lined with stacked stone.
23356	55	pit	undetermined	1.0	0.5	0.6	Located amid boulders.
23356	56	shelter	cupboard	1.0	0.6	0.3	Stacked sides and slab roof.
23356	57	enclosure	habitation?	4.4	2.5	1.1	At least half bulldozed.
23356	58	boulder	shrine	4.7	2.3	3.2	Bashed vertical face exposing red interior.
23356	58.1	enclosure	shrine	4.9	2.1	0.5	Located at base of feature 58.
23356	58.2	path	trail	6.0	0.7		Trail from feature 59 to feature 58.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	59	terrace	habitation/ <i>heiau</i>	11.0	6.0	0.6	Boulder block foundation.
23356	59.1	boulder	undetermined	2.8	2.7	1.5	Bashed boulder located at edge of site, beginning of trail.
23356	60	wall	undetermined	3.0	0.9	1.2	Connects boulders.
23356	61	pit	undetermined	3.0	1.2	0.2	Located between features 60 and 61.
23356	62	terrace	habitation	5.6	4.5	0.2	Slab pavement mostly gone.
23356	63	terrace	habitation	5.0	3.2	0.7	Cobble surface with boulder and pit feature 68 on surface.
23356	64	wall	habitation	3.4	0.4	0.3	Disturbed.
23356	65	mound	modern	2.0	1.3	1.0	Modern, raised fireplace.
23356	67	C-shape enclosure	modern campfire	1.0	0.8		Modern windbreak fireplace.
23356	68	pit	campfire habitation	0.7	0.5	0.5	Located in surface of feature 62.
23356	69	terrace	habitation	7.2		0.4	Eroded, and therefore cannot determine depth.
23356	70	wall	habitation	5.0	0.8	0.3	Partial foundation.
23356	71	wall	modern	4.0	1.5	0.8	Windbreak shelter.
23356	73	circular alignment	modern camping	1.1	1.0	0.2	Fireplace ring.
23356	74	mound	campfire remnant	2.0	1.0	0.3	
23356	75	wall	undetermined	12.0	0.9	0.2	Might have been part of a large triangular enclosure.
23356	76	enclosure	canoe shed	12.0	7.0	0.9	It is possible that the <i>makai</i> end was enclosed and destroyed.
23356	77	circular alignment	modern campfire	0.6	0.5	0.2	Modern.
23356	78	platform enclosure	habitation	6.5	5.2	0.2	Located on edge of <i>pāhoehoe</i> , with beach facing 1.3 m high, made of 50
23356	79	circular alignment	modern campfire	1.1	0.9		Modern.
23356	80	platform enclosure	habitation	6.0	5.0	0.4	
23356	81	terrace	habitation	3.4	2.4	0.4	
23356	82	depression	undetermined	1.0	0.8	0.1	Pecked depression.
23356	83	pavement	habitation	4.4	3.1		Filled low area in <i>pāhoehoe</i> .
23356	84	terrace	habitation	7.4	4.9		Facings collapsed, length reported is estimated, height unclear.
23356	85	mound	habitation	3.2	2.1	0.3	Remnant; probably part of an enclosure with features 86 and 87.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	86	wall	habitation	3.1	0.8	0.3	See feature 85 comment, interior facing foundation appears intact.
23356	87	wall	habitation	3.5	0.9	0.5	See feature 85 comment, exterior foundation remnant intact.
23356	88	cave	habitation	2.0	1.5	1.0	Possibly shelter or disposal area, entry bashed through <i>pāhoehoe</i> .
23356	89	depression	undetermined	0.8	0.7	0.2	Pecked depression.
23356	90	path	trail	35.0	0.7		Some cobble fill, could be modern. <i>Mauka</i> end not determined.
23356	90.1	wall	undetermined	3.9	0.7	0.4	Modern wall.
23356	91	enclosure	animal pen	2.8	2.8	0.8	Built into <i>pāhoehoe</i> niche by beach.
23356	92	enclosure	habitation	3.9	3.2	0.4	Built around opening of cave.
23356	92.1	cave	habitation				Looted, only entry is located on map.
23356	93	cave	habitation	5.5	4.1		Looted.
23356	94	overhang shelter	undetermined	6.2	2.5	0.9	Dimensions are of entry, underground extent not on map; midden not noted; wall segment and cobbles inside, including some water-worn.
23356	95	C-shape enclosure	undetermined	1.8	1.0	0.3	Located at edge of pit feature 95.1, providing windbreak on northwest side.
23356	95.1	pit	undetermined	1.8			Not completely drawn on map, but appears small; possible cupboard or agricultural feature.
23356	96	pit	quarry?	3.1	2.7		Some cobbles inside, including one water-worn.
23356	97	pit	quarry?	1.9	1.7		Some cobbles inside.
23356	98	pit	undetermined	2.1	1.4		Nearly filled with cobbles.
23356	99	pit	quarry?	6.1	2.3		Width is of largest lobe, but overall an irregular T-shape, probably connected underground to filled feature 98.
23356	100	overhang shelter	cupboard	1.0	0.7		Top of shelter has sand, small <i>pāhoehoe</i> slabs, and midden.
23356	100.1	deposit	habitation	2.0	0.8	0.1	Shoreline sand, coral, pebbles, as well as <i>pāhoehoe</i> slabs.
23356	101	pit	quarry?	9.5	2.1		Narrower crack in south end, 4.0 by 0.5 m partially filled with cobbles.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	101.1	overhang shelter	cupboard	1.0	0.7		Contains fish bones.
23356	102	enclosure	undetermined	4.5	4.1	1.0	Bobby Canara calls this a well, but it is an enclosure over a small lava tube entry that heads <i>makai</i> ; now full of camper feces, underwear, etc.
23356	103	terrace	habitation	3.8	2.0	0.5	Partially covered with wave-deposited boulders.
23356	104	enclosure	habitation	7.3	3.7	0.3	<i>pāhoehoe</i> slabs set upright to form wall foundation.
23356	105	platform	habitation?	5.5	4.5	0.5	Caim built up on center, and what appears to be a wall on south side.
23356	106	wall	modern camping	2.5	0.4	0.4	Privacy wall for impromptu outhouse.
23356	107	wall	modern camping	2.0	0.4	0.5	Privacy wall for impromptu outhouse.
23356	108	overhang shelter	habitation	2.7	1.4		Adjacent to trail, outside shelter is 10 m long natural depression full of sand, midden, water-worn basalt and coral.
23356	109	boulder	undetermined	3.0	1.6		Cobbles on top appear to have formed a cupboard.
23356	110	cave	habitation	20.0	2.8	0.8	Lava tube might be longer than measured; side/skylight entries measure 4.2 by 2 m and 1.2 by 0.9 m; looted.
23356	112	mound	modern looting	3.0	2.0	0.9	Consists of water-worn and slab pavers, cobbles, and boulders;
23356	113	pavement	habitation	5.1	4.0		Cobble pavement filling dip in <i>pāhoehoe</i> .
23356	114	platform	causeway/trail	3.5	3.1	0.7	Connects lava tube trail to shrine complex.
23356	115	terrace	causeway/trail	5.2	3.6	0.8	Step up from feature 114, connects to shrine complex.
23356	115.1	depression	undetermined	0.4	0.3	0.1	Pecked depression.
23356	116	terrace	habitation	4.6	4.0	0.5	Located above feature 113 and below feature 115; slab pavement mostly dismantled, much of it in mound feature 112.
23356	117	terrace enclosure	shrine complex?	4.2	5.0	0.5	C-shape enclosure on top open to <i>makai</i> , terrace and wall each 0.5 m high.
23356	117.1	terrace	shrine complex?	1.7	0.5	0.5	Step in front of feature 117.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Hi./Depth	Comments
23356	117.2	wall	shrine complex?	5.0	0.8	0.2	Wall remnant extends out from feature 117 east wall, one <i>pāhoehoe</i> and one 'a'ā upright at east end.
23356	118	terrace	shrine complex?	2.9	1.2	0.7	Nicely made concave terrace with upright slabs below feature 117.
23356	119	alignment	trail	6.5	1.0		Crushed cobbles and pebbles.
23356	120	terrace	habitation?	1.8	2.3	0.2	Terrace fills low spot in lava flow.
23356	121	boulder	shrine	3.0	1.0	0.5	Natural hollow on <i>makai</i> side of boulder filled with cobbles and branch coral.
23356	121.1	pavement	shrine	1.6	1.2		Branch coral on pebble and cobble pavement above and behind feature 121.
23356	122	mound	undetermined	4.0	3.5	1.5	10–20 cm stones piled at end of small ridge, and in crack atop ridge.
23356	123	cave	cupboard	1.0	1.3	0.3	
23356	124	cave	undetermined	1.6	2.0		Lava tube partly filled with stone, not sure how deep.
23356	125	terrace	undetermined	2.0	1.3	0.4	Located over feature 126 lava tube, could seal larger entrance.
23356	126	cave	undetermined	3.0	1.2	0.2	Appears impassable by humans.
23356	127	mound	undetermined	1.4	1.0	0.5	
23356	128	pit	undetermined	1.4	0.7	0.5	
23356	129	pit	undetermined	1.6	1.0	0.9	
23356	130	pit	undetermined	2.3	1.4		Cobble filled.
23356	131	pit	undetermined	0.8	0.5		Cobble filled, connected to feature 130.
23356	132	petroglyph	undetermined	2.2	1.1		Simple pecked surface, no figures.
23356	133	pavement	undetermined	5.0	3.5		Low spot in <i>pāhoehoe</i> filled with cobble and pebble pavement.
23356	134	mound	undetermined	0.6	0.6	0.4	Includes 2 water-worn stones.
23356	135	terrace	burial?	2.0	1.8	0.6	
23356	136	mound	undetermined	0.9	0.9	0.2	Very low, seems to be a remnant of a larger mound.
23356	137	pit	undetermined	1.9	1.1	0.5	West edge filled with rock, possibly a blocked lava tube entry.
23356	138	pit	undetermined	0.7	0.6	0.5	Connected to feature 138.1 by a small lava tube.
23356	138.1	pit	undetermined	0.7	0.7	1.0	Connected to feature 138 by a small lava tube.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht/Depth	Comments
23356	139	mound	undetermined	1.1	1.1	0.3	
23356	140	pit	undetermined	1.3	1.2		Filled with cobbles.
23356	141	pit	undetermined	1.1	1.0		Filled with cobbles.
23356	142	mound	undetermined	1.1	1.1	0.4	Perimeter is faced.
23356	143	mound	modern trail	0.3	0.3	0.7	Located near road, probably served as a marker for bulldozer.
23356	144	mound	undetermined	1.2	1.0	0.2	
23356	145	pit	undetermined	1.1	0.4	0.3	Excavated sideways into ridge, filled with cobbles. Possible lava tube entry.
23356	146	pit	undetermined	2.4	0.9	0.7	Trash and toilet paper on partially cobble-filled pit.
23356	147	cave	habitation	4.5	1.8	1.0	Looted, but still has some coral files and cache of possible <i>kānane</i> pieces.
23356	147.1	pit	cave entry	1.8	0.8	1.0	
23356	148	enclosure	habitation	5.0	3.4	0.6	Only northeast corner remains, probably connected to feature 149.
23356	149	wall	habitation	4.2	1.0	0.3	Probably part of a large enclosure with feature 148.
23356	150	wall	habitation	4.7	1.0	0.2	Probably connected to feature 149.
23356	151	pavement	habitation	5.1	2.1		Possibly connected to features 150 and 147.
23356	152	pavement	habitation	6.0	4.0		Includes <i>pāhoehoe</i> and 'a'ā, rough surface.
23356	153	pavement	parking	5.4	2.7		Mostly coral, some 'ili'ili; space for one truck.
23356	154	pit	quarry?	2.6	2.0	1.7	<i>Pāhoehoe</i> and water-worn coral and basalt inside.
23356	155	pit	quarry?	1.4	0.9	0.7	<i>Pāhoehoe</i> and coral inside.
23356	156	cave	habitation	9.3	1.8	0.8	More than half open; looted.
23356	157	pit	quarry?	4.3	2.1	0.3	Crushed <i>pāhoehoe</i> floor, looter back-dirt and possibly some prior midden.
23356	158	cave	habitation	7.0	2.0	1.8	Connects to feature 159 entry; looted and modern trash.
23356	159	pit	cave entry	2.5	1.0	0.8	
23356	160	cave	habitation	6.0	3.8	0.6	Located at corner of feature 161.
23356	161	enclosure	habitation	10.8	10.0	0.8	North and east walls perceivable, but collapsed, and a new platform built at southeast corner; other walls may have enclosed area where midden is; possible interior dividing wall.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	162	mound	modern	2.6	1.2	0.9	Modern platform mound, stacked.
23356	163	pavement	habitation	7.5	2.8		Cobble-filled low spot.
23356	164	pavement	habitation	9.0	9.0		Cobble-filled low spot.
23356	165	pavement	habitation	6.0	2.5		Cobble-filled low spot.
23356	166	enclosure	shrine	5.4	3.6	0.5	Wall limited, rest is a modification and refinement of pit; upright and branch coral by wall, some sediment.
23356	167	mound	burial?	3.3	2.9	0.6	
23356	168	wall	habitation?	2.6	0.5	0.4	Small midden scatter to south.
23356	169	cave	habitation	3.9	2.4	1.1	Scant midden, maybe temporary.
23356	170	lined pit	shrine?	2.0	1.4		Branch coral to north and east.
23356	171	cave	cupboard	6.5	2.1	0.6	Contains long bamboo pieces, possibly fishing poles.
23356	172	pit	undetermined	0.3	0.3		The <i>pāhoehoe</i> in this area is very fragmented.
23356	173	cave	habitation	10.8	2.2	0.8	A 2 m opening at the <i>makai</i> end, and a large skylight entry at <i>mauka</i> end 4.5 m long, midden and cobbles inside, feature 176 on top.
23356	174	C-shape enclosure	habitation	5.1	4.4	0.5	Open to the north, east wall curls around, nearly enclosing front; nice upright slab construction on back inner wall, all of these faced with whitish underside to feature interior, another upright slab at front end of west wall.
23356	174.1	path	trail	32.0	0.7		Worn <i>pāhoehoe</i> trail connects north and south portions of cluster.
23356	175	enclosure	habitation	3.0	2.7	0.7	North wall more of a mound, paved area small, uses upright slabs, many now fallen.
23356	175.1	pavement	habitation	3.5	1.3		North of feature 175, might represent the same pavement.
23356	176	pavement	habitation	3.2	4.4		<i>Pāhoehoe</i> slabs atop cave feature 173 roof, very poor condition.
23356	177	petroglyph	<i>papamū</i>	0.5	0.4		Located on low <i>pāhoehoe</i> ridge fronting feature 174, near cave feature 173 <i>makai</i> entry.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	178	wall	habitation	4.5	1.1		Might be north edge of feature 176 pavement.
23356	179	pavement	undetermined	1.2	1.0		A nice, little, isolated, slab pavement.
23356	180	cave	burial	12.5	4.5	1.2	Stacking near entry of uncertain age, since it is by the road.
23356	180.1	wall	burial	2.0	0.6	0.6	Probably sealed off burial portion of cave with feature 180.2.
23356	180.2	wall	burial	1.9	0.6	0.6	Probably sealed off burial portion of cave with feature 180.1.
23356	181	pit	shrine	1.8	1.4	1.0	Pointed out by B. Camara, was filled with rubble stone, but upon emptying it, has several oblong <i>alā</i> stones inside.
23356	181.1	wall	shrine	1.8	0.3		
23356	182	<i>pāhoehoe</i> pit	undetermined	1.5	1.2	0.2	
23356	183	' <i>a</i> ' <i>ā</i> pit	undetermined	5.0	4.0	0.3	
23356	184	' <i>a</i> ' <i>ā</i> pit	undetermined	0.8	0.5	0.3	An <i>alā</i> cobble associated.
23356	185	<i>pāhoehoe</i> pit	undetermined	1.3	1.25	0.35	
23356	186	boulder	quarry	7.0	0.0	0.0	Crack in rock quarried.
23356	187	mound	boundary	0.4	0.4	0.4	3-4 courses high.
23356	188	<i>alā</i> cobble	hammerstone				
23356	189	<i>pāhoehoe</i> pit	undetermined	2.8	3.0	0.5	
23356	190	<i>pāhoehoe</i> pit	undetermined	3.0	2.5		No clear pit outline, but two empty spaces among jumbled chunks of <i>pāhoehoe</i> .
23356	191	' <i>a</i> ' <i>ā</i> pit	undetermined	0.4	0.35	0.65	Base of ' <i>a</i> ' <i>ā</i> outcrop.
23356	192	' <i>a</i> ' <i>ā</i> pit	undetermined	0.65	0.45	0.55	
23356	193	<i>alā</i> cobble	hammerstone				
23356	196	<i>pāhoehoe</i> pit	undetermined	1.5	1.0	0.0	
23356	197	<i>pāhoehoe</i> pit	undetermined	0.0	0.0	0.0	
23356	198	<i>pāhoehoe</i> pit	undetermined	0.0	0.0	0.0	
23356	202	platform	undetermined	0.0	0.0	0.0	Constructed at side and partially on top of boulder.
23356	215	platform	temporary habitation	1.9	1.3	0.6	Built between 3 boulders.
23356	216	clearing	temporary habitation	4.0	2.0		' <i>A</i> '= <i>a</i> gravel and pebble paving.
23356	217	platform	temporary habitation	1.8	1.0	0.3	Small coral cobble and two <i>alā</i> hammerstones off side of feature.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	218	mound	burial?	2.0	1.3	0.5	Branch coral on top—located next to extensively bashed boulder.
23356	219	boulder	quarry	0.0	0.0	0.0	Extensively bashed exposing red ropy interior lava.
23356	220	alignment	undetermined				Four slabs on end forming a rectangular enclosure.
23356	221	'a'ā pit	undetermined	0.4	0.4	0.8	Contains <i>alā</i> cobble at base of boulder.
23356	222	wall	undetermined	1.7		0.7	Crudely stacked in places to two courses.
23356	223	enclosure	temporary habitation	1.7	1.4	0.8	Paved with 'a'ā cobbles and with one coral and one <i>alā</i> cobble in interior.
23356	224	enclosure	temporary habitation	2.2	1.3	0.8	C-shape; interior paved with 'a'ā pebbles.
23356	225	overhang shelter	temporary habitation	1.2	0.9	0.6	Shelter under boulder.
23356	226	overhang shelter	cupboard	2.6	0.4	0.4	Built along base of boulder.
23356	227	enclosure	temporary habitation	5.5	2.2	1.1	At base of boulder.
23356	228	overhang shelter	temporary habitation	1.5	1.3	0.6	Shelter under boulder.
23356	229	'a'ā pit	undetermined	0.5	0.5	0.9	
23356	230	overhang shelter	temporary habitation	1.3	1.2	0.5	Shelter under boulder.
23356	231	'a'ā pit	undetermined	0.9	0.9	0.3	
23356	232	overhang shelter	temporary habitation	0.6	0.6	0.6	At base of boulder.
23356	233	'a'ā pit	undetermined	1.2	0.9	0.8	Base of boulder.
23356	234	'a'ā pit	undetermined	0.6	0.4		Two pits.
23356	235	'a'ā pit	undetermined				Located at northwest side of boulder.
23356	236	'a'ā pit	undetermined	1.0	1.0	1.0	Located at southeast end of boulder.
23356	237	'a'ā pit	undetermined	0.6	0.5	0.5	
23356	238	'a'ā pit	undetermined	0.9	0.8	0.7	
23356	239	'a'ā pit	undetermined	1.4	1.2	0.9	
23356	240	overhang shelter	temporary habitation	3.0	1.3	0.5	Difficult entrance under boulder.
23356	241	'a'ā pit	undetermined	1.4	0.5	0.6	Base of boulder.
23356	242	'a'ā pit	undetermined				Two pits.
23356	243	'a'ā pit	undetermined	1.1	0.6	0.9	Between three large boulders.
23356	244	'a'ā pit	undetermined	0.6	0.4	0.6	Base of boulder.
23356	245	alignment	quarry	1.3			Alignment on boulder.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht/Depth	Comments
23356	246	'a'ā pit	undetermined				Two pits.
23356	247	'a'ā pit	undetermined	0.5	0.5	0.5	
23356	248	'a'ā pit	undetermined	0.5	0.4	0.6	Between two boulders.
23356	249	'a'ā pit	undetermined	1.3	1.0	0.6	Between three boulders.
23356	250	'a'ā pit	temporary habitation				Two features: 'a'ā pit with pebble paving.
23356	251	'a'ā pit	undetermined	0.45	0.3	0.6	Base of boulder.
23356	252	overhang shelter	temporary habitation	1.2	0.7	0.5	Under south side of boulder.
23356	253	'a'ā pit	undetermined	0.8	0.7	0.6	
23356	254	'a'ā pit	undetermined	0.5	0.4	0.4	Between three boulders with stacked cobbles on fourth side.
23356	255	platform	temporary habitation	1.5	1.0	0.3	Terrace between three boulders and faced with 'a'ā cobbles on the west side.
23356	256	wall	boundary			0.8	Stacked sections between boulders, disturbed by bulldozing.
23356	257	'a'ā pit	undetermined	1.1	0.6	0.3	
23356	258	'a'ā pit	undetermined	1.0	1.0	0.7	
23356	259	'a'ā pit	undetermined	0.5	0.5	1.0	
23356	260	'a'ā pit	undetermined	0.6	0.6	1.0	
23356	261	overhang shelter	temporary habitation	1.0	0.5	0.5	Shelter under boulder.
23356	262	overhang shelter	temporary habitation	1.2	0.6	0.6	Shelter under boulder.
23356	263	'a'ā pit	undetermined				Two pits.
23356	264	'a'ā pit	undetermined	1.0	1.0	0.8	
23356	265	overhang shelter	temporary habitation	1.6	1.1	0.7	Under south side of large boulder.
23356	266	human remains	burial				In crack in boulder.
23356	267	'a'ā pit	undetermined	1.1	1.0	0.4	
23356	268	enclosure	temporary habitation	2.5	1.7	0.5	Located at quarried boulder.
23356	269	overhang shelter	temporary habitation	1.0	0.6	0.8	Shelter under boulder.
23356	270	overhang shelter	temporary habitation	2.4	1.1	0.85	Associated deposit of coral and <i>alā</i> cobbles and <i>pipipi</i> and other shells
23356	271	'a'ā pit	undetermined	1.1	0.9	0.4	
23356	272	'a'ā pit	undetermined	1.8	1.6	0.4	Contains <i>alā</i> cobble and cowrie shell.
23356	273	'a'ā pit	undetermined				Three pits, with <i>alā</i> cobble, cowrie shell, and <i>Drupa</i> .
23356	274	enclosed shelter	temporary habitation	2.0	2.0	0.6	Cowrie and <i>pipipi</i> shell in interior.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	275	mound	boundary				One of six <i>ahu</i> in a line. Average size 0.6 m in diameter and 0.3 m high.
23356	276	mound	boundary				One of six <i>ahu</i> in a line. Average size 0.6 m in diameter and 0.3 m high.
23356	277	mound	boundary				One of six <i>ahu</i> in a line. Average size 0.6 m in diameter and 0.3 m high.
23356	278	mound	boundary				One of six <i>ahu</i> in a line. Average size 0.6 m in diameter and 0.3 m high.
23356	279	mound	boundary				One of six <i>ahu</i> in a line. Average size 0.6 m in diameter and 0.3 m high.
23356	280	mound	boundary				One of six <i>ahu</i> in a line. Average size 0.6 m in diameter and 0.3 m high.
23356	281	<i>alā</i> cobble	hammerstone				
23356	282	enclosed shelter	temporary habitation	4.6	2.8	0.6	Enclosed shelter.
23356	283	<i>alā</i> cobble	hammerstone				
23356	284	<i>pāhoehoe</i> pit	undetermined	1.8	0.7	0.6	
23356	285	mound	boundary	1.2	0.6	0.2	Broken down <i>ahu</i> .
23356	286	<i>pāhoehoe</i> pit	undetermined	0.4	0.25	0.7	Broken in top of lava tube.
23356	287	<i>pāhoehoe</i> pit	undetermined	0.35	0.15	0.5	Broken in top of lava tube.
23356	288	<i>pāhoehoe</i> pit	undetermined	1.8	1.2	0.6	
23356	289	<i>pāhoehoe</i> pit	undetermined	1.0	1.0	0.5	Boulder blocks inside.
23356	290	<i>alā</i> cobble	hammerstone				
23356	291	<i>pāhoehoe</i> pit	undetermined	1.8	1.0	0.4	
23356	292	<i>pāhoehoe</i> pit	undetermined	1.1	0.7	0.6	
23356	293	<i>pāhoehoe</i> pit	undetermined	1.3	1.0	0.4	
23356	294	<i>pāhoehoe</i> pit	undetermined	0.4	0.3	0.5	
23356	295	<i>alā</i> cobble	hammerstone				
23356	296	<i>pāhoehoe</i> pit	undetermined	2.0	1.8	0.4	
23356	297	<i>pāhoehoe</i> pit	undetermined	2.0	0.8	0.3	

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	298	<i>pāhoehoe</i> pit	undetermined	2.9	0.8	0.4	
23356	299	<i>pāhoehoe</i> pit	undetermined	3.4	3.1	0.35	One <i>alā</i> cobble inside.
23356	300	<i>pāhoehoe</i> pit	undetermined	3.8	2.4	0.5	
23356	301	<i>pāhoehoe</i> pit	undetermined	0.6	0.4	0.6	
23356	302	<i>pāhoehoe</i> pit	undetermined	1.4	0.9	0.6	
23356	303	<i>alā</i> cobble	hammerstone				
23356	304	<i>pāhoehoe</i> pit	undetermined	0.45	0.45	0.45	
23356	305	cave	undetermined	3.8	3.2		
23356	306	<i>alā</i> cobble	hammerstone				
23356	307	<i>pāhoehoe</i> pit	undetermined	1.0	0.5	0.7	
23356	308	<i>pāhoehoe</i> pit	undetermined	0.7	0.7	0.2	
23356	309	<i>pāhoehoe</i> pit	undetermined	0.7	0.5	0.3	
23356	310	<i>pāhoehoe</i> pit	undetermined	1.3	0.5	0.3	
23356	311	<i>pāhoehoe</i> pit	undetermined	0.7	0.5	0.5	One <i>alā</i> cobble inside.
23356	312	<i>pāhoehoe</i> pit	undetermined				With <i>alā</i> cobble at toe of 'a'ā lava flow.
23356	313	overhang shelter	temporary habitation	3.3	1.7	1.0	Lacks deposit.
23356	314	<i>pāhoehoe</i> pit	undetermined	4.3	1.0	0.2	
23356	315	<i>pāhoehoe</i> pit	undetermined	2.9	0.7	0.5	
23356	316	<i>alā</i> cobble	hammerstone				
23356	317	cave	temporary habitation	2.1	1.8	0.9	Scant deposit.
23356	318	<i>alā</i> cobble	hammerstone				
23356	319	<i>alā</i> cobble	hammerstone				
23356	320	<i>alā</i> cobble	hammerstone				
23356	321	mound	undetermined	1.6	0.9	0.3	
23356	322	overhang shelter	temporary habitation	2.2	2.0	0.35	Enclosed shelter.
23356	323	<i>pāhoehoe</i> pit	undetermined	3.3	1.1	0.3	
23356	324	<i>pāhoehoe</i> pit	undetermined	1.1	0.6	0.3	

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23356	325	<i>pāhoehoe</i> pit	undetermined	2.5	1.4	0.3	
23356	326	<i>pāhoehoe</i> pit	undetermined	2.6	0.6	0.4	Located on south side of tumulus.
23356	327	'a'ā pit	undetermined	1.4	0.8	0.6	
23356	328	<i>alā</i> cobble	hammerstone				
23356	329	<i>pāhoehoe</i> pit	undetermined	2.4	0.8	0.4	
23356	330	<i>pāhoehoe</i> pit	undetermined	0.75	0.45	0.4	
23356	331	overhang shelter	temporary habitation	0.8	0.7	0.8	Shelter under toe of lava flow.
23356	332	mound	boundary	1.0	1.0	0.7	
23356	333	<i>pāhoehoe</i> pit	undetermined	1.0	0.6	0.7	<i>Alā</i> boulder and cobble associated.
23356	334	<i>pāhoehoe</i> pit	temporary habitation	2.0	1.0	0.7	Under toe of 'a'ā lava flow.
23357	1	overhang shelter	habitation	2.8	1.2	0.9	
23357	2	wall	habitation	5.2	0.6	0.4	
23357	3	mound	habitation	2.0	1.6	0.6	
23357	4	pavement	habitation	10.5	6.0		Dirty coral area with non-beach rock.
23357	5	C-shape enclosure	habitation	3.5	3.2	0.7	Wall across most of <i>makai</i> -facing opening, upright at northwest opening, sand interior.
23357	6	enclosure	modern camping	2.2	1.9	0.8	Foundation of <i>mauka</i> portion may be older.
23357	7	enclosure	habitation	4.6	2.7	0.6	South side of enclosure actually a natural outcrop, <i>makai</i> side covered by beach cobbles.
23357	8	C-shape enclosure	habitation	3.5	2.5	0.7	<i>Mauka</i> of main cluster, open to north.
23357	8.1	<i>pāhoehoe</i> pit	quarry				<i>Mauka</i> of main cluster; complex of pits likely provided building materials for features 1-8.
23357	9	<i>pāhoehoe</i> pit	undetermined	1.2	0.8	0.6	
23357	9.1	pavement	habitation	12.0	7.0		Dirty coral area with non-beach rock.
23357	10	pavement	undetermined	4.0	0.5		Coral filled crack behind feature 11.
23357	11	C-shape enclosure	habitation	2.9	3.2	0.3	More sites <i>mauka</i> , outside survey area.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23357	15	enclosure	habitation	8.2	7.2	0.5	
23357	16	wall	modern	3.4	0.8	0.7	
23357	17	enclosure	camping habitation	2.5	1.3	0.2	Inside corner foundation, dis- mantled to make features 16 and 18.
23357	18	wall	modern	3.4	0.5	1.0	
23357	19	enclosure	camping canoe shed	16.3	6.9	0.9	Front end open, left side wall nearly collapsed, wave deposit inside.
23357	20	circular alignment	modern fire	2.0	1.8	0.3	Modern structure, made from feature 19 stone. Stair-step sec- tion of trail adjacent to this.
23357	21	wall	modern camping	2.7	0.7		
23357	22	enclosure	habitation	9.1	6.8	0.5	Very deteriorated.
23357	23	mound	modern trail marker	0.6	0.6	0.4	
23357	25	<i>pāhoehoe</i> pit	quarry zone?				<i>Mauka</i> end of <i>pāhoehoe</i> pit area. Maigret notebook p 21 sketch Quarried outcrop.
23357	26	cave	habitation				
23357	27	<i>pāhoehoe</i> pit	quarry?				
23357	27.1	pit	quarry?	0.0	0.0	0.0	Quarried outcrop. Cluster of <i>pāhoehoe</i> pits and slabs.
23357	28	<i>pāhoehoe</i> pit	quarry?				C-shape enclosure in pit com- plex.
23357	29	enclosure	temporary habitation				<i>Ahu</i> . Water-worn basalt cobble ham- merstone in <i>pāhoehoe</i> pits. Complex of pits.
23357	30	mound	boundary?				
23357	31	<i>pāhoehoe</i> pit	hammerstone				
23357	32	<i>pāhoehoe</i> pit	undetermined				Two stones. T9 T10
23357	33	mound	trail marker				
23357	34	mound	trail marker				
23357	35	<i>pāhoehoe</i> pit	quarry?				
23357	37	cave	habitation	8.7	1.1	0.8	Cave with midden on top, stacking and water-worn cob- bles inside.
23357	38	mound	undetermined	1.6	1.5	0.6	
23357	39	mound	undetermined	0.9	0.8	0.5	
23357	40	<i>pāhoehoe</i> pit	undetermined	0.5	0.5	0.7	
23357	41	<i>pāhoehoe</i> pit	undetermined				

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23357	42	mound	boundary				
23357	43	<i>pāhoehoe</i> pit	quarry?				Located next to outcrop, water-worn basalt cobble hammerstone.
23357	44	mound	quarry?				
23357	45	platform	burial?				
23357	47	mound	shrine/marker?				Single coral upright.
23357	48	cave	habitation				Cave.
23357	48.1	pit	cave entry	1.1	1.0	0.7	Northern tube entry.
23357	48.2	pit	cave entry	1.5	1.4	0.9	Bend entry.
23357	48.3	pit	cave entry	4.4	1.5	1.0	Northeast entry.
23357	48.4	enclosure	habitation?	2.0	2.0	0.6	10 m south of tube, built on outcrop.
23357	48.5	mound	cave entry	1.8	1.4	0.4	Chunks of <i>pāhoehoe</i> from making tube entry.
23357	48.6	mound	cave entry	1.6	1.2	0.3	Chunks of <i>pāhoehoe</i> from making tube entry.
23357	49	C-shape enclosure	habitation	4.0	3.3	0.6	Midden inside, opens to <i>mauka</i> .
23357	50	wall	habitation	4.1	1.8	0.7	L-shaped, inner- <i>makai</i> side has level <i>pāhoehoe</i> and midden, probably associated with quarrying of <i>pāhoehoe</i> , evidence of which is all around.
23357	51	<i>pāhoehoe</i> pit	undetermined	0.3	0.3	0.7	
23357	52	wall	habitation	2.8	0.5	0.4	
23357	53	C-shape enclosure	habitation	1.4	0.8	0.5	
23357	54	<i>pāhoehoe</i> pit	quarry	3.1	1.0	0.3	Probably a source of stone for feature 49.
23357	56	<i>pāhoehoe</i> pit	quarry	1.5	0.8	0.3	Probably a source of stone for feature 49.
23357	57	<i>pāhoehoe</i> pit	quarry	1.0	0.7	0.3	Probably a source of stone for feature 49.
23357	58	<i>pāhoehoe</i> pit	quarry	3.6	1.8	0.3	Probably a source of stone for feature 49.
23357	59	<i>pāhoehoe</i> pit	quarry	5.0	2.5	0.5	Probably a source of stone for feature 49.
23357	60	<i>pāhoehoe</i> pit	habitation	1.0	0.8	1.2	Deeper pit adjacent to feature 49.
23357	61	<i>pāhoehoe</i> pit	quarry	1.3	1.0	0.3	Probably a source of stone for feature 49.
23357	62	overhang shelter	cupboard	1.5	0.4	0.6	Platy <i>pāhoehoe</i> stacked over crack, partially collapsed.
23357	63	pit	undetermined	1.1	0.7	1.0	Stacked wall on one side, outcrop on the other.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23357	64	enclosure	undetermined	3.4	1.4	0.5	Oriented north-south with upright slabs on west with ropy black surface facing to interior; small cobbles make remainder; all on surface of <i>pāhoehoe</i> .
23357	65	terrace	<i>heiau?</i>	23.3	7.5	0.4	Level with beach, terrace face <i>mauka</i> , roughly mapped; <i>mauka</i> of this is level area that is fairly large.
23357	66	enclosure	<i>heiau?</i>	2.4	2.4	0.3	Many water-worn stones, circular.
23357	67	wall	<i>heiau?</i>	3.5	0.7	0.4	Wall attached to a.2.
23357	68	pavement	undetermined	4.4	2.7	0.0	Flat, not cleared, but appears paved.
23357	69	terrace	<i>heiau?</i>	4.0	4.5	0.2	Within south end of overall feature.
23357	70	pavement	<i>heiau?</i>	10.0	8.5	0.0	Behind a.4, coral-sand-cobble surface.
23357	71	clearing	<i>heiau?</i>	15.0	10.0	0.0	Behind a north section, some fill on flat <i>pāhoehoe</i> , bounded by natural ridges, <i>ahu</i> on hill behind outside of area.
23357	72	circular alignment	modern campfire	0.9	0.9	0.2	Modern fire ring.
23357	73	mound	trail/boundary marker?	1.4	0.7	0.6	Rough stone mound.
23358	1	wall	habitation	11.5	0.5	0.5	Possibly back of a platform.
23358	2	circular alignment	modern campfire	1.4	1.3	0.2	Modern fire ring.
23358	3	circular alignment	modern campfire	2.2	1.6		Modern fire ring.
23358	4	circular alignment	modern campfire	1.3	1.1		Modern fire ring.
23358	5	mound	modern campfire	1.5	1.5		Modern elevated fireplace.
23358	6	enclosure	habitation/pen	3.9	3.2	0.9	Interior facing remains, <i>makai</i> two walls gone, <i>mauka</i> exterior blends into <i>pāhoehoe</i> .
23358	7	C-shape enclosure	habitation	3.9	5.8	0.6	Back built into <i>pāhoehoe</i> outcrop.
23358	7.1	terrace	habitation	2.1	1.0	0.5	Shelf outside feature 7.
23358	7.2	terrace	habitation	2.4	0.6	0.2	Shelf outside feature 7.
23358	8	overhang shelter	habitation	6.8	5.8	0.9	A 1.8 m long wall stacked by entry, blister cave; midden inside.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23358	8.1	wall	habitation	1.6	0.6	0.3	Divides feature 8 in half.
23358	8.2	terrace	habitation	1.3	0.7	0.2	Forms southeast edge of feature 8 opening.
23358	9	pavement	habitation	0.5	2.7		Sand, coral pebbles, some water-worn basalt, little midden, located on flat <i>pāhoehoe</i> .
23358	10	cave	habitation	4.5	0.1	0.5	Very low inside, not explored, but appears to have midden only below skylight entry, possibly just used for disposal.
23358	11	pavement	habitation	4.7	2.5		Sand, coral pebbles, some water-worn basalt, little midden, located on flat <i>pāhoehoe</i> .
23358	11.1	path	trail	30.0	0.7		Follows top of small lava tube like at site 50-10-18-23356 cluster F, total length not recorded, but goes up into <i>pāhoehoe</i> pit zone.
23358	12	mound	trail marker	0.1	0.8	0.6	Possibly modern.
23358	13	mound	boundary marker	1.5	1.5	1.6	Metal pipe at base.
23358	14	mound	boundary marker	1.5	1.5	1.8	
23358	15	terrace	<i>kilo i'a</i>	5.7	2.5	0.5	Slab front built onto outcrop.
23358	16	terrace	<i>kilo i'a</i>	4.3	3.1	0.6	Irregular front, conch shell present.
23358	17	mound	undetermined	0.7	0.6	0.5	
23358	18	enclosure	habitation	22.8	8.2	0.7	Southern part of wall double-faced, core-filled and wider than stacked northern part; interior of north is smoother coral and cobbles.
23358	19	enclosure	habitation	19.6	4	0.7	Surrounds northern portion of main enclosure on <i>makai</i> and north sides.
23358	20	pit	undetermined	0.9	0.8	0.7	Squarish pit against south interior wall.
23358	21	pit	undetermined	1.2	0.5	0.2	Squarish pit against south interior wall.
23358	22	enclosure	habitation	8.5	5.5	0.8	Front eroded. Modern trash.
23358	23	C-shape enclosure	habitation	3.7	3.0	0.8	
23358	24	shelter	cupboard	0.4	1.0	0.4	
23358	25	midden	habitation	17	11.5		North edge possibly defined by an alignment.
23358	26	C-shape enclosure	habitation	3.3	2.0	0.6	

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23358	27	terrace	habitation	13.3	5.5	0.8	Midden scatter continues 10 m south. Upright stones in face appear structural.
23358	28	midden	habitation	12.5	5		South of terrace.
23358	29	C-shape enclosure	habitation	3.5	2.2	0.5	
23358	30	mound	habitation	4	2.8	0.5	Might be an enclosure remnant.
23358	31	platform	undetermined	4	4	0.8	<i>Pāhoehoe</i> with filled in low areas. Probably a modern camping feature.
23358	32	circular alignment	modern campfire				
23358	33	enclosure	canoe shed?	7.5	4.8	0.5	Half is natural <i>pāhoehoe</i>
23358	34	C-shape enclosure	habitation	4.3	5.2	0.9	Open to beach.
23358	35	C-shape enclosure	habitation	4.8	3.7	0.8	Open to beach.
23358	36	overhang shelter	cupboard	0.3	0.4		Constructed cupboard in wall contains echinoid spine abrader and shells.
23358	37	overhang shelter	cupboard	0.4	0.3	0.5	Contains sandstone and coral.
23358	38	alignment	trail	17.5	0.8		Modern camping feature. Trail edges marked with stone alignments.
23358	39	C-shape enclosure	habitation	6.2	4.8	0.7	Squarish, collapsed over much of wall.
23358	40	C-shape enclosure	agriculture?	4.5	3.3	0.9	Squarish interior face; open to SSW; does not match Donham description.
23358	41	C-shape enclosure	agriculture?	4.5	3.3	0.8	Only S and E walls remain in discernible form, north is collapsed, appears to have opened to west; may have been a large enclosure including 160.1.
23358	42	<i>pāhoehoe</i> pit	quarry?	1.2	0.9	0.5	
23358	43	<i>pāhoehoe</i> pit	quarry?	0.9	0.4	0.1	
23358	44	<i>pāhoehoe</i> pit	quarry?	1.5	1.5	0.4	
23358	45	shelter	agriculture?	1.6	0.8	0.4	Stacked slab roof over 1 m; GPS M041901A.
23358	46	enclosure	agriculture?	0.5	0.5	0.5	Lean-to shelter, possibly recent <i>pakalolo</i> blind; GPS M041901A.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23358	47	C-shape enclosure	habitation	3.1	3.0	0.6	Open to east; GPS M042321D.
23358	48	terrace	habitation	2.0	1.5	0.6	Built on outcrop 6m 333° from T-158
23358	49	enclosure	habitation	2.7	2.4	0.8	GPS M042321B.
23358	50	mound	habitation	1.3	1.1	0.7	
23358	51	wall	habitation	3.3	0.8	0.4	GPS M042321C.
23358	52	clearing	habitation	9.1	3.2	0.0	Midden and sand deposit on natural terrace shelf.
23358	53	mound	boundary	0.5	0.5	0.5	Modern?; ""BDY"" Spray-painted next to mound.
23358	54	mound	burial?	1.5	1.5	0.6	
23358	55	mound	burial?	1.6	1.4	0.6	
23358	56	wall	undetermined	3.2	5.8	0.7	Donham's dimensions.
23358	57	C-shape enclosure	modern trash disposal	2.5	2.5	0.5	Right location for Donham T-151, but well built and boxy, with modern trash beneath wall stones—probably rebuilt on or near original location with same material; now full of trash.
23358	58	enclosure	pen	9.1	5.8	0.5	Modern <i>pakalolo</i> cultivation also; at <i>mauka</i> Kuili slope.
23358	59	C-shape enclosure	habitation	2.7	1.5	0.4	Rudimentary enclosure near a filled <i>pāhoehoe</i> pit.
23358	60	C-shape enclosure	habitation	2.5	1.5	0.4	MaryAnne notes.
23358	61	pit	undetermined	0.5	0.4	0.6	Roughly stacked oval pit of <i>pāhoehoe</i> cobbles and small boulders built within a natural depression in lava.
23358	62	pit	undetermined	0.0	0.0	0.0	
23359	1	platform	habitation	5.8	5.6	0.3	
23359	2	terrace enclosure	habitation	13.0	7.0	0.8	
23359	3	enclosure	habitation	4.8	2.4	0.7	
23359	4	clearing	habitation	1.7	1.0		
23359	5	clearing	habitation	4.1	2.7		
23359	6	terrace enclosure	habitation	23.3	20.2	1.2	
23359	7	pit	cistern	2.7	2.7	0.6	Pit mortared and lined.
23359	8	terrace	habitation	13.5	4.5	0.8	
23359	9	enclosure	habitation	5.4	5.4	0.4	
23359	10	C-shape enclosure	modern campfire	1.0	0.8		

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23359	11	terrace	habitation	22.6	5.0		Only outcrop and large boulders remain, but eroding midden indicates habitation.
23359	12	circular alignment	modern campfire	0.9	0.8		
23359	13	wall	habitation	7.0	1.1		Might be side wall of feature 8.
23359	14	lined pit	water source	1.0	1.0	0.6	Standing water in bottom, anchialine.
23359	16	<i>pāhoehoe</i> pit	quarry?	4.0	3.0	0.6	Located 7 m northeast of cave feature 15.
23359	17	boulder	quarry?	8.0	6.0	3.5	Located 15 m at 100° from feature 15; battered on top and north side, <i>pāhoehoe</i> blocks.
23359	18	overhang shelter	undetermined	0.9	1.2	0.8	Located at base of feature 17 boulder.
23359	19	berm	undetermined	8.0	0.5	0.3	
23359	20	enclosed shelter	habitation	2.3	2.2	0.5	Situated in <i>pāhoehoe</i> depression.
23359	21	<i>pāhoehoe</i> pit	undetermined	1.2	0.8	0.7	Water-worn basalt cobble hammerstone at edge of feature; possible evidence of probing for a lava tube.
23359	22	mound	burial?	2.0	1.5	0.9	Upright slabs in facing.
23359	23	<i>pāhoehoe</i> pit	undetermined	1.6	1.5	0.5	Possible evidence of probing for a lava tube.
23359	24	<i>pāhoehoe</i> pit	undetermined	0.4	0.3	0.3	Possible evidence of probing for a lava tube.
23359	25	mound	burial?	2.1	2.1	0.4	Circular plan.
23359	26	platform	causeway	75.0	3.5	0.5	Trail from lower <i>pāhoehoe</i> flat up to feature B and site T-104 area; incorporates lava ridge, and could conceivably disguise cave openings.
23359	27	enclosure	habitation?	5.3	4.1	0.6	No opening, some midden.
23359	28	terrace	habitation	5.8	1.1		Flat <i>pāhoehoe</i> behind this feature expands level surface to 4 m deep.
23359	29	enclosure	habitation	11.5	8.2	0.5	Interior has midden, but not very level; south wall is collapsed; east wall is natural <i>pāhoehoe</i> .
23359	30	platform	habitation	23.0	12.0	0.6	Described as site T-104 feature A (Donham 1987:24–28).
23359	31	terrace enclosure	habitation	5.0	6.8	0.8	Back "enclosure" is combination of stacked cobbles and natural formation.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23359	32	enclosure	habitation	4.2	3.5	0.4	Walls difficult to define, partially enclosed by natural lava shelf.
23359	33	enclosure	habitation	8.8	4.5	0.4	Walls tumbled, but easier to define than feature 107b.
23359	34	cairn	boundary	1.6	1.3	1.2	
23359	35	terrace	burial?	2.7	2.8	0.8	Fills low spot on a ridge southwest of features 31-33.
23359	36	enclosure	undetermined	11.0	2.7	0.5	Natural depression with some sections walled to make it complete.
23359	37	pit	cave entry	1.0	0.5		Entry into looted habitation cave described by Donham.
23359	38	pit	cave entry	1.1	0.8		Entry into looted habitation cave described by Donham.
23359	39	pit	cave entry	1.2	0.8		Entry into looted habitation cave described by Donham.
23359	40	pit	cave entry	1.0	0.7		Entry into looted habitation cave described by Donham.
23359	41	<i>pāhoehoe</i> pit	habitation	3.8	2.5	1.5	Shallow overhang, half of floor paved with crushed cobbles.
23359	42	pit	cave entry	5.4	0.6		All but 1.2 m at end is a cobble-filled crack; entry into looted habitation cave described by Donham.
23359	43	<i>pāhoehoe</i> pit	cave entry?	1.5	0.6		Cobble filled.
23359	44	pavement	habitation	5.0	4.0		Level <i>pāhoehoe</i> with some infilling, backed by <i>pāhoehoe</i> ridge forming natural C-shape enclosure.
23359	49	wall	undetermined	1.3	0.4	0.2	
23359	50	wall	undetermined	5.4	0.7	0.2	
23359	51	platform	burial?	5.4	3.5	0.5	Built into outcrop, two water-worn stones on surface.
23359	52	enclosure	pen	18.5	7.0	0.9	Irregularly shaped enclosure built against a <i>pāhoehoe</i> outcrop.
23359	53	platform	habitation	4.5	2.8	0.4	Midden scatter west of platform.
23359	54	C-shape enclosure	habitation	2.0	1.5	0.35	Waterworn boulder on surface.
23360	1.1	terrace	trail	2.2	1.0	0.4	
23360	1.2	terrace	trail	3.7	1.0	0.7	
23360	1.3	path	trail	10.0	0.7	0.0	Goes farther <i>mauka</i> , total length not known.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23360	1.4	path	trail	17.0	0.7	0.0	Branch to features <i>mauka</i> of Map 24 cluster.
23360	1.5	path	trail	75.0	0.7	0.0	Trail along top of 110 lava tube flow, naturally forms a very nice trail, although <i>makai</i> portion does have some slab and water-worn stepping stones.
23360	2	wall	boundary	0.0	0.6	1.0	On either side of trail.
23360	3	enclosure	habitation	2.0	2.0	1.0	Built against the southwest side of a massive boulder.
23360	4	pit	undetermined	0.0	0.0	0.2	Two shallow pits bashed through the lava crust on top of a boulder.
23360	5	'a'ā pit	undetermined	0.6	0.45	0.7	Steep-sided pit.
23360	6	'a'ā pit	undetermined	0.3	0.2	0.5	Two cowrie shells and a water-worn cobble.
23360	7	'a'ā pit	undetermined	1.8	1.5	0.9	Sloping sides.
23360	8	'a'ā pit	undetermined	1.0	0.8	0.8	Steep sided pit with one water-worn pebble.
23360	9	'a'ā pit	undetermined	1.2	0.8	0.9	Partially slumped.
23360	10	'a'ā pit	undetermined	2.4	1.3	0.7	
23360	11	pit	undetermined	0.0	0.0	0.2	Three overlapping pits on top of boulder. Probable cobble hammerstone associated.
23360	12	'a'ā pit	undetermined	1.3	0.8	0.4	Excavated at base of large boulder.
23360	13	'a'ā pit	undetermined	0.0	0.0	0.0	Two pits at the base of intersecting massive boulders.
23360	14	'a'ā pit	undetermined	1.2	0.8	0.6	Contains a piece of coral.
23360	15	'a'ā pit	undetermined	1.6	0.5	0.6	Excavated at the base of a massive boulder.
23360	17	'a'ā pit	undetermined	2.6	1.8	1.0	Excavated at the base of a boulder near trail. Coral cobbles inside.
23360	18	'a'ā pit	undetermined	1.1	1.0	1.2	Located in a swale.
23360	19	<i>alā</i> cobble	hammerstone	0.0	0.0	0.0	
23360	20	<i>alā</i> cobble	hammerstone	0.0	0.0	0.0	Three cobbles at the south side of a large boulder.
23360	21	boulder	bashed	2.4	1.2	0.9	Bashed on the southeast end.
23360	22	'a'ā pit	undetermined	2.0	0.8	0.8	Excavated between boulders, with low walls at ends.
23360	23	'a'ā pit	undetermined	1.1	0.4	0.5	Pit broken through a crack in boulder.
23360	24	'a'ā pit	undetermined	1.1	0.8	0.5	Pit at base of boulder with cobble alignment on top.
23360	25	'a'ā pit	undetermined	1.0	0.9	0.6	Pit partially filled.
23360	26	platform	burial?	2.0	1.4	0.5	Constructed at side and partially on top of boulder.

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Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23360	27	boulder	quarry				Bashed on S side and top.
23360	28	overhang shelter	temporary habitation	2.2	1.3	1.4	Water-worn cobbles, coral, 'opihi, and bottles inside.
23360	29	'a'ā pit	undetermined	0.5	0.4	0.6	Between boulders.
23360	30	'a'ā pit	undetermined	1.2	1.1	1.1	Contains coral cobble.
23360	31	'a'ā pit	undetermined	0.7	0.6	0.7	Located between four boulders.
23360	32	'a'ā pit	undetermined	2.1	0.9	0.7	Base of large boulder.
23360	33	'a'ā pit	undetermined				Two pits.
23360	34	'a'ā pit	undetermined	1.0	0.8	0.7	Base of boulder, sloping sides.
23360	35	'a'ā pit	undetermined	1.2	1.0	0.8	Sides steep.
23360	36	'a'ā pit	undetermined	3.2	0.8	0.9	Base of large boulder.
23360	37	'a'ā pit	undetermined	0.9	0.8	0.7	Base of boulder.
23360	38	wall	boundary	2.4	0.4	0.5	Slightly curved wall segment separates trail segment from a rough pavement.
23360	39	boulder	shrine	3.0	1.7	2.5	Vertical face to due west, cobble cairn on top.
23360	40	pavement	shrine	5.4	2.4		Located at base of boulder.
23360	41	overhang shelter	shrine	2.8	0.6	0.5	Located beneath boulder, contains some water-worn coral, some constructed facing.
23360	42	pavement	shrine?	3.5	3.0		Nearly circular area of coral in larger cobble pavement, basalt uprights around soil in center.
23360	43	midden	habitation?	5.5	4.4		
23360	44	C-shape enclosure	habitation	2.8	2.5	1.0	Donham called it a U-shape enclosure, boxy, cobble-filled low spot in front.
23360	45	destroyed	DAMAGED				Altered by campers into fire rings and windbreaks.
23360	46	enclosure	habitation?	4.4	4.0	0.2	Perpendicular embedded alignments fade into rising pāhoehoe.
23360	47	fill	undetermined	15.0	10.0		Blocky pāhoehoe fragments, not measured; no structure visible, but not storm wash; located between sites T-115 and T-123.
23360	48	fill	undetermined	15.0	8.0		Blocky pāhoehoe fragments, not measured; no structure visible, but not storm wash; located between sites T-115 and T-123.
23360	49	enclosure	habitation?	24.5	12.6	1.0	much of front hard to see under storm deposit and fallen kiawe.
23635	0	platform	burial?	6.2	4.2	0.7	Located at base of 'a'ā ridge.
23636	0	mound	burial?	2.0	2.0	0.5	Located on top of Pu'u Kuili.
23637	1	overhang shelter	burial	0.0	0.0	0.0	Previously noted by Cordy.

Continued on next page

Table 19—Continued

Site	Fea.	Form	Function	Length	Width	Ht./Depth	Comments
23637	2	C-shape shelter	habitation	2.0	1.0	0.4	Filled depression nearby.
23637	3	enclosure	agriculture	0.0	0.0	0.0	Modern marijuana cultivation.
23637	4	cairn	trail marker	0.0	0.0	0.0	Single stone on boulder.
23637	5	'a'a pit	undetermined	1.5	1.0	0.4	Located at base of bashed boulder.
23637	6	alā cobble	trail marker	0.0	0.0	0.0	Three cobbles in a line near worn areas in the <i>pāhaehoe</i> .
23637	7	alā cobble	trail marker	0.0	0.0	0.0	Six cobbles in a line with scattered coral.
23638	1	<i>pāhoehoe</i> pit	closed tube entry?	3.0	2.0		Filled with cobbles, possibly modern, being near squatter camp.
23638	3	wall	habitation	8.2	1.1	0.6	Several upright slabs incorporated, not clear from map whether this is part of an enclosure.
23638	4	overhang shelter	habitation	3.0	2.5	0.8	Upright slabs by entry.
23638	5	<i>pāhoehoe</i> pit	quarry?	2.4	2.2	0.3	
23638	6	mound	quarry stock-pile?	1.8	0.7	0.6	
23638	7	mound	burial?	3.7	1.3	0.4	
23638	8	wall	undetermined	27.0	1.3	0.5	Dogleg 20 m into wall; area to east is flat, bulldozed.
23638	9	mound	undetermined	1.1	0.6	0.4	



Appendix B

Field Catalog

Table 20. Field catalog

Catalog number	Site	Location	Layer	Note
01	T-140 B	back-dirt		cultural materials
02	23355 92	firepit		bulk sample
03	23355 23	back-dirt		cultural materials
04	23355 98	firepit		bulk sample
05	23355 93	TU-1	I	cultural materials
06	23355 93	TU-1	II	cultural materials
07	23355 93	TU-1 charcoal concentration	II	bulk sample
08	23355 93	TU-1	II	sediment sample
09	T-164 A	back-dirt		cultural materials
10	23356 Upper pit	dune profile	II	bulk sample
11	23356 Lower pit	dune profile	III	bulk sample
12	23356	dune profile	I	sediment sample
13	23356	dune profile	II	sediment sample
14	23356	dune profile	III	sediment sample
15	23356	dune profile	IV	sediment sample
16	23356 104	TU-1	I	sediment sample
17	23356 104	TU-1	II	sediment sample
18	23356 104	TU-1	III	sediment sample
19	23356 104	TU-1	IV	sediment sample
20	23356 104	TU-1 beneath west wall	III	bulk sample
21	23356 104	TU-1	III	cultural material
22	23356 159	cave interior	surface	cultural material
23	23356 63	eroding deposit	surface	artifact
24	23355 between fea. 31 and 45	surface	surface	artifact
25	23356	graded road	surface	artifact
26	23356 117	surface	surface	artifact
27	T-129 A	surface	surface	artifact
28	23356 147	Camara 1	surface, b	artifacts
29	23355 Cluster A	Camara 2	surface	artifacts
30	23356 113	Camara 3	surface, b	artifacts
31	23356 147	Camara 4	surface, b	artifacts
32	23357 Mauka cave	Camara 5	surface	artifacts
33	23356 147	Camara 6	back-dirt	artifact
34	23356	Camara 7		artifacts
35	23356	Camara 7		artifacts

Appendix C

Artifact List

Measurements for artifacts recovered during the Kekaha Kai project, as well as those collected in the 1980s by Bobby Camara, are given in table 21. The table has columns for artifact type, variety, and material, along with three columns for length measures, one for weight, and one for comments. Since the artifacts represent a variety of functional types and stages of manufacture, use, and breakage, each type required its own measurement protocol. The list below explains the column values given in the data table for each artifact type and variety.

flake Three varieties of lithic flake are recognized. These include varieties v1, v2 and v3. Four measurements are made on all three varieties lithic flakes and are organized in the data table as follows: column X is flake length, column Y is flake width, column Z is flake thickness, and column Weight is flake weight.

Variety v1 are complete flakes with standard conchoidal fracture attributes such as percussion bulb, striking platform, and distinguishable ventral and dorsal surfaces. Four measurements are made on variety v1 flakes: length from point of impact (striking platform) to distal termination; width between lateral terminations, perpendicular to length; maximum thickness between ventral and dorsal surfaces; and weight.

Variety v2 are incomplete or broken flakes, or flakes which have indistinguishable ventral and dorsal surfaces. Four measurements are made on variety v2 flakes: maximum length; maximum width measured perpendicular to length; maximum thickness between ventral and dorsal surfaces; and weight.

Variety v3 are irregularly shaped flakes which do not exhibit ventral or dorsal surfaces, are often blocky, and are commonly referred to as "shatter". Four measurements are made on variety v2 flakes: maximum length; maximum width measured perpendicular to length; maximum thickness measured perpendicular to width; and weight.

urchin spine file Three varieties of urchin spine file are recognized. These include files with their working facet on their proximal end (prox), those with their working facet on their distal end (dist), and those for which the location of the working

facet is ambiguous (unkn). Four measurements are made on all three varieties lithic flakes and are organized in the data table as follows: column X is the length of spine between proximal and distal ends regardless of breakage, column Y is the length of the working facet, column Z is the width of working the facet, and column Weight is the tool's weight.

Another class of distinction is also made with respect to the degree of completeness of the artifact. The great majority of urchin spine files, as would be expected for discarded tools, are broken. The completeness and location of breakage of these tools clearly affect the comparability of the measurement data. For this reason, a simple set of distinctions were also recorded in column Comment using letter codes (Fig. 183). Urchin spine files which are complete or are only missing a portion of their facet are recorded as *c*. Those which are broken but exhibit a complete working facet are recorded as *cf*. Those which are fragments of the working facet are recorded as *ff*. Those which are fragmentary and include only part of the working facet and part of the stem are recorded as *sf*.

Unmodified urchin spines are so noted by the term "unmod" in the variety column. Length for these artifacts is measured between proximal and distal ends regardless of breakage. Width is measured as a maximum value perpendicular to length, and maximum thickness is likewise measured perpendicular to width. Partial urchin spines are noted by an *f* in the Comment column, followed by a qualifier indicating whether the fragment includes the distal or proximal end (dist or prox). Complete urchin spines are indicated by a *c*.

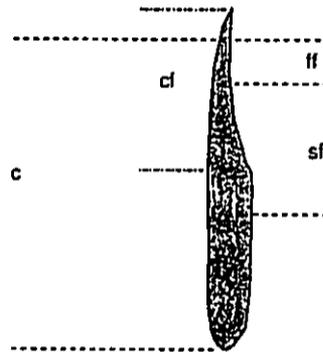


Figure 183. Schematic profile of an urchin spine file with a proximal end facet. Letter codes used to represent the parts of the urchin spine file are also shown.

coral abrader Three types of coral abrader are recognized in this study: surface abraders, edge abraders, and subconic abraders. Subconic abraders are further distinguished between edged and round varieties. Measurement protocols for these abrader types are as follows.

Surface abraders are measured with respect to length (column X), width (column Y), thickness (column Z), and weight (column Weight). Length is defined as the

longest dimension measured across the primary working surface of the abrader. Width is the maximum distance measured perpendicular to length, again across the primary working surface. Thickness is the maximum distance between the primary working surface and its obverse side.

Edge abraders are also measured with respect to length (column X), width (column Y), thickness (column Z), and weight (column Weight). Length is defined as a measure of the primary working edge of the tool. Since the primary working edge typically runs the length of the tool, this measure indicates both the length of the edge and the tool itself. Width is measured perpendicular to the edge, and runs from the edge to back (sometimes exhibiting a secondary edge) on the same plane as length. Thickness is measured on a plane perpendicular to length and width.

Subconic coral abraders are of two varieties, edged and round. The subconic-edged variety are measured with respect to length (column X), basal width (column Y), and top width (column Z). Length is the distance from the tool's apex to its base. Width is a measure of the tool's maximum cross-sectional distance at its base. Top width is the maximum cross-sectional distance at its top. Top width is measured only if no apex is present (i.e., it is broken off)

The subconic-round variety is measured with respect to length (column X) and maximum base diameter (column Y). If the apex is missing, then a measure of maximum top diameter (column Z) is also made.

basalt abrader Basalt abraders occur in two major varieties, tabular and subconic. Tabular abraders are measured with respect to three dimensions: length (column X), width (column Y), and thickness (column Z). Length is defined as the longest dimension on the plane of the primary working surface of the abrader. Width is measured perpendicular to length on the same plane. Thickness is measured on a plane perpendicular to length and width.

Subconic abraders are measured using the protocol described above for coral subconic-round abraders. Subconic abraders are measured with respect to length (column X) and maximum base diameter (column Y). Length is measured from point to base.

hammer/slingstone Two measurements were made on the spherical hammer/slingstone; diameter (column X) and weight (column Weight).

coral fragments/debitage Coral fragments and possible debitage or broken tools were measured for their length (column X), width (column Y), and thickness (column Z). Length is measured as a maximum value along the artifacts greatest dimension. Width is then measured perpendicular to length. Thickness is measured along the remaining dimension perpendicular to both length and width. Weight is also recorded for these artifacts (column Weight).

octopus lure sinker The single octopus lure was measured for length (column X), width (column Y), thickness (column Z), and weight (column Weight). Length

was measured along the artifacts maximum dimension. Width was measure perpendicular to this, from lateral side to lateral side. Thickness was measured from where the sinker would have been attached to the lure (back) to its front surface.

puka shell Two measures were made on puka shells: diameter (column X) and weight (column Weight).

modified bone Cut and/or ground bone artifacts were usually measured with respect to length (column X), width (column Y), and weight (column weight). Length was measured along the maximum dimension of the artifact and width was measured perpendicular to length on the same plane. In most cases the bone artifacts were very thin and were considered to be two dimensional object for measurement purposes. An occasional piece of modified bone would, however, have a substantial thickness, which was recorded as a maximum value perpendicular to the plane of length and width (column Z).

fishhook and fishhook blank Fishhooks were measured according to the method proposed by Emory (Emory et al. 1968:13). According to this scheme:

For one-piece hooks, the length of the shank and point were taken at right angles to the base; the width was taken from the outer edge of the shank to the outer edge of the point and parallel with the base (fig. 7, a).

For two-piece and composite hooks, those with a flat base were measured with the base parallel to the measuring instrument (fig. 7, a, c); all others, with the curving point tangential to the instrument (fig. 7, d). (Emory et al. 1968:13)

In the data table, column X contains shank length, column Y contains width, and column Z contains point length for one-piece fishhooks (fig. 184). For two-piece fishhooks, points are measured for point length (column X) and point width (column Y) (fig. 184).

Fishhook blanks are oriented according to a best approximation of final fishhook form as derived from the blank's shape. Measurements of length and width are made as for completed fishhooks.

hammerstone Hammerstones, both pebble and cobble varieties, were measured for length (column X), width (column Y), thickness (column Z), and weight (column Weight). Length was measured from the primary working end to the back of the hammer, typically along the longest axis of the tool. Width was measured perpendicular to length, on the same plane. Thickness was measured perpendicular to the plane of measure for length and width.

adze and adze fragment Adzes are measure with respect to length (column X), width (column Y), and thickness (column Z). Length was measured from blade edge to butt. Width was measured from lateral side to lateral side at the widest point. Thickness was measured from front to back at the thickest point.

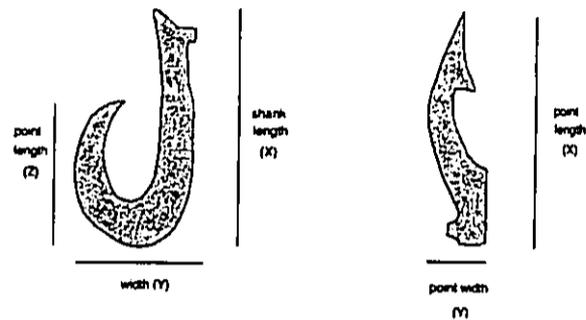


Figure 184. Fishhook measurement scheme, adapted from Emory et al. (1968). Point width measure for two-piece fishhook point added for this analysis.

Adze fragments do not typically retain enough of the adze to properly orient the adze. Therefore, their three measured dimensions are analogous to those of coral fragment and type v3 flakes. Length is measured as a maximum value along the artifacts greatest dimension. Width is then measured perpendicular to length. Thickness is measured along the remaining dimension perpendicular to both length and width. Weight is also recorded for adzes and adze fragments (column Weight).

octopus lure Shell octopus lures were measured for length (column X), width (column Y), thickness (column Z), and weight (column Weight). Length was measured along the long axis of the lure when oriented for hafting. This dimension is in line with the piercings at either ends of the lure. Width is measured on the same plane, but perpendicular to length. Width runs from lateral side to lateral side of the shell. Thickness is measured at the center of the shell, from its aperture to its top.

Several pieces of worked *Cypraea* sp. shell are present in the artifact assemblage which may be broken octopus lures or scraping tools. These artifacts are measured for length and width according to the above method. These shells do not retain enough integrity to measure thickness.

awl Awls and possible awls are measured for length (column X) and weight (column Weight). Length is measured from the base of the artifact to its point. This is typically the longest dimension of the tool.

Table 21. Artifact catalog

Type	Variety	Material	Wt. (g)	x	y	z	Comment
Catalog 01							
abrader	elongate-edged	coral	2.2	30.0	12.0	8.0	
adze	fragment	basalt	5.0	19.0	18.0	10.0	2 adjoined ground surfaces
core		volcanic glass	11.7	21.0	21.0	18.0	
file	unknown	urchin spine	0.1	9.0	9.0	5.0	ff
file	proximal	urchin spine	0.4	25.0	7.0	5.0	sf
file	unknown	urchin spine	0.4	15.0	14.0	6.0	ff
file	unknown	urchin spine	0.4	15.0	15.0	9.0	ff
file	unknown	urchin spine	0.4	19.0	10.0	6.0	sf
file	unknown	urchin spine	0.5	13.0	13.0	8.0	ff
file	unknown	urchin spine	0.5	15.0	15.0	10.0	ff-2 facets
file	unknown	urchin spine	0.5	22.0	22.0	8.0	ff-2 facets
file	unknown	urchin spine	0.6	18.0	18.0	8.0	ff
file	proximal	urchin spine	0.8	36.0	18.0	7.0	c
file	proximal	urchin spine	0.8	33.0	29.0	9.0	c
file	unknown	urchin spine	0.8	19.0	19.0	9.0	cf
file	proximal	urchin spine	0.9	27.0	27.0	8.0	ff
file	unknown	urchin spine	0.9	25.0	25.0	9.0	ff
file	unknown	urchin spine	0.9	31.0	31.0	8.0	ff
file	unknown	urchin spine	1.0	30.0	30.0	9.0	ff
file	unknown	urchin spine	1.1	29.0	25.0	8.0	sf
file	proximal	urchin spine	1.3	39.0	15.0	8.0	c
file	proximal	urchin spine	1.3	39.0	22.0	8.0	c
file	proximal	urchin spine	1.4	40.0	24.0	9.0	c
file	proximal	urchin spine	1.6	40.0	40.0	8.0	cf
file	proximal	urchin spine	1.9	57.0	25.0	8.0	c
file	unknown	urchin spine	2.0	41.0	22.0	9.0	sf
file	proximal	urchin spine	2.2	54.0	29.0	9.0	c
fishhook	unbarbed, jabbing	bone	0.1	11.0	6.0	0.0	whole
fishhook		bone	0.1	10.0	5.0	0.0	fragment
fishhook		bone	0.1	12.0	0.0	0.0	fragment, point broken
fishhook		bone	0.1	14.0	0.0	0.0	fragment, point broken
fishhook	unbarbed, jabbing	bone	0.1	9.0	6.0	0.0	almost whole
fishhook	blank	bone	0.2	12.0	6.0	0.0	preform, almost complete

Continued on next page

Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
fishhook	blank	bone	1.4	30.0	11.0	4.0	small to medium or medium mammal
fishhook	fragments	shell	0.1	7.0	2.0	0.0	
fishhook	fragments	shell	0.1	7.0	2.0	0.0	
fishhook	shank	shell	0.1	11.0	3.0	0.0	fragments
fishhook		shell	0.2	19.0	8.0	0.0	point broken
flake	v3	volcanic glass	0.1	5.0	5.0	3.0	
flake	v2	volcanic glass	0.1	9.0	8.0	2.0	
flake	v2	volcanic glass	0.1	7.0	5.0	1.0	
flake	v1	volcanic glass	0.1	7.0	9.0	2.0	
flake	v2	volcanic glass	0.1	6.0	4.0	1.0	
flake	v2	volcanic glass	0.1	10.0	4.0	1.0	
flake	v2	volcanic glass	0.1	8.0	5.0	2.0	
flake	v2	volcanic glass	0.1	8.0	5.0	1.0	
flake	v3	volcanic glass	0.2	10.0	6.0	4.0	
flake	v2	volcanic glass	0.2	11.0	7.0	3.0	
flake	v1	volcanic glass	0.2	10.0	7.0	2.0	
flake	v1	volcanic glass	0.2	6.0	10.0	2.0	
flake	v1	volcanic glass	0.2	9.0	8.0	2.0	
flake	v2	volcanic glass	0.2	9.0	5.0	2.0	
flake	v2	volcanic glass	0.2	10.0	8.0	3.0	
flake	v2	volcanic glass	0.2	9.0	6.0	3.0	
flake	v1	volcanic glass	0.2	9.0	7.0	3.0	
flake	v2	volcanic glass	0.2	11.0	8.0	2.0	
flake	v1	volcanic glass	0.2	8.0	7.0	3.0	
flake	v1	volcanic glass	0.2	11.0	8.0	2.0	
flake	v1	volcanic glass	0.2	9.0	8.0	2.0	
flake	v1	volcanic glass	0.2	12.0	5.0	3.0	
flake	v1	volcanic glass	0.2	12.0	7.0	1.0	
flake	v1	volcanic glass	0.2	6.0	6.0	3.0	
flake	v2	volcanic glass	0.2	7.0	7.0	2.0	
flake	v2	volcanic glass	0.3	10.0	10.0	3.0	
flake	v3	volcanic glass	0.3	10.0	10.0	5.0	
flake	v1	volcanic glass	0.3	19.0	6.0	3.0	
flake	v2	volcanic glass	0.3	10.0	9.0	3.0	
flake	v1	volcanic glass	0.3	11.0	8.0	3.0	
flake	v1	volcanic glass	0.3	16.0	6.0	3.0	
flake	v2	volcanic glass	0.3	12.0	8.0	2.0	
flake	v1	volcanic glass	0.3	8.0	9.0	2.0	
flake	v1	volcanic glass	0.4	11.0	10.0	4.0	
flake	v1	volcanic glass	0.4	10.0	14.0	3.0	
flake	v2	volcanic glass	0.4	16.0	9.0	4.0	
flake	v1	volcanic glass	0.4	11.0	15.0	2.0	

Continued on next page

Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
flake	v1	volcanic glass	0.4	8.0	12.0	4.0	
flake	v2	volcanic glass	0.4	18.0	8.0	3.0	
flake	v2	volcanic glass	0.4	14.0	9.0	3.0	
flake	v2	volcanic glass	0.4	12.0	7.0	4.0	
flake	v2	volcanic glass	0.5	18.0	12.0	3.0	
flake	v3	volcanic glass	0.5	15.0	7.0	4.0	
flake	v2	volcanic glass	0.5	14.0	10.0	3.0	
flake	v3	volcanic glass	0.5	13.0	7.0	4.0	
flake	v1	volcanic glass	0.5	14.0	10.0	3.0	
flake	v1	volcanic glass	0.6	15.0	13.0	3.0	
flake	v1	volcanic glass	0.7	13.0	16.0	5.0	
flake	v3	volcanic glass	0.7	13.0	12.0	6.0	
flake	v1	volcanic glass	0.8	12.0	12.0	6.0	
flake	v1	volcanic glass	0.8	13.0	10.0	5.0	
flake	v3	volcanic glass	0.8	12.0	9.0	8.0	
flake	v2	volcanic glass	0.8	17.0	10.0	5.0	
flake	v1	volcanic glass	0.9	19.0	10.0	5.0	
flake	v1	volcanic glass	0.9	17.0	13.0	4.0	
flake	v2	volcanic glass	1.0	13.0	12.0	5.0	
flake	v1	volcanic glass	1.0	17.0	14.0	4.0	
flake	v1	volcanic glass	1.2	14.0	19.0	4.0	
flake	v1	volcanic glass	1.3	15.0	17.0	6.0	
flake	v1	volcanic glass	1.3	19.0	15.0	5.0	
flake	v1	volcanic glass	2.0	20.0	19.0	8.0	
manuport	fragment	coral	0.3	14.0	9.0	4.0	
manuport	fragment	coral	0.7	15.0	10.0	7.0	
manuport	fragment	coral	4.6	20.0	17.0	16.0	
manuport	fragment	coral	5.1	39.0	18.0	16.0	possible use-wear
manuport	unmodified	urchin spine	0.7	34.0	0.0	0.0	c
manuport	unmodified	urchin spine	0.8	25.0	0.0	0.0	f-dst
pebble		siltstone	1.8	15.0	14.0	11.0	unmodified
pebble		siltstone	2.3	21.0	11.0	8.0	unmodified
worked	cut	bone	0.1	1.0	0.5	0.0	small to medium or medium mammal
bone							
worked	cut/ground	bone	0.4	24.0	7.0	0.0	small to medium or medium mammal
bone							
worked	cut	bone	0.5	30.0	6.0	0.0	humerus of medium Procellariid
bone							
worked	ground	bone	0.6	18.0	9.0	0.0	small to medium or medium mammal, burnt
bone							
worked	cut	bone	1.4	38.0	10.0	0.0	small to medium or medium mammal
bone							

Continued on next page

Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
worked bone	cut/ground	bone	1.4	32.0	12.0	0.0	small to medium or medium mammal
worked bone	cut	bone	2.7	36.0	16.0	0.0	small to medium or medium mammal
worked shell	<i>puka</i>	shell	0.5	11.0	0.0	0.0	
worked shell	pierced	shell	6.0	0.0	0.0	0.0	n=18
Catalog 03							
abrader	subconic-edged	coral	0.1	7.0	5.0	0.0	apex
abrader	subconic-edged	coral	0.2	9.0	8.0	0.0	apex
abrader	subconic-edged	coral	0.2	7.0	6.0	0.0	apex
abrader	subconic-edged	coral	0.4	12.0	8.0	7.0	no apex
abrader	subconic-edged	coral	0.5	18.0	8.0	0.0	apex
abrader	subconic-edged	coral	0.5	15.0	7.0	5.0	no apex
abrader	subconic-edged	coral	0.5	21.0	8.0	6.0	no apex
abrader	subconic-edged	coral	0.8	16.0	10.0	8.0	no apex
abrader	subconic-edged	coral	1.0	17.0	11.0	9.0	no apex
abrader	subconic-round	coral	1.2	18.0	10.0	0.0	no apex
abrader	subconic-edged	coral	1.2	16.0	11.0	9.0	no apex
abrader	subconic-edged	coral	1.4	32.0	7.0	0.0	apex
abrader	subconic-edged	coral	1.5	19.0	15.0	8.0	no apex
abrader	subconic-edged	coral	1.8	19.0	20.0	0.0	apex
abrader	subconic-edged	coral	2.2	28.0	16.0	10.0	no apex
abrader	subconic-edged	coral	2.7	17.0	22.0	18.0	no apex
abrader	subconic-edged	coral	2.7	26.0	15.0	0.0	apex
abrader	subconic-edged	coral	5.0	12.0	9.0	8.0	no apex
abrader	subconic-edged	coral	5.2	39.0	16.0	0.0	apex

Continued on next page

Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
abrader	subconic- edged	coral	5.3	34.0	19.0	13.0	no apex
abrader	edge	coral	9.9	31.0	29.0	17.0	
abrader	edge	coral	11.4	47.0	29.0	12.0	
abrader	subconic- edged	coral	12.0	26.0	26.0	15.0	no apex
abrader	surface	coral	80.0	61.0	51.0	42.0	
file	proximal	urchin spine	0.1	11.0	11.0	6.0	ff
file	unknown	urchin spine	0.1	10.0	10.0	6.0	ff
file	unknown	urchin spine	0.1	15.0	15.0	4.0	ff
file	unknown	urchin spine	0.1	12.0	12.0	7.0	ff
file	unknown	urchin spine	0.1	7.0	7.0	7.0	ff
file	unknown	urchin spine	0.1	8.0	8.0	7.0	ff
file	unknown	urchin spine	0.2	16.0	16.0	8.0	ff
file	unknown	urchin spine	0.2	17.0	17.0	6.0	ff
file	unknown	urchin spine	0.2	10.0	10.0	9.0	ff
file	unknown	urchin spine	0.2	14.0	14.0	7.0	ff
file	unknown	urchin spine	0.2	8.0	8.0	7.0	ff
file	unknown	urchin spine	0.2	13.0	13.0	7.0	ff
file	unknown	urchin spine	0.2	16.0	16.0	7.0	ff
file	proximal	urchin spine	0.3	23.0	12.0	6.0	c
file	unknown	urchin spine	0.3	14.0	14.0	6.0	ff
file	unknown	urchin spine	0.3	14.0	14.0	8.0	ff
file	unknown	urchin spine	0.3	13.0	13.0	8.0	ff
file	unknown	urchin spine	0.3	17.0	17.0	7.0	ff
file	unknown	urchin spine	0.3	17.0	17.0	7.0	ff
file	unknown	urchin spine	0.3	14.0	14.0	6.0	ff
file	unknown	urchin spine	0.3	9.0	9.0	9.0	ff
file	unknown	urchin spine	0.3	17.0	17.0	6.0	ff
file	unknown	urchin spine	0.3	14.0	14.0	9.0	ff
file	unknown	urchin spine	0.3	14.0	8.0	5.0	sf
file	unknown	urchin spine	0.3	16.0	16.0	5.0	ff
file	unknown	urchin spine	0.3	24.0	15.0	5.0	sf
file	proximal	urchin spine	0.4	30.0	9.0	6.0	c
file	unknown	urchin spine	0.4	15.0	15.0	8.0	ff
file	unknown	urchin spine	0.4	17.0	17.0	7.0	ff
file	unknown	urchin spine	0.4	23.0	23.0	7.0	ff
file	unknown	urchin spine	0.4	24.0	24.0	6.0	ff
file	unknown	urchin spine	0.4	15.0	15.0	8.0	ff
file	unknown	urchin spine	0.4	19.0	19.0	7.0	ff
file	unknown	urchin spine	0.4	11.0	11.0	9.0	ff
file	unknown	urchin spine	0.4	22.0	22.0	7.0	ff
file	unknown	urchin spine	0.4	11.0	11.0	8.0	ff

Continued on next page

Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
file	unknown	urchin spine	0.4	18.0	9.0	4.0	sf
file	unknown	urchin spine	0.4	13.0	8.0	4.0	ff
file	unknown	urchin spine	0.4	25.0	16.0	5.0	sf
file	unknown	urchin spine	0.4	21.0	13.0	5.0	sf
file	unknown	urchin spine	0.4	20.0	20.0	7.0	ff
file	unknown	urchin spine	0.4	28.0	12.0	5.0	sf
file	distal	urchin spine	0.5	17.0	15.0	8.0	ff
file	proximal	urchin spine	0.5	22.0	18.0	7.0	c
file	proximal	urchin spine	0.5	27.0	11.0	6.0	c
file	unknown	urchin spine	0.5	30.0	30.0	7.0	ff
file	unknown	urchin spine	0.5	21.0	21.0	10.0	ff
file	unknown	urchin spine	0.5	20.0	20.0	8.0	ff
file	unknown	urchin spine	0.5	23.0	23.0	9.0	ff
file	unknown	urchin spine	0.5	17.0	17.0	8.0	ff
file	unknown	urchin spine	0.5	16.0	16.0	8.0	ff
file	unknown	urchin spine	0.5	24.0	15.0	5.0	sf
file	unknown	urchin spine	0.5	23.0	14.0	6.0	sf
file	distal	urchin spine	0.6	31.0	13.0	7.0	c, two facets
file	distal	urchin spine	0.6	21.0	20.0	4.0	ff
file	proximal	urchin spine	0.6	22.0	12.0	6.0	c
file	proximal	urchin spine	0.6	36.0	13.0	6.0	c
file	proximal	urchin spine	0.6	31.0	31.0	7.0	c
file	proximal	urchin spine	0.6	29.0	16.0	7.0	c
file	proximal	urchin spine	0.6	31.0	25.0	8.0	sf
file	unknown	urchin spine	0.6	15.0	15.0	8.0	ff
file	unknown	urchin spine	0.6	15.0	15.0	9.0	ff
file	unknown	urchin spine	0.6	20.0	20.0	8.0	ff
file	unknown	urchin spine	0.6	21.0	21.0	8.0	ff
file	unknown	urchin spine	0.6	33.0	12.0	6.0	sf
file	unknown	urchin spine	0.6	23.0	15.0	7.0	sf
file	unknown	urchin spine	0.6	24.0	14.0	7.0	sf
file	unknown	urchin spine	0.6	22.0	9.0	5.0	sf
file	unknown	urchin spine	0.6	18.0	12.0	6.0	sf
file	unknown	urchin spine	0.6	19.0	19.0	9.0	ff
file	proximal	urchin spine	0.7	35.0	18.0	6.0	c
file	proximal	urchin spine	0.7	31.0	12.0	7.0	c
file	proximal	urchin spine	0.7	33.0	21.0	7.0	c
file	proximal	urchin spine	0.7	32.0	28.0	7.0	c
file	proximal	urchin spine	0.7	32.0	19.0	7.0	c
file	proximal	urchin spine	0.7	32.0	21.0	6.0	c
file	proximal	urchin spine	0.7	25.0	25.0	7.0	c
file	unknown	urchin spine	0.7	20.0	20.0	8.0	ff
file	unknown	urchin spine	0.7	22.0	22.0	10.0	ff

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
file	unknown	urchin spine	0.7	21.0	21.0	8.0	ff
file	unknown	urchin spine	0.7	25.0	25.0	8.0	ff
file	unknown	urchin spine	0.7	27.0	14.0	6.0	sf
file	unknown	urchin spine	0.7	24.0	19.0	7.0	sf
file	unknown	urchin spine	0.7	24.0	24.0	8.0	ff
file	proximal	urchin spine	0.8	32.0	21.0	6.0	c
file	unknown	urchin spine	0.8	25.0	18.0	8.0	sf
file	unknown	urchin spine	0.8	31.0	22.0	6.0	sf
file	proximal	urchin spine	0.9	31.0	19.0	8.0	c
file	proximal	urchin spine	0.9	37.0	31.0	8.0	c
file	proximal	urchin spine	0.9	40.0	25.0	8.0	c
file	proximal	urchin spine	0.9	36.0	17.0	6.0	c
file	proximal	urchin spine	0.9	30.0	22.0	9.0	c
file	unknown	urchin spine	0.9	25.0	25.0	9.0	ff
file	unknown	urchin spine	0.9	27.0	13.0	5.0	sf
file	proximal	urchin spine	1.0	30.0	22.0	9.0	c
file	proximal	urchin spine	1.0	39.0	25.0	7.0	c
file	proximal	urchin spine	1.0	39.0	23.0	6.0	sf
file	unknown	urchin spine	1.1	30.0	30.0	9.0	ff
file	unknown	urchin spine	1.1	37.0	20.0	7.0	sf
file	proximal	urchin spine	1.2	32.0	19.0	9.0	c
file	proximal	urchin spine	1.2	35.0	27.0	9.0	c
file	proximal	urchin spine	1.2	28.0	18.0	9.0	c
file	proximal	urchin spine	1.3	38.0	34.0	9.0	c
file	proximal	urchin spine	1.3	38.0	25.0	8.0	c
file	unknown	urchin spine	1.3	28.0	21.0	9.0	ff
file	distal	urchin spine	1.4	39.0	11.0	7.0	c, conic working surface
file	proximal	urchin spine	1.6	44.0	15.0	8.0	c
file	proximal	urchin spine	1.9	39.0	24.0	10.0	c
file	proximal	urchin spine	1.9	33.0	30.0	11.0	c
file	unknown	urchin spine	2.0	35.0	35.0	7.0	ff
file	proximal	urchin spine	2.4	56.0	25.0	10.0	c
file	proximal	urchin spine	2.4	47.0	36.0	10.0	c
file	proximal	urchin spine	2.6	44.0	22.0	9.0	c
file	proximal	urchin spine	2.9	40.0	40.0	11.0	sf
file	distal	urchin spine	3.1	44.0	25.0	9.0	c
file	distal	urchin spine	3.1	38.0	12.0	9.0	c
file	distal	urchin spine	3.2	48.0	26.0	8.0	c
fishhook	unbarbed, jabbing	bone	0.0	10.0	3.0	0.0	bird or mammal, bend and part of shank only
fishhook	unbarbed, jabbing	bone	0.1	10.0	6.0	0.0	bird or mammal, head missing

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
fishhook	blank	bone	0.2	12.0	8.0	0.0	small to medium or medium mammal
	fragment						
fishhook	blank	bone	0.2	9.0	6.0	0.0	small to medium or medium mammal
	fragment						
fishhook	blank	shell	0.2	18.0	11.0	0.0	
	fragment						
fishhook	blank	shell	0.3	19.0	10.0	0.0	
	fragment						
fishhook	blank	shell	0.3	14.0	8.0	0.0	
	fragment						
fishhook	blank	shell	0.3	18.0	12.0	0.0	
	fragment						
fishhook	blank	shell	0.4	14.0	11.0	0.0	
	fragment						
fishhook	blank	shell	0.5	14.0	8.0	0.0	
fishhook	blank	shell	0.5	17.0	9.0	0.0	
	fragment						
fishhook	blank	shell	0.7	23.0	18.0	0.0	filed
fishhook	blank	shell	0.9	19.0	15.0	0.0	
fishhook	blank	shell	1.1	25.0	14.0	0.0	
flake	v1	basalt	0.1	8.0	9.0	2.0	ground
flake	v1	basalt	0.4	12.0	8.0	4.0	ground
flake	v1	basalt	1.0	12.0	15.0	6.0	
flake	v2	basalt	2.5	17.0	17.0	7.0	
flake	v1	basalt	2.7	22.0	27.0	5.0	ground
flake	v1	basalt	2.8	15.0	35.0	5.0	
flake	v1	basalt	3.6	23.0	24.0	6.0	
flake	v1	basalt	3.8	20.0	23.0	9.0	
flake	v1	basalt	7.4	25.0	47.0	5.0	
flake	v3	basalt	13.3	31.0	26.0	19.0	
flake	v1	chert	0.7	24.0	8.0	5.0	
flake	v2	volcanic glass	0.1	7.0	6.0	2.0	
flake	v1	volcanic glass	0.1	9.0	5.0	2.0	
flake	v2	volcanic glass	0.1	5.0	6.0	1.0	
flake	v2	volcanic glass	0.1	6.0	5.0	1.0	
flake	v1	volcanic glass	0.1	10.0	6.0	3.0	
flake	v1	volcanic glass	0.1	11.0	5.0	2.0	
flake	v1	volcanic glass	0.1	11.0	7.0	2.0	
flake	v3	volcanic glass	0.1	7.0	4.0	2.0	
flake	v1	volcanic glass	0.1	7.0	7.0	2.0	
flake	v1	volcanic glass	0.1	10.0	5.0	2.0	
flake	v3	volcanic glass	0.1	7.0	6.0	2.0	
flake	v2	volcanic glass	0.1	7.0	5.0	1.0	
flake	v2	volcanic glass	0.1	6.0	5.0	2.0	

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
flake	v2	volcanic glass	0.1	8.0	5.0	2.0	
flake	v2	volcanic glass	0.1	7.0	4.0	2.0	
flake	v3	volcanic glass	0.1	7.0	5.0	2.0	
flake	v2	volcanic glass	0.1	8.0	4.0	2.0	
flake	v1	volcanic glass	0.1	8.0	6.0	1.0	
flake	v2	volcanic glass	0.1	4.0	6.0	1.0	
flake	v2	volcanic glass	0.1	5.0	5.0	2.0	
flake	v2	volcanic glass	0.2	9.0	6.0	3.0	
flake	v2	volcanic glass	0.2	14.0	4.0	3.0	
flake	v1	volcanic glass	0.2	10.0	7.0	2.0	
flake	v1	volcanic glass	0.2	8.0	8.0	2.0	
flake	v2	volcanic glass	0.2	12.0	6.0	2.0	
flake	v1	volcanic glass	0.2	13.0	8.0	2.0	
flake	v1	volcanic glass	0.2	14.0	4.0	2.0	
flake	v1	volcanic glass	0.2	8.0	12.0	3.0	
flake	v1	volcanic glass	0.2	14.0	7.0	2.0	
flake	v2	volcanic glass	0.2	9.0	7.0	3.0	
flake	v2	volcanic glass	0.2	10.0	6.0	2.0	
flake	v1	volcanic glass	0.2	10.0	11.0	2.0	
flake	v1	volcanic glass	0.2	11.0	6.0	3.0	
flake	v1	volcanic glass	0.2	9.0	6.0	2.0	
flake	v3	volcanic glass	0.2	7.0	6.0	5.0	
flake	v2	volcanic glass	0.2	8.0	7.0	3.0	
flake	v3	volcanic glass	0.2	7.0	7.0	3.0	
flake	v2	volcanic glass	0.2	11.0	7.0	2.0	
flake	v1	volcanic glass	0.2	8.0	7.0	2.0	
flake	v2	volcanic glass	0.2	9.0	7.0	3.0	
flake	v2	volcanic glass	0.2	10.0	8.0	2.0	
flake	v3	volcanic glass	0.2	8.0	5.0	4.0	
flake	v2	volcanic glass	0.2	8.0	7.0	3.0	
flake	v3	volcanic glass	0.2	11.0	3.0	3.0	
flake	v2	volcanic glass	0.2	7.0	5.0	2.0	
flake	v2	volcanic glass	0.2	5.0	7.0	1.0	
flake	v1	volcanic glass	0.3	14.0	12.0	3.0	
flake	v1	volcanic glass	0.3	10.0	8.0	3.0	
flake	v1	volcanic glass	0.3	15.0	8.0	3.0	
flake	v1	volcanic glass	0.3	10.0	10.0	2.0	
flake	v1	volcanic glass	0.3	14.0	6.0	3.0	
flake	v1	volcanic glass	0.3	14.0	11.0	3.0	
flake	v1	volcanic glass	0.3	12.0	9.0	3.0	
flake	v2	volcanic glass	0.3	11.0	7.0	3.0	
flake	v1	volcanic glass	0.3	12.0	7.0	4.0	
flake	v1	volcanic glass	0.3	13.0	11.0	2.0	

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
flake	v2	volcanic glass	0.3	11.0	6.0	3.0	
flake	v2	volcanic glass	0.3	12.0	12.0	4.0	
flake	v1	volcanic glass	0.3	13.0	10.0	2.0	
flake	v2	volcanic glass	0.3	12.0	8.0	4.0	
flake	v1	volcanic glass	0.3	10.0	9.0	3.0	
flake	v2	volcanic glass	0.3	14.0	6.0	3.0	
flake	v3	volcanic glass	0.3	11.0	8.0	5.0	
flake	v1	volcanic glass	0.3	10.0	7.0	4.0	
flake	v2	volcanic glass	0.3	9.0	8.0	2.0	
flake	v3	volcanic glass	0.3	7.0	7.0	4.0	
flake	v2	volcanic glass	0.4	13.0	9.0	3.0	
flake	v1	volcanic glass	0.4	14.0	13.0	3.0	
flake	v2	volcanic glass	0.4	10.0	14.0	3.0	
flake	v1	volcanic glass	0.4	12.0	8.0	4.0	
flake	v2	volcanic glass	0.4	22.0	5.0	5.0	
flake	v2	volcanic glass	0.4	11.0	8.0	4.0	
flake	v1	volcanic glass	0.4	15.0	7.0	3.0	
flake	v2	volcanic glass	0.4	12.0	8.0	3.0	
flake	v1	volcanic glass	0.4	14.0	9.0	3.0	
flake	v1	volcanic glass	0.4	12.0	9.0	4.0	
flake	v3	volcanic glass	0.4	11.0	6.0	6.0	
flake	v2	volcanic glass	0.4	12.0	8.0	4.0	
flake	v2	volcanic glass	0.4	14.0	10.0	3.0	
flake	v2	volcanic glass	0.4	17.0	7.0	4.0	
flake	v1	volcanic glass	0.4	13.0	10.0	3.0	
flake	v2	volcanic glass	0.4	11.0	7.0	3.0	
flake	v2	volcanic glass	0.4	11.0	9.0	3.0	
flake	v3	volcanic glass	0.5	12.0	7.0	7.0	
flake	v1	volcanic glass	0.5	18.0	14.0	2.0	
flake	v3	volcanic glass	0.5	13.0	8.0	5.0	
flake	v1	volcanic glass	0.5	16.0	8.0	3.0	
flake	v1	volcanic glass	0.5	16.0	6.0	5.0	
flake	v1	volcanic glass	0.5	12.0	10.0	5.0	
flake	v2	volcanic glass	0.5	12.0	10.0	5.0	
flake	v2	volcanic glass	0.5	15.0	7.0	4.0	
flake	v1	volcanic glass	0.5	14.0	10.0	4.0	
flake	v3	volcanic glass	0.5	13.0	9.0	5.0	
flake	v2	volcanic glass	0.5	14.0	10.0	4.0	
flake	v1	volcanic glass	0.6	13.0	9.0	4.0	
flake	v1	volcanic glass	0.6	12.0	15.0	3.0	
flake	v1	volcanic glass	0.6	18.0	10.0	3.0	
flake	v2	volcanic glass	0.6	15.0	10.0	4.0	
flake	v1	volcanic glass	0.6	12.0	10.0	5.0	

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
flake	v1	volcanic glass	0.6	14.0	13.0	5.0	
flake	v1	volcanic glass	0.6	19.0	9.0	5.0	
flake	v3	volcanic glass	0.6	9.0	6.0	6.0	
flake	v2	volcanic glass	0.6	17.0	8.0	5.0	
flake	v3	volcanic glass	0.6	10.0	9.0	6.0	
flake	v1	volcanic glass	0.7	16.0	9.0	5.0	
flake	v1	volcanic glass	0.7	14.0	12.0	4.0	
flake	v1	volcanic glass	0.7	15.0	10.0	5.0	
flake	v1	volcanic glass	0.7	19.0	8.0	5.0	
flake	v2	volcanic glass	0.7	14.0	9.0	4.0	
flake	v1	volcanic glass	0.8	16.0	10.0	3.0	
flake	v1	volcanic glass	0.8	15.0	11.0	5.0	
flake	v1	volcanic glass	0.8	12.0	18.0	4.0	
flake	v3	volcanic glass	0.8	15.0	10.0	5.0	
flake	v1	volcanic glass	0.8	15.0	11.0	4.0	
flake	v1	volcanic glass	0.8	14.0	14.0	4.0	
flake	v1	volcanic glass	0.8	13.0	13.0	4.0	
flake	v1	volcanic glass	0.8	13.0	10.0	4.0	
flake	v1	volcanic glass	0.9	10.0	17.0	6.0	
flake	v2	volcanic glass	0.9	15.0	14.0	5.0	
flake	v1	volcanic glass	0.9	18.0	14.0	4.0	
flake	v3	volcanic glass	0.9	14.0	8.0	7.0	
flake	v2	volcanic glass	0.9	13.0	10.0	7.0	
flake	v2	volcanic glass	1.0	22.0	15.0	3.0	
flake	v1	volcanic glass	1.0	25.0	12.0	5.0	
flake	v2	volcanic glass	1.1	17.0	18.0	5.0	
flake	v1	volcanic glass	1.1	22.0	10.0	5.0	
flake	v3	volcanic glass	1.1	12.0	11.0	9.0	
flake	v3	volcanic glass	1.1	14.0	11.0	7.0	
flake	v1	volcanic glass	1.2	17.0	14.0	6.0	
flake	v2	volcanic glass	1.2	14.0	13.0	6.0	
flake	v2	volcanic glass	1.2	15.0	13.0	6.0	
flake	v1	volcanic glass	1.4	19.0	16.0	9.0	
flake	v1	volcanic glass	1.5	22.0	11.0	5.0	
flake	v1	volcanic glass	1.7	26.0	12.0	5.0	
flake	v1	volcanic glass	1.7	15.0	17.0	5.0	
flake	v2	volcanic glass	2.1	21.0	20.0	5.0	
flake	v1	volcanic glass	2.7	37.0	15.0	7.0	
flake	v1	volcanic glass	3.4	22.0	19.0	8.0	
flake	v3	volcanic glass	3.7	22.0	18.0	13.0	
flake	v3	volcanic glass	4.1	21.0	13.0	10.0	
hammerstone		basalt	62.4	59.0	34.0	20.0	
manuport	fragment	coral	0.4	18.0	8.0	5.0	possible use-wear

Continued on next page

Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
manuport	fragment	coral	0.5	15.0	10.0	5.0	
manuport	fragment	coral	1.5	17.0	13.0	8.0	possible use-wear
manuport	fragment	coral	2.3	25.0	16.0	10.0	
manuport	fragment	coral	7.4	29.0	25.0	13.0	
manuport	fragment	coral	8.4	40.0	20.0	14.0	
manuport	fragment	coral	8.8	32.0	32.0	22.0	
manuport	unmodified	urchin spine	0.2	15.0	0.0	0.0	c
manuport	unmodified	urchin spine	0.3	21.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.3	17.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.3	12.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.3	13.0	0.0	0.0	fragment fractured sectionally and lengthwise
manuport	unmodified	urchin spine	0.4	16.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.4	15.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.4	16.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.4	20.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.5	21.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.5	23.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.9	25.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.9	35.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.9	25.0	0.0	0.0	f
manuport	unmodified	urchin spine	1.4	26.0	0.0	0.0	f
manuport	unmodified	urchin spine	1.4	35.0	0.0	0.0	c
manuport	unmodified	urchin spine	1.6	42.0	0.0	0.0	f
modified pebble		basalt	49.1	43.0	42.0	21.0	
octopus lure	possible fragment	shell	1.5	35.0	22.0	0.0	<i>Cypraea leviathan</i> , pierced
worked bone	cut	bone	0.2	20.0	5.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.2	16.0	6.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.2	9.0	6.0	4.0	small to medium or medium mammal
worked bone	cut	bone	0.2	11.0	4.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.2	10.0	6.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.2	7.0	5.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.2	14.0	7.0	0.0	bird or mammal
worked bone	cut	bone	0.2	10.0	6.0	6.0	distal metapodial, <i>Canis familiaris</i>

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
worked bone	cut	bone	0.3	17.0	7.0	3.0	small to medium or medium mammal
worked bone	cut	bone	0.3	17.0	8.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.3	14.0	10.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.3	17.0	5.0	3.0	small to medium or medium mammal
worked bone	cut	bone	0.3	20.0	10.0	0.0	bird or mammal
worked bone	cut	bone	0.4	15.0	10.0	5.0	
worked bone	cut	bone	0.4	21.0	7.0	4.0	small to medium or medium mammal
worked bone	cut	bone	0.4	23.0	10.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.4	14.0	11.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.4	18.0	7.0	3.0	small to medium or medium mammal
worked bone	cut	bone	0.5	24.0	10.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.6	21.0	12.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.7	23.0	7.0	5.0	small to medium or medium mammal
worked bone	cut	bone	0.8	26.0	9.0	3.0	small to medium or medium mammal
worked bone	cut	bone	0.9	20.0	13.0	5.0	small to medium or medium mammal
worked bone	cut	bone	1.0	26.0	17.0	0.0	small to medium or medium mammal
worked bone	cut	bone	1.3	46.0	7.0	4.0	
worked bone	cut	bone	1.9	24.0	20.0	11.0	distal end radius, <i>Sus scrofa</i>
worked shell	pierced	shell	0.2	15.0	10.0	0.0	
worked shell	<i>puka</i>	shell	0.2	7.0	0.0	0.0	
worked shell	<i>puka</i>	shell	0.2	8.0	0.0	0.0	
worked shell	pierced	shell	3.4	0.0	0.0	0.0	n=13
Catalog 05							
file	unknown	urchin spine	0.1	12.0	12.0	5.0	ff
file	unknown	urchin spine	0.3	14.0	7.0	5.0	c
file	unknown	urchin spine	0.3	15.0	9.0	6.0	cf

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
file	unknown	urchin spine	0.6	24.0	7.0	6.0	sf
file	unknown	urchin spine	0.6	27.0	27.0	7.0	ff-2 facets
fishhook	point, two- piece	bone	0.6	24.0	10.0	0.0	medium mammal
flake	v1	volcanic glass	0.3	10.0	11.0	13.0	
manuport	fragment	coral	1.4	16.0	13.0	11.0	
manuport	fragment	coral	2.4	22.0	12.0	10.0	
manuport	fragment	coral	2.9	23.0	18.0	12.0	
manuport	fragment	coral	5.4	37.0	25.0	25.0	
manuport	unmodified	urchin spine	0.3	12.0	0.0	0.0	f
worked bone	cut	bone	0.1	14.0	5.0	0.0	bird or mammal
Catalog 06							
debitage		shell	0.6	22.0	11.0	0.0	
file	proximal	urchin spine	1.2	56.0	26.0	8.0	c
fishhook	blank	shell	1.4	24.0	16.0	0.0	
fishhook	blank	shell	3.0	27.0	27.0	0.0	
Catalog 07							
flake	v3	volcanic glass	0.1	6.0	5.0	1.0	
Catalog 09							
abrader	subconic- edged	coral	0.3	10.0	8.0	6.0	no apex
abrader	subconic- edged	coral	0.4	15.0	10.0	0.0	apex
abrader	subconic- round	coral	1.2	23.0	10.0	8.0	no apex
abrader	subconic- round	coral	1.2	25.0	11.0	0.0	apex
abrader	subconic- edged	coral	1.3	22.0	10.0	6.0	no apex
abrader	subconic- edged	coral	1.3	19.0	16.0	14.0	no apex
abrader	subconic- edged	coral	1.3	13.0	17.0	14.0	no apex
abrader	subconic- edged	coral	1.4	25.0	13.0	0.0	apex
abrader	subconic- edged	coral	1.5	29.0	11.0	9.0	no apex
abrader	subconic- edged	coral	1.7	18.0	13.0	10.0	no apex
abrader	subconic- edged	coral	1.8	23.0	11.0	9.0	no apex
abrader	subconic- round	coral	2.0	23.0	12.0	10.0	no apex

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
abrader	subconic- edged	coral	2.1	25.0	18.0	13.0	no apex
abrader	subconic- edged	coral	2.6	32.0	15.0	0.0	apex
abrader	subconic- edged	coral	2.8	26.0	15.0	11.0	no apex
abrader	subconic- fragment	coral	3.9	27.0	16.0	14.0	no apex
abrader	subconic- edged	coral	4.4	33.0	16.0	14.0	no apex
abrader	subconic- edged	coral	5.1	20.0	22.0	18.0	no apex
abrader	edge	coral	5.9	22.0	22.0	12.0	
abrader	subconic- round	coral	6.2	39.0	17.0	0.0	apex
abrader	edge	coral	6.3	28.0	19.0	14.0	
abrader	subconic- edged	coral	6.7	24.0	24.0	21.0	no apex
abrader	subconic- round	coral	8.2	50.0	16.0	7.0	no apex
abrader	edge	coral	8.3	39.0	24.0	11.0	
abrader	edge	coral	8.3	25.0	29.0	18.0	
abrader	edge	coral	18.2	50.0	29.0	16.0	
abrader	edge	coral	26.5	55.0	40.0	14.0	
abrader	edge	coral	33.8	40.0	44.0	21.0	
abrader	edge	coral	41.6	78.0	37.0	14.0	
abrader	surface	coral	51.1	55.0	43.0	37.0	
abrader	surface	coral	118.6	74.0	55.0	39.0	
abrader	edge	coral	201.3	88.0	70.0	50.0	
abrader	surface	coral	222.9	130.0	60.0	28.0	
abrader	subconic fragment	vesicular basalt	0.3	15.0	7.0	0.0	in 2 pieces
abrader	subconic	vesicular basalt	0.4	10.0	10.0	7.0	
abrader	subconic	vesicular basalt	0.7	20.0	10.0	0.0	
abrader	subconic	vesicular basalt	1.2	22.0	12.0	0.0	
abrader	subconic	vesicular basalt	1.3	30.0	10.0	0.0	
abrader	tabular	vesicular basalt	9.6	35.0	30.0	12.0	
abrader	tabular	vesicular basalt	12.6	35.0	30.0	19.0	22 mm edge
abrader	tabular	vesicular basalt	15.9	45.0	33.0	10.0	32 mm edge
abrader	tabular	vesicular basalt	42.3	64.0	52.0	15.0	47 mm edge
abrader	tabular	vesicular basalt	43.6	78.0	45.0	18.0	
abrader	tabular	vesicular basalt	62.0	83.0	58.0	14.0	69 mm edge
adze	fragment	basalt	2.2	13.0	13.0	8.0	2 adjoined ground surfaces
awl	possible	bone	0.2	32.0	0.0	0.0	medium bird
awl	possible	bone	0.3	40.0	0.0	0.0	distal end humerus, <i>Bulweria bulwerii</i>

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Table 21—Continued

Type	Variety possible	Material bone	Wt. (g)	x	y	z	Comment
awl			1.0	43.0	0.0	0.0	Monacanthid dorsal spine
debitage		shell	9.6	33.0	23.0	10.0	Cassis cornuta
file	unknown	urchin spine	0.1	10.0	10.0	7.0	ff
file	unknown	urchin spine	0.2	11.0	11.0	6.0	ff
file	unknown	urchin spine	0.2	15.0	15.0	10.0	ff
file	unknown	urchin spine	0.3	18.0	18.0	7.0	ff
file	unknown	urchin spine	0.3	17.0	17.0	5.0	ff
file	unknown	urchin spine	0.4	18.0	18.0	8.0	ff
file	unknown	urchin spine	0.4	23.0	23.0	7.0	ff
file	distal	urchin spine	0.5	26.0	5.0	5.0	steeply angled facet
file	proximal	urchin spine	0.5	23.0	9.0	4.0	sf
file	unknown	urchin spine	0.5	29.0	18.0	5.0	c
file	unknown	urchin spine	0.5	19.0	19.0	8.0	ff
file	proximal	urchin spine	0.6	23.0	12.0	7.0	c
file	unknown	urchin spine	0.6	24.0	24.0	9.0	ff
file	unknown	urchin spine	0.6	16.0	16.0	9.0	ff
file	unknown	urchin spine	0.6	25.0	0.0	0.0	possible use-wear
file	distal	urchin spine	0.7	27.0	6.0	5.0	steeply angled facet
file	proximal	urchin spine	0.7	32.0	23.0	7.0	c
file	unknown	urchin spine	0.7	27.0	17.0	6.0	sf
file	unknown	urchin spine	0.8	21.0	16.0	7.0	sf
file	unknown	urchin spine	0.8	27.0	13.0	7.0	sf
file	unknown	urchin spine	0.8	24.0	24.0	8.0	ff
file	proximal	urchin spine	0.9	41.0	30.0	7.0	c
file	unknown	urchin spine	0.9	29.0	18.0	8.0	sf
file	unknown	urchin spine	0.9	28.0	19.0	8.0	sf
file	proximal	urchin spine	1.0	25.0	25.0	10.0	ff
file	proximal	urchin spine	1.1	34.0	17.0	7.0	c
file	unknown	urchin spine	1.1	32.0	26.0	7.0	sf
file	distal	urchin spine	1.2	38.0	13.0	6.0	c, conic working surface
file	proximal	urchin spine	1.2	51.0	28.0	6.0	c
file	proximal	urchin spine	1.5	48.0	17.0	7.0	c
file	unknown	urchin spine	1.5	37.0	8.0	7.0	facet on top and partially on side
file	unknown	urchin spine	1.8	34.0	0.0	0.0	no facet but possible groove on one end
file	proximal	urchin spine	2.1	61.0	61.0	8.0	c
file	proximal	urchin spine	2.9	47.0	29.0	12.0	c
file	proximal	urchin spine	3.0	70.0	30.0	9.0	c
fishhook	unbarbed, rotating	bone	0.1	10.0	7.0	8.0	bird or mammal, complete fishhook

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
fishhook	unbarbed, jabbing	bone	0.1	14.0	8.0	11.0	bird or mammal
fishhook		bone	0.1	14.0	0.0	0.0	bird or mammal, shank and bend
fishhook		bone	0.1	11.0	0.0	0.0	bird or mammal, shank only
fishhook	point, two- piece, fragment	bone	0.1	6.0	0.0	0.0	bird or mammal
fishhook		bone	0.2	16.0	0.0	0.0	bird or mammal, shank only
fishhook		bone	0.2	15.0	0.0	0.0	bird or mammal, shank and bend
fishhook	unbarbed, rotating	bone	0.3	14.0	13.0	0.0	small to medium or medium mammal, bend and partial shank only
fishhook		bone	0.3	19.0	0.0	0.0	bird or mammal, shank only
fishhook	point, two- piece	bone	0.3	12.0	0.0	0.0	bird or mammal
fishhook	blank	bone	0.7	22.0	11.0	0.0	small to medium or medium mammal
fishhook	blank	bone	1.0	24.0	14.0	0.0	medium mammal
fishhook	blank	bone	2.2	26.0	16.0	0.0	medium mammal
fishhook		shell	0.1	10.0	7.0	0.0	bend only
fishhook	drilled	shell	0.2	9.0	3.0	0.0	
fishhook	blank	shell	0.3	19.0	5.0	0.0	
fishhook	shank	shell	0.4	15.0	15.0	0.0	
fishhook	blank fragment	shell	0.5	18.0	13.0	0.0	
fishhook	filed	shell	1.3	24.0	16.0	0.0	
fishhook	blank	shell	1.3	23.0	18.0	0.0	
fishhook	blank	shell	3.7	38.0	22.0	0.0	
flake	v1	basalt	1.0	17.0	20.0	3.0	
flake	v2	basalt	3.1	24.0	17.0	5.0	water-worn
flake	spall	basalt	5.7	28.0	25.0	10.0	
flake	v1	basalt	13.4	50.0	22.0	10.0	
flake	v1	basalt	33.7	44.0	42.0	13.0	
flake	v1	volcanic glass	0.1	10.0	9.0	1.0	
flake	v1	volcanic glass	0.1	7.0	6.0	1.0	
flake	v2	volcanic glass	0.1	10.0	3.0	2.0	

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Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
flake	v2	volcanic glass	0.1	13.0	5.0	3.0	
flake	v2	volcanic glass	0.1	8.0	4.0	2.0	
flake	v3	volcanic glass	0.1	7.0	5.0	3.0	
flake	v2	volcanic glass	0.1	7.0	4.0	1.0	
flake	v1	volcanic glass	0.2	10.0	8.0	3.0	
flake	v2	volcanic glass	0.2	12.0	11.0	3.0	
flake	v2	volcanic glass	0.2	13.0	5.0	3.0	
flake	v2	volcanic glass	0.2	4.0	5.0	3.0	
flake	v2	volcanic glass	0.2	10.0	8.0	2.0	
flake	v3	volcanic glass	0.2	6.0	6.0	4.0	
flake	v2	volcanic glass	0.2	10.0	8.0	3.0	
flake	v2	volcanic glass	0.2	8.0	8.0	3.0	
flake	v2	volcanic glass	0.2	12.0	7.0	2.0	
flake	v1	volcanic glass	0.2	9.0	7.0	2.0	
flake	v3	volcanic glass	0.2	8.0	6.0	3.0	
flake	v2	volcanic glass	0.3	17.0	5.0	7.0	
flake	v2	volcanic glass	0.3	9.0	6.0	4.0	
flake	v1	volcanic glass	0.3	11.0	8.0	3.0	
flake	v2	volcanic glass	0.3	10.0	9.0	2.0	
flake	v3	volcanic glass	0.3	9.0	6.0	4.0	
flake	v2	volcanic glass	0.3	13.0	4.0	3.0	
flake	v1	volcanic glass	0.4	13.0	11.0	3.0	
flake	v1	volcanic glass	0.4	14.0	9.0	2.0	
flake	v3	volcanic glass	0.4	12.0	11.0	7.0	
flake	v3	volcanic glass	0.4	13.0	5.0	5.0	
flake	v1	volcanic glass	0.5	17.0	9.0	3.0	
flake	v3	volcanic glass	0.5	11.0	8.0	6.0	
flake	v3	volcanic glass	0.5	12.0	9.0	5.0	
flake	v2	volcanic glass	0.5	9.0	9.0	4.0	
flake	v1	volcanic glass	0.6	12.0	12.0	4.0	
flake	v2	volcanic glass	0.6	20.0	8.0	5.0	
flake	v2	volcanic glass	0.7	14.0	11.0	4.0	
flake	v2	volcanic glass	0.7	13.0	11.0	5.0	
flake	v2	volcanic glass	0.7	14.0	12.0	4.0	
flake	v1	volcanic glass	0.8	15.0	13.0	4.0	
flake	v2	volcanic glass	0.8	15.0	10.0	5.0	
flake	v2	volcanic glass	0.9	21.0	11.0	4.0	
flake	v2	volcanic glass	1.1	17.0	12.0	4.0	
flake	v2	volcanic glass	1.1	14.0	10.0	4.0	
flake	v1	volcanic glass	1.2	14.0	15.0	5.0	
flake	v1	volcanic glass	1.3	15.0	13.0	6.0	
flake	v3	volcanic glass	1.4	16.0	9.0	8.0	
flake	v2	volcanic glass	1.4	17.0	11.0	6.0	

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Table 21—Continued

Type	Variety	Material	WL (g)	x	y	z	Comment
flake	v1	volcanic glass	1.6	17.0	18.0	4.0	
flake	v3	volcanic glass	2.2	14.0	11.0	10.0	
flake	v3	volcanic glass	3.6	26.0	16.0	11.0	
flake	v3	volcanic glass	12.2	35.0	22.0	15.0	
hammer/slingstone		coral	128.6	60.0	0.0	0.0	
hammerstone		basalt	352.1	78.0	70.0	45.0	
hammerstone		basalt	1000.0	145.0	87.0	50.0	
manuport	fragment	coral	0.3	14.0	9.0	4.0	
manuport	fragment	coral	0.8	13.0	9.0	9.0	
manuport	fragment	coral	1.1	15.0	11.0	9.0	
manuport	fragment	coral	1.4	17.0	13.0	7.0	
manuport	fragment	coral	1.5	18.0	14.0	8.0	
manuport	fragment	coral	1.9	23.0	17.0	6.0	
manuport	fragment	coral	2.1	19.0	16.0	10.0	
manuport	fragment	coral	3.0	19.0	18.0	13.0	
manuport	fragment	coral	3.0	21.0	18.0	11.0	
manuport	fragment	coral	4.2	27.0	21.0	10.0	
manuport	fragment	coral	7.0	34.0	22.0	16.0	
manuport	unmodified	urchin spine	0.1	18.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.1	7.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.1	9.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.3	15.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.4	17.0	0.0	0.0	fragment fractured sectionally and lengthwise
manuport	unmodified	urchin spine	0.6	20.0	0.0	0.0	f
manuport	unmodified	urchin spine	0.9	30.0	0.0	0.0	f
manuport	unmodified	urchin spine	1.4	42.0	0.0	0.0	some wear on distal end
octopus lure	possible fragment	shell	0.6	19.0	14.0	0.0	<i>Cypraea</i> sp.
octopus lure	possible fragment	shell	0.7	15.0	14.0	0.0	<i>Cypraea</i> sp., pierced
octopus lure	possible fragment	shell	7.4	40.0	33.0	0.0	<i>Cypraea</i> sp.
octopus lure		shell	36.7	61.0	43.0	30.0	<i>Cypraea</i> sp.
pebble	fragment	basalt	7.1	26.0	17.0	17.0	
pebble		basalt	8.0	34.0	18.0	12.0	
worked bone	cut	bone	0.1	9.0	4.0	0.0	medium bird
worked bone	cut	bone	0.2	19.0	5.0	5.0	medium bird
worked bone	cut	bone	0.2	11.0	6.0	3.0	small to medium or medium mammal

Continued on next page

Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
worked bone	cut	bone	0.2	10.0	9.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.3	14.0	5.0	4.0	small to medium or medium mammal
worked bone	cut	bone	0.3	17.0	5.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.3	11.0	7.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.3	18.0	8.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.4	11.0	8.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.5	20.0	6.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.5	10.0	8.0	6.0	small to medium or medium mammal
worked bone	cut	bone	0.6	15.0	12.0	0.0	small to medium or medium mammal
worked bone	cut	bone	0.9	18.0	15.0	7.0	small to medium or medium mammal
worked bone	cut	bone	0.9	28.0	8.0	0.0	medium mammal
worked bone	cut	bone	1.3	17.0	15.0	11.0	small to medium or medium mammal
worked bone	cut	bone	1.6	25.0	17.0	0.0	medium mammal
worked bone	cut	bone	3.2	30.0	26.0	11.0	medium mammal
worked bone	cut	bone	3.7	35.0	16.0	6.0	medium mammal, possibly human
worked bone	cut	bone	10.5	80.0	19.0	9.0	medium mammal, possibly human
worked shell	<i>puka</i>	shell	0.1	7.0	0.0	0.0	
worked shell	cut	shell	0.3	15.0	10.0	0.0	
worked shell	<i>puka</i>	shell	0.6	12.0	0.0	0.0	
worked shell	pierced	shell	1.1	0.0	0.0	0.0	<i>Nerita polita</i>
worked shell		shell	1.8	47.0	41.0	0.0	<i>Cypraea sp.</i>
worked shell	pierced	shell	2.6	0.0	0.0	0.0	<i>Nerita polita</i>
worked shell		shell	4.8	35.0	25.0	0.0	<i>Cypraea sp.</i>
Catalog 21 abrader	edge	coral	5.0	40.0	21.0	9.0	

Continued on next page

Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
Catalog 22							
abrader	edge	coral	1.5	21.0	13.0	5.0	one edge
abrader	edge	coral	5.2	27.0	23.0	11.0	one edge
abrader	edge	coral	10.5	56.0	24.0	10.0	two edges
flake	v3	volcanic glass	0.6	16.0	8.0	6.0	shatter
flake	v1	volcanic glass	5.7	29.0	22.0	8.0	cortex
'ili'ili		basalt	0.4	9.0	0.0	0.0	
'ili'ili		basalt	0.6	8.0	0.0	0.0	
'ili'ili		basalt	0.6	9.0	0.0	0.0	
'ili'ili		basalt	0.8	11.0	0.0	0.0	
'ili'ili		basalt	0.8	11.0	0.0	0.0	
'ili'ili		basalt	0.9	9.0	0.0	0.0	
'ili'ili		basalt	0.9	10.0	0.0	0.0	
'ili'ili		basalt	0.9	11.0	0.0	0.0	
'ili'ili		basalt	1.0	12.0	0.0	0.0	
'ili'ili		basalt	1.0	11.0	0.0	0.0	
'ili'ili		basalt	1.0	12.0	0.0	0.0	
'ili'ili		basalt	1.0	11.0	0.0	0.0	
'ili'ili		basalt	1.0	11.0	0.0	0.0	
'ili'ili		basalt	1.0	11.0	0.0	0.0	
'ili'ili		basalt	1.0	12.0	0.0	0.0	
'ili'ili		basalt	1.1	11.0	0.0	0.0	
'ili'ili		basalt	1.1	11.0	0.0	0.0	
'ili'ili		basalt	1.1	13.0	0.0	0.0	
'ili'ili		basalt	1.2	10.0	0.0	0.0	
'ili'ili		basalt	1.2	10.0	0.0	0.0	
'ili'ili		basalt	1.2	12.0	0.0	0.0	
'ili'ili		basalt	1.2	11.0	0.0	0.0	
'ili'ili		basalt	1.2	11.0	0.0	0.0	
'ili'ili		basalt	1.3	11.0	0.0	0.0	
'ili'ili		basalt	1.4	15.0	0.0	0.0	
'ili'ili		basalt	1.4	12.0	0.0	0.0	
'ili'ili		basalt	1.4	12.0	0.0	0.0	
'ili'ili		basalt	1.5	11.0	0.0	0.0	
'ili'ili		basalt	1.6	11.0	0.0	0.0	
'ili'ili		basalt	1.6	14.0	0.0	0.0	
'ili'ili		basalt	1.6	13.0	0.0	0.0	
'ili'ili		basalt	1.7	12.0	0.0	0.0	
'ili'ili		basalt	1.9	13.0	0.0	0.0	
'ili'ili		basalt	1.9	12.0	0.0	0.0	
'ili'ili		basalt	2.0	13.0	0.0	0.0	
'ili'ili		basalt	2.3	13.0	0.0	0.0	
'ili'ili		basalt	2.4	16.0	0.0	0.0	
'ili'ili		basalt	2.6	15.0	0.0	0.0	

Continued on next page

Table 21—Continued

Type	Variety	Material	WL (g)	x	y	z	Comment
'ili'ili		basalt	2.6	14.0	0.0	0.0	
'ili'ili		basalt	2.8	15.0	0.0	0.0	
'ili'ili		basalt	3.2	16.0	0.0	0.0	
'ili'ili		basalt	3.2	15.0	0.0	0.0	
'ili'ili		coral	0.7	13.0	0.0	0.0	
'ili'ili		coral	0.8	13.0	0.0	0.0	
'ili'ili		coral	0.9	13.0	0.0	0.0	
'ili'ili		coral	1.0	13.0	0.0	0.0	
'ili'ili		coral	1.1	12.0	0.0	0.0	
'ili'ili		coral	1.3	13.0	0.0	0.0	
'ili'ili		coral	1.5	16.0	0.0	0.0	
'ili'ili		coral	1.8	19.0	0.0	0.0	
'ili'ili		coral	2.4	18.0	0.0	0.0	
Catalog 23							
fishhook	HT4	pearlshell	1.1	25.0	0.0	0.0	shank
Catalog 24							
sinker	breadloaf	volcanic rock	109.5	66.0	38.0	35.0	possible reworked 'ulu fragment
Catalog 25							
adze	rectangular	basalt	29.5	57.0	23.0	10.0	
Catalog 26							
sinker	breadloaf	basalt	113.0	65.0	45.0	44.0	longitudinal groove on base
Catalog 27							
adze	fragment	basalt	17.0	39.0	22.0	12.0	portion of bevel
Catalog 28							
abrader	edge	coral	5.8	38.0	20.0	8.0	Manini'owali
abrader	edge	coral	14.7	60.0	27.0	14.0	Manini'owali
octopus lure		shell	8.5	65.0	41.0	32.0	<i>Cypraea</i> sp.
worked shell	possible scraper	shell	30.0	70.0	60.0	0.0	<i>Cypraea</i> sp.
Catalog 29							
abrader	surface	coral	64.0	70.0	56.0	20.0	Kākapa
abrader	surface	coral	161.1	98.0	70.0	36.0	Kākapa
Catalog 30							
abrader	surface	coral	54.3	52.0	42.0	23.0	Kākapa
fishhook	unbarbed, rotating	shell	0.1	12.0	10.0	10.0	top of shank missing
Catalog 31							
abrader	edge	coral	9.0	36.0	23.0	13.0	Manini'owali
abrader	edge	coral	9.0	45.0	30.0	10.0	Manini'owali
abrader	surface	coral	19.8	49.0	25.0	25.0	Manini'owali
file	unknown	urchin spine	0.5	21.0	21.0	7.0	

Continued on next page

Table 21—Continued

Type	Variety	Material	Wt. (g)	x	y	z	Comment
file	proximal	urchin spine	0.7	23.0	17.0	7.0	
file	proximal	urchin spine	1.5	41.0	21.0	9.0	
flake	v2	volcanic glass	0.5	14.0	11.0	4.0	
flake	v2	volcanic glass	1.0	21.0	10.0	4.0	
flake	v1	volcanic glass	1.1	18.0	20.0	4.0	
manuport	unmodified	urchin spine	0.6	38.0	0.0	0.0	
manuport	unmodified	urchin spine	0.9	31.0	0.0	0.0	
manuport	unmodified	urchin spine	1.3	35.0	0.0	0.0	
worked shell	<i>puka</i>	shell	0.5	8.0	0.0	0.0	
worked shell	<i>puka</i>	shell	0.7	11.0	0.0	0.0	
Catalog 32							
octopus lure		shell	32.7	58.0	40.0	30.0	<i>Cypraea</i> sp.
octopus lure		shell	33.5	60.0	40.0	30.0	<i>Cypraea</i> sp.
octopus lure		shell	48.8	61.0	44.0	34.0	<i>Cypraea</i> sp.
sinker	breadloaf	basalt	108.7	64.0	41.0	38.0	Punaloa mauka
Catalog 33							
worked shell	pierced	shell	35.9	79.0	25.0	0.0	<i>Mitra</i> sp.
Catalog 34							
flake	v3	volcanic glass	0.4	17.0	7.0	5.0	Manini'owali
flake	v1	volcanic glass	0.6	13.0	14.0	3.0	Manini'owali
flake	v1	volcanic glass	1.0	18.0	13.0	5.0	Manini'owali
Catalog 35							
flake	v3	volcanic glass	0.3	10.0	10.0	5.0	Manini'owali
flake	v2	volcanic glass	0.3	7.0	10.0	3.0	Manini'owali
flake	v1	volcanic glass	0.4	19.0	10.0	3.0	Manini'owali
flake	v1	volcanic glass	0.5	13.0	15.0	2.0	Manini'owali
flake	v1	volcanic glass	0.5	17.0	13.0	3.0	Manini'owali
flake	v1	volcanic glass	0.7	9.0	14.0	6.0	Manini'owali
flake	v2	volcanic glass	0.7	14.0	12.0	4.0	Manini'owali
flake	v3	volcanic glass	0.8	16.0	6.0	5.0	Manini'owali
flake	v1	volcanic glass	1.1	25.0	14.0	4.0	Manini'owali
flake	v1	volcanic glass	1.4	17.0	18.0	4.0	Manini'owali
flake	v1	volcanic glass	1.4	13.0	20.0	6.0	Manini'owali
flake	v3	volcanic glass	1.5	17.0	14.0	8.0	Manini'owali
flake	v2	volcanic glass	1.9	23.0	12.0	6.0	Manini'owali
flake	v1	volcanic glass	3.7	29.0	26.0	6.0	Manini'owali

Appendix D

Vertebrate Faunal Categories

This appendix contains descriptions of the categories used by Alan C. Ziegler in the identification and analysis of vertebrate faunal remains. The descriptions are listed alphabetically by taxon within class to facilitate reference.

Aves

Bulweria bulwerii Bulwer's petrel.

Gallus gallus In almost all cases, fragmentary material representing pre-Contact Polynesian junglefowl would not be distinguishable from that of historically introduced chicken breeds of this same species. Also, I am not sure that most such material of other phasianids such as various species of larger pheasants (*Phasianus*, *Lophura*, etc.), as well as guineafowl (*Numida*), –all historically introduced– could usually be distinguished.

Medium Bird Member(s) of indeterminate order and family in the general size range of shearwater and petrel, tropicbird, night-heron, duck, hawk, junglefowl (= chicken), moorhen and coot, curlew, gull, owl, crow, and so on; in Hawaii, probably no passeriform other than *Corvus hawaiiensis* (Hawaiian Crow) would be included but a number of native or historically introduced species of up to a half-dozen orders could potentially be.

Medium Procellariid Medium-sized member(s) of the family Procellariidae, in the general size range of *Puffinus pacificus* (Wedge-tailed Shearwater), *Puffinus newelli* (Newell's Shearwater), and *Pterodroma phaeopygia* (Hawaiian Petrel).

Oceanodroma castro Material of a very small member of this family, presumably this species but I have not been able to obtain comparative skeletal material of it either locally or from the Smithsonian Institution, although I have satisfactory material of the larger *Oceanodroma tristrami* (Tristram's Storm-Petrel).

Phaethon lepturus The smallest of the 3 tropicbird species occurring in the Pacific.

Pterodroma phaeopygia Hawaiian petrel.

Puffinus sp. Member(s) of this genus that in Hawaii most likely include the relatively small species *Puffinus nativitatis* (Christmas Shearwater) and, possibly, *Puffinus lherminieri* (Audubon's Shearwater; see Olson and James 1982:33), as well as the medium-sized species *Puffinus pacificus* (Wedge-tailed Shearwater) and *Puffinus newelli* (Newell's Shearwater).

Small Anatid Duck(s) in the size range of *Anas wyvilliana* (Hawaiian Duck), *Anas laysanensis* (Laysan Duck), and some migrant or accidental continental teal; smaller than most other migrant ducks that often reach the Hawaiian Islands, which are often in the general "medium" size range of continental *Anas platyrhynchos* (Mallard).

Small Procellariid Smaller member(s) of the family Procellariidae, in the general size range of *Puffinus nativitatis* (Christmas Shearwater), *Bulweria bulwerii* (Bulwer's Petrel), *Pterodroma hypoleuca* (Bonin Petrel), as well as, possibly, *Puffinus lherminieri* (Audubon's Shearwater; see Olson and James 1982:33) and the extinct *Pterodroma jugabilis* (Gracile Petrel) of Olson and James 1991:17-22.

Chondrichthyes

Shark Not identified to any lower taxonomic level; in Hawaii there are 9 families comprising about 22 species.

Indeterminate

Medium Vertebrate Comprises highly fragmented bone material representing member(s) of indeterminate class, order, and family, but with an estimated head-and-body length of from about 0.3 m to, roughly, 2.0 m.

Mammalia

Canis familiaris I doubt that it is possible to distinguish remains of pre-Contact Pacific island domesticated dogs from morphologically similar breeds of post-Contact introduced ones, although individuals of very large or otherwise osteologically distinct introduced modern breeds of this same species might be successfully identified as such.

Herpestes auropunctatus Small Indian Mongoose. Introduced to the Hawaiian Islands in 1883.

Homo sapiens Modern Human.

Mus musculus House Mouse. Introduced to the Hawaiian Islands sometime after 1778.

Rattus exulans Comprises all material of this Polynesian-introduced species that, because of its relatively small size, could be distinguished with some degree of certainty from corresponding material of the larger *Rattus norvegicus* (Norway Rat) and *Rattus rattus* (Roof Rat), both historically introduced to the Hawaiian Islands.

Sus scrofa Comprises material presumably representing this species although the usually fragmentary remains probably could not be safely distinguished from remains of other suids such as *Sus barbatus* (Bearded Pig) and *Babyrusa babyrussa* (Babirusa) of farther southwest in the Pacific; thus, for certain localities I preface the scientific name with "cf.". (Just as in the case of the Domestic Dog, I doubt that it is possible to distinguish remains of pre-Contact Pacific domesticated pigs from morphologically similar breeds of post-Contact introduced ones, although individuals of extremely large or otherwise osteologically distinct introduced modern breeds of this same species might be successfully identified as such.)

Osteichthyes

Acanthurid Member(s) of the family Acanthuridae (Surgeonfishes), of which there are over 20 species in Hawaii, most of them inshore forms, with the genus *Naso* (Unicornfish or [mostly] *Kala*) comprising the 5 generally largest of these, reaching 40 to 75 cm in length.

Apogonid Member(s) of the family Apogonidae (Cardinalfishes), of which there are 11 species in Hawaii; all relatively common inshore forms but active mostly only at night, with the largest species reaching no more than about 18 cm in length.

Balistid Member(s) of the family Balistidae (Triggerfishes), of which there are about 10 species in Hawaii; mostly inshore forms, with the largest reaching about 35 cm in length.

Belonid Member(s) of the family Belonidae (Needlefishes), of which there are 3 species in Hawaii; usually found somewhat offshore near the ocean surface, and reaching 100 cm in length.

Carangid Member(s) of the family Carangidae (Jacks), of which there are over 20 species in Hawaii; most of them deeper-water and fairly large forms; the species *Caranx ignobilis* (*Ulua*—or *Pāpio* for the smaller young) sometimes ranging in close to shore, and reaching 100 cm or more in length.

Cirrhitid Member(s) of the family Cirrhitidae (Hawkfishes), of which there are 5 or 6 species in Hawaii, all inshore forms, only 1 of which reaches as much as 30 cm in length.

Congrid Member(s) of the family Congridae (Conger Eels), of which there are at least 7 species in Hawaii; some reaching a length of 150 cm.

- Diodontid** Member(s) of the family Diodontidae (Spiny Puffers), of which 2 species of the genus *Diodon*, ranging from 35 to 70 cm in maximum length, are by far the most abundant in Hawaiian inshore waters, the single remaining species reported for Hawaii (genus *Chilomycterus*, 50 cm in length) apparently being quite rare here; all of these species are suspected of possessing an intrinsic poison although the flesh is apparently eaten without ill effects.
- Fish** Material of indeterminate class and family, although essentially always a bony fish rather than shark or ray.
- Holocentrid** Member(s) of the family Holocentridae (Squirrelfishes), of which there are about 15 species in Hawaii; many of them found in deeper reef areas, with most of them fairly small and only 1 or 2 approaching 45 cm in length.
- Labrid** Member(s) of the family Labridae (Wrasses), which is the largest family of fishes in Hawaii with over 40 species; predominately inshore forms, most of them fairly small but with a few larger forms reaching about 50 cm in length.
- Lutjanid** Member(s) of the family Lutjanidae (Snappers), of which there are 10 or 11 native species in Hawaii; most of them offshore deep-water—although not pelagic—forms, reaching maximum lengths of 30 to almost 100 cm.
- Marine Eel** Member(s) of 1 (or more) of the 10 eel families recorded for Hawaiian waters, of which the Muraenidae (Moray Eels), Congridae (Conger Eels), and Ophichthidae (Snake Eels) are by far the most speciose and frequently encountered groups.
- Monacanthid** Member(s) of the family Monacanthidae (Filefishes), of which the small *Pervagor spilosoma* (Fantail Filefish), reaching only about 15 cm in length and sometimes washing up on beaches dead in great numbers, is by far the most abundant of the 8 species to be expected in near-shore Hawaiian waters.
- Mullid** Member(s) of the family Mullidae (Goatfishes), of which there are 10 species in Hawaii; many of them living on the reef or frequently visiting it, usually about 20-25 cm long but a few reaching 40-60 cm.
- Muraenid** Member(s) of the family Muraenidae (Moray Eels), of which there are over 35 species in Hawaii; some reaching a length of 150 cm.
- Ostraciontid** Member(s) of the family Ostraciontidae (Boxfishes), of which there are about 6 species in Hawaii, most of them less than 15 cm long.
- Polynemid** Member(s) of the family Polynemidae (Threadfins), of which *Polydactylus sexfilis* (*Moi*) of inshore sand-bottomed areas is apparently the only species thus far reported for Hawaii, reaching perhaps 45 or 50 cm in length.
- Pomacentrid** Member(s) of the family Pomacentridae (Damsel-fishes), of which there are about 14 species in Hawaii, all except 2 characteristic of inshore waters (most in abundance), and reaching maximum lengths of near 25 cm.

Priacanthid Member(s) of the family Priacanthidae (Aweoweos or Bigeyes), of which 4 species are usually encountered in Hawaii; either near-shore or deeper-water forms, with maximum lengths of about 35 cm.

Scarid Member(s) of the family Scaridae (Parrotfishes), of which the genera *Calotomus* (2? species) and *Scarus* (4-5 species) are essentially the only 2 expected to occur in Hawaii, both being typically inshore groups, and including 1 or 2 species that may reach 70 cm in length.

Scombrid Member(s) of the family Scombridae (Tunas and Mackerels), of which there are perhaps a dozen species in Hawaiian waters; almost all open-ocean (pelagic) forms, many reaching a meter or more in length.

Serranid Member(s) of the family Serranidae (Groupers), of which there are about 15 species in Hawaii; most of them being deeper-water, and fairly small (2-20 cm), forms, although 1 species reaches 40-45 cm and 2 others are occasionally between 1 and almost 3 m long.

Sparid Member(s) of the family Sparidae (Bigeye Emperors), the only species of which thus far reported from Hawaii is *Monotaxis grandoculis* (Mü).

Sphyraenid Member(s) of the family Sphyraenidae (Barracudas), of which there are 2 species in Hawaii; most often pelagic but sometimes found either singly or in small schools near shore, usually about 50-80 cm in length although an occasional individual may reach almost 200 cm.

Tetraodontid Member(s) of the family Tetraodontidae (Smooth Puffers), of which there are about 5 species, ranging up to 50 cm in length, in Hawaii (—or perhaps close to a dozen if the several, generally small, species of the genus *Canthigaster* [considered to constitute the family Canthigasteridae [Sharp-backed Puffers] by some authors] are included—); a few of both types of these puffers may be found in shallower inshore areas, and all of the species may possess an intrinsic poison although the flesh is apparently sometimes eaten without ill effects.



Appendix E

Vertebrate Faunal Remains

This appendix presents lists of the vertebrate faunal remains identified by Alan Ziegler. Table 22 lists the remains by number of identified specimens. Table 23 lists the remains by weight. The categories used in the faunal analysis are described in appendix D.

Table 22. Numbers of identified vertebrate faunal specimens

Taxon	01	03	05	06	07	09	18	Total
Aves								
<i>Bulweria bulwerii</i>	44	12	0	1	0	26	0	83
<i>Gallus gallus</i>	0	4	0	0	0	0	0	4
Medium Bird	0	0	1	0	0	0	0	1
Medium Procellariid	7	12	0	0	0	5	0	24
<i>Oceanodroma castro</i>	1	0	0	0	0	1	0	2
<i>Phaethon lepturus</i>	16	3	0	0	0	11	0	30
<i>Pterodroma phaeopygia</i>	4	1	0	0	0	0	0	5
<i>Puffinus</i> sp.	1	0	0	0	0	0	0	1
Small Anatid	0	0	0	0	0	2	0	2
Small Procellariid	0	1	0	0	0	0	0	1
Chondrichthyes								
Shark	1	1	0	0	0	0	0	2
Indeterminate								
Medium Vertebrate	0	1	0	0	0	0	0	1
Mammalia								
<i>Canis familiaris</i>	1	7	2	0	0	6	0	16
<i>Herpestes auropunctatus</i>	0	0	0	0	0	1	0	1
<i>Homo sapiens</i>	1	0	0	0	0	1	0	2
<i>Mus musculus</i>	1	0	0	0	0	0	0	1
<i>Rattus exulans</i>	47	11	0	0	0	36	0	94
<i>Sus scrofa</i>	0	2	0	0	0	7	0	9
Osteichthyes								
Acanthurid	159	77	4	1	0	293	0	534
Apogonid	0	3	1	0	0	2	0	6
Balistid	328	78	5	0	0	326	0	737
Belonid	4	2	0	0	0	1	0	7
Carangid	0	1	1	0	0	25	0	27
Cirrhid	37	13	0	0	0	24	0	74
Congrid	1	0	0	0	0	6	0	7
Diodontid	8	15	1	0	0	21	0	45
Fish	9348	4984	1020	510	197	13572	62	29693
Holocentrid	18	19	1	0	0	15	0	53
Labrid	68	59	0	1	0	89	0	217
Lutjanid	0	0	0	0	0	2	0	2
Marine Eel	6	0	2	0	0	1	0	9
Monacanthid	88	18	37	10	0	43	0	196
Mullid	18	11	1	1	0	43	0	74
Muraenid	2	0	0	0	0	1	0	3
Ostraciontid	1	0	0	0	0	5	0	6
Polynemid	4	1	0	0	0	0	0	5
Pomacentrid	13	3	0	0	0	12	0	28
Priacanthid	6	0	0	0	0	3	0	9
Scarid	52	49	7	1	0	125	0	234
Scombrid	17	3	2	0	0	41	0	63
Serranid	0	1	0	0	0	2	0	3
Sparid	1	1	0	0	0	11	0	13
Sphyraenid	2	0	0	0	0	0	0	2
Tetraodontid	0	0	0	0	0	3	0	3
Total	10362	5567	1097	530	197	14888	62	32703

Table 23. Weight of identified vertebrate faunal specimens

Taxon	01	03	05	06	07	09	18	Total
Aves								
<i>Bulweria bulwerii</i>	6.1	1.2	0	0.1	0	3.4	0	10.8
<i>Gallus gallus</i>	0	1.8	0	0	0	0	0	1.8
Medium Bird	0	0	0.1	0	0	0	0	0.1
Medium Procellariid	2.9	1.7	0	0	0	2.4	0	7.0
<i>Oceanodroma castro</i>	0.1	0	0	0	0	0.6	0	0.7
<i>Phaethon lepturus</i>	4.0	0.4	0	0	0	2.9	0	7.3
<i>Pterodroma phaeopygia</i>	0.3	0.2	0	0	0	0	0	0.5
<i>Puffinus</i> sp.	0.2	0	0	0	0	0	0	0.2
Small Anatid	0	0	0	0	0	0.5	0	0.5
Small Procellariid	0	0.1	0	0	0	0	0	0.1
Chondrichthyes								
Shark	0.1	0.1	0	0	0	0	0	0.2
Indeterminate								
Medium Vertebrate	0	0.5	0	0	0	0	0	0.5
Mammalia								
<i>Canis familiaris</i>	0.1	1.4	0.1	0	0	1.7	0	3.3
<i>Herpestes auropunctatus</i>	0	0	0	0	0	0.3	0	0.3
<i>Homo sapiens</i>	0.2	0	0	0	0	2.5	0	2.7
<i>Mus musculus</i>	0.1	0	0	0	0	0	0	0.1
<i>Rattus exulans</i>	1.7	0.2	0	0	0	1.4	0	3.3
<i>Sus scrofa</i>	0	3.7	0	0	0	11.2	0	14.9
Osteichthyes								
Acanthurid	18.1	7.2	0.1	0.1	0	26.1	0	51.6
Apogonid	0	0.2	0.1	0	0	0.2	0	0.5
Balistid	33.0	10.3	1.0	0	0	37.7	0	82.0
Belonid	0.3	0.1	0	0	0	0.1	0	0.5
Carangid	0	0.1	0.1	0	0	7.2	0	7.4
Cirrhid	3.1	0.9	0	0	0	3.2	0	7.2
Congrid	0.1	0	0	0	0	1.0	0	1.1
Diodontid	1.5	8.1	0.1	0	0	4.2	0	13.9
Fish	336.7	198.7	13.1	4.6	2.9	654.0	0.9	1210.9
Holocentrid	3.4	1.5	0.1	0	0	3.5	0	8.5
Labrid	21.1	25.1	0	0.1	0	18.4	0	64.7
Lutjanid	0	0	0	0	0	0.9	0	0.9
Marine Eel	0.2	0	0.1	0	0	0.1	0	0.4
Monacanthid	3.9	0.7	1.8	0.3	0	4.8	0	11.5
Mullid	1.9	0.7	0.1	0.1	0	4.0	0	6.8
Muraenid	0.9	0	0	0	0	0.1	0	1.0
Ostraciontid	0.1	0	0	0	0	0.2	0	0.3
Polynemid	0.5	0.1	0	0	0	0	0	0.6
Pomacentrid	0.3	0.1	0	0	0	1.0	0	1.4
Priacanthid	0.1	0	0	0	0	0.1	0	0.2
Scarid	18.4	12.0	0.7	0.4	0	55.6	0	87.1
Scombrid	4.0	0.9	0.2	0	0	23.7	0	28.8
Serranid	0	0.1	0	0	0	1.2	0	1.3
Sparid	0.1	6.9	0	0	0	6.6	0	13.6
Sphyraenid	0.2	0	0	0	0	0	0	0.2
Tetraodontid	0	0	0	0	0	0.7	0	0.7
Total	471.5	315.9	22.4	8.3	2.9	914.4	0.9	1736.3

Appendix F

Wood Charcoal Identification

Gail Murakami
November 15, 2002

Introduction

This report presents the results of taxa identification in seven charcoal samples from the inventory survey of portions of Kekaha Kai State Park project on Hawai'i Island. Identification of charcoal found in archaeological context can give insight into the vegetation of the surrounding area at the time of the fire. This information can then be used to interpret the environment as well as possible cultural use of specific plants. Changes in vegetation or firewood use may be indicated in a study of multiple samples. In this way charcoal samples may be viewed as partial records of the environmental and cultural history of an area.

Methods

Seven charcoal samples were examined for taxa identification. The freshly fractured transverse and tangential facets of each charcoal piece were viewed under magnification of a dissecting microscope. Taxa identifications were made by comparing the anatomical characteristics seen during examination against those of known woods in the Pacific Islands Wood Collection at the Department of Botany, University of Hawai'i, and published descriptions.

Results

Twenty-nine woody taxa were identified in the two samples from Kua Bay, three from site 50-10-18-23355, and one each from sites T-140 and T-164. In addition, *Aleurites* kernel and nutshell were identified. Parenchyma tissue was also recognized but not

identified further to taxa. Six woody taxa remain unidentified. The identified charcoal taxa, listed in table 24, are described in the review which follows. In the summary of results presented in table 25, "cf." indicates that the charcoal resembles the taxon specified but its exact identity is uncertain at this time. Table 26 presents the occurrence of taxa among the samples in percent sorted sample weight.

Table 24. List of taxa identified in charcoal samples

Family	Scientific Name	Other Name	Origin	Habit	Ethnobotanical Uses
Agavaceae	<i>Cordyline fruticosa</i>	Kī, ti	Polynesian introduction	Shrub	House thatch, food wrappers, raincoats, and sandals from leaves; swollen fleshy roots were baked for food or used to produce an alcoholic beverage.
Amaranthaceae	<i>Nototrichium sandwicensis</i>	Kulu'i	Native	Shrub	
Araliaceae	<i>Tetraplasandra</i> sp.	'Ohe'ohe	Native	Tree	
Arecaceae	<i>Cocos nucifera</i>	Coconut, niu	Polynesian introduction	Tree	House posts, drums and food containers from trunk; baskets, thatching, brooms, kukui nut light supports from leaves; eating or drinking utensils from nutshell; food from fruit.
Asteraceae	<i>Bidens</i> sp.	Ko'oko'olau	Native and Polynesian introductions	Shrub	Medicinal tea from leaves and flowers.
Celastraceae	<i>Perrottetia sandwicensis</i>	Olomea	Native	Tree	Wood used as fire plow by rubbing against a softer wood to create fire.
Chenopodiaceae	<i>Chenopodium oahuense</i>	'Āheahea, 'āweoweo	Native	Shrub	Leaves eaten as greens.
Clusiaceae	<i>Calophyllum inophyllum</i>	Kamani	Polynesian introduction	Tree	Wood used to make calabashes.
Cucurbitaceae	<i>Lagenaria siceraria</i>	Ipu	Polynesian introduction	Vine	Smaller gourds were once used as receptacles for food or water and rattles for dances while larger gourds were made into drums or served as places to hold kapa bark cloth or other articles.

Continued on next page

Table 24—Continued

Family	Scientific Name	Other Name	Origin	Habit	Ethnobotanical Uses
Ebenaceae	<i>Diospyros sandwicensis</i>	<i>Lama</i>	Native	Tree	Houses, enclosures for idols, chisel handles from the wood; fruits eaten.
Euphorbiaceae	<i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian introduction	Tree	Dyes from bark and roots; kernels burned for light or eaten as relish; net floats and dugout canoes from wood.
Euphorbiaceae	<i>Antidesma pulvinatum</i>	<i>Hame</i>	Native	Tree	Wood used as anvils for beating and preparing <i>Touchardia (olonā)</i> fibers and the fruit yielded a red dye.
Euphorbiaceae	<i>Chamaesyce</i> sp.	<i>'Akako</i>	Native	Shrub	Firewood.
Fabaceae	<i>Acacia koa</i>	<i>Koa</i>	Native	Tree	Canoes, paddles, surfboards, bowls, utensils, etc. from wood.
Fabaceae	<i>Senna</i> sp.	<i>Kolomona</i>	Native and Polynesian introductions	Tree	
Malvaceae	<i>Hibiscus</i> sp.		Native and Polynesian introductions	Shrub	
Malvaceae	<i>Sida fallax</i>	<i>'Ilima</i>	Native	Shrub	Floor coverings, walls using the entire plant; medicine from roots and flowers.
Moraceae	<i>Artocarpus altilis</i>	<i>'Ulu</i>	Polynesian introduction	Tree	Wood used in construction of house doors and bodies of canoes; the bark of the young shoot was made into rough tapa; drums were sometimes made from the trunk; latex used as caulking for canoes and birdlime and the fruit was baked or pounded into <i>poi</i> .
Myoporaceae	<i>Myoporum sandwicense</i>	<i>Naio</i>	Native	Tree	Wood used for house posts.
Myrsinaceae	<i>Myrsine</i> sp.	<i>Kōlea</i>	Native	Tree	Wood used for house posts and beams, and for anvils to beat <i>kapa</i> ; charcoal made a black <i>kapa</i> and red dye from the bark.
Myrtaceae	<i>Metrosideros polymorpha</i>	<i>'Ōhi'a lehua</i>	Native	Tree	Wood used for spears and mallets, idols, posts and rafters for houses, and enclosures around temples.

Continued on next page

Table 24—Continued

Family	Scientific Name	Other Name	Origin	Habit	Ethnobotanical Uses
Oleaceae	<i>Nestegis sandwicensis</i>	<i>Olopua</i>	Native	Tree	Wood used for adze handles, spears, and digging sticks; kindling.
Pittosporaceae	<i>Pittosporum</i> sp.	<i>Hō'awa</i>	Native	Tree	
Rosaceae	<i>Osteomeles anthyllidifolia</i>	<i>'Ūlei</i>	Native	Shrub	Digging sticks, fishing spears, carrying poles, musical bow from wood; smaller branches bent into hoops for fishing.
Rubiaceae	<i>Bobea timonioides</i>	<i>'Ahakea</i>	Native	Tree	Wood used for canoe rims and <i>poi</i> boards.
Rubiaceae	<i>Coprosma</i> sp.	<i>Pilo</i>	Native	Shrub or tree	
Rubiaceae	<i>Psychotria</i> sp.	<i>Kōpiko</i>	Native	Tree	Wood used as firewood and to make <i>kapa</i> logs.
Sapindaceae	<i>Dodonaea viscosa</i>	<i>'A'ali'i</i>	Native	Shrub	Fruit capsule clusters and leaves made into <i>lei</i> ; house posts from wood.
Thymeleaceae	<i>Wikstroemia</i> sp.	<i>'Ākia</i>	Native	Shrub or tree	Bark was a source of fibers for ropes and braids and the juice from pounded roots, bark, and leaves was used to capture fish by narcotizing them.

Review of Taxa

Agavaceae

Cordyline fruticosa (L.) A. Chev. (*Kī, ti*) This Polynesian introduction is a shrub cultivated in the mesic valleys and forests of all the main Hawaiian Islands except Kaho'olawe. The leaves, arranged in a close spiral at the tips of the stems, were used for house thatch, food wrappers, raincoats, and sandals (Wagner et al. 1990:1348–1349). The swollen fleshy roots were baked for food or used to produce an alcoholic beverage (Neal 1965:203). The charred stem of *kī*, identified only in the sample from site T-164, constitutes 0.2 percent of the sorted sample weight.

Amaranthaceae

Nototrichium sandwicense (A. Gray) Hillebr. (*Kulu'i*) This endemic shrub or small tree, 1–7 m tall, has been found on all of the main Hawaiian Islands in dry forests, exposed ridges, and lava fields, at 0–750 m elevations (Wagner et al. 1990:194). Wood charcoal resembling *kulu'i*, constituting 3.3 percent sorted sample weight, was identified in the sample from Site T-140.

Araliaceae

Tetraplasandra sp. ('Ohe, 'ohe'ohe, 'ohe mauka) This endemic genus of six species consist of shrubs or trees, 2.5 to 25 m tall, which generally occur in mesic to wet forests. The three species found on Hawai'i are *Tetraplasandra hawaiiensis* ('ohe), *T. kawaiensis* ('ohe'ohe), and *T. oahuensis* ('ohe mauka) (Wagner et al. 1990:234–236). Wood charcoal resembling 'ohe, found in the sample from site T-140, constitutes 0.3 percent sorted sample weight.

Areaceae

Cocos nucifera L. (Niu, coconut) This Polynesian introduction is a palm that grows up to 30 m tall and is widely cultivated today. Coconut appears to be sparingly naturalized in coastal areas where it is thought to have been originally cultivated. All parts of the plant was used by the Hawaiians. Among the many uses were: house posts, drums, and food containers from the trunk; baskets, thatching, brooms, *kukui* nut lamp supports from parts of the leaves; rope from the husk; utensils for eating or drinking from the shell; and the flesh and water of the fruit were eaten (Wagner et al. 1990:1362–1363). Charcoal resembling coconut wood, found in the samples from sites T-140 and at Manini'ōwali Bay, constitutes 0.8 and 0.6 percent sorted sample weight, respectively.

Asteraceae

Bidens sp. (Ko'oko'olau) Twenty native and three naturalized species of this genus occur in Hawai'i. The native species are perennials which become woody shrubs up to 4 m tall (Wagner et al. 1990:270–282). In the past, the leaves of some species, brewed as a tea, were used medicinally (Neal 1965:717). Wood charcoal resembling *Bidens* constitutes 7.8 percent of the sorted sample weight from site T-140, 6.7 percent of the sample from site 50-10-18-23355, and 19.0 percent of the sample from site T-164.

Celastraceae

Perrottetia sandwicensis A. Gray (*Olomea*) This endemic species ranges in habit from a shrub to small tree up to 8 m tall and is common in wet forests at 300 to 1250 m elevations on all of the main islands except Ni'ihau and Kaho'olawe (Wagner et al. 1990:531). The wood was used to make fire by rubbing against the softer *hau* (*Hibiscus tiliaceus*) wood (Malo 1951:21); (Rock 1974:269). Wood charcoal resembling *olomea* constitutes 1.3 sorted weight in field catalog 10 from Manini'ōwali Bay.

Chenopodiaceae

Chenopodium oahuense (Meyen) Aellen ('Āheahea, 'āweoweo) This endemic species is usually a shrub in the coastal lowlands but may become arborescent at higher

elevations (Hillebrand 1965:380). Its known distribution in the main Hawaiian Islands includes coastal, dry forest, and subalpine shrubland at 0 to 2,520 meters elevation (Wagner et al. 1990:538). The soft wood was probably not used by the ancient Hawaiians but the leaves were cooked and eaten as greens (Hillebrand 1965:380); (Malo 1951:23). *Āheahea* wood charcoal was identified in six samples. The percent sorted sample weight range from 2.3 to 20.2.

Clusiaceae

Calophyllum inophyllum L. (*Kamani*) This Polynesian introduction is a tree 8–20 m tall that has naturalized in coastal and low elevation regions on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i (Wagner et al. 1990:542). The hard wood was formerly used for making calabashes (Neal 1965:586). Wood charcoal resembling *kamani*, constituting 0.8 percent sorted sample weight, was found in site T-164.

Cucurbitaceae

Lagenaria siceraria (Molina) Standl. (*Ipu*) The fruit of this annual spreading vine, a native of tropical Asia or Africa, was brought to the Hawaiian Islands by the early settlers (Neal 1965:810). The smaller gourds were once used as receptacles for food or water and rattles for dances while the larger gourds were made into drums or served as places to hold *kapa* bark cloth or other articles (Pukui and Elbert 1986:103). Pieces of *ipu* rinds, found in sites T-140 and T-164, constitute < 0.1 and 0.1 percent sorted sample weight, respectively.

Ebenaceae

Diospyros sandwicensis (A. DC) Fosb. (*Lama*) This small endemic tree, 2–10 m tall, is found in wet or dry regions of all the main Hawaiian Islands (Rock 1974:395); (Wagner et al. 1990:587). Its hard wood was once used by Hawaiians for houses, enclosures for certain idols (Malo 1951:21), and chisel handles (Buck 1957:38). The small fruits were eaten by the natives (Hillebrand 1965:275). *Lama* wood charcoal, identified in the samples from sites T-140, 50–10–18–23355, and T-164, constitutes 8.3, 5.6, and 4.1 percent sorted sample weight, respectively.

Euphorbiaceae

Aleurites moluccana (L.) Willd. (*Kukui*) Once cultivated, this Polynesian introduction has escaped into the native forest, where the pale foliage of the 10–20 m trees (Wagner et al. 1990:598) can be seen in abundance in moist gulches and valleys. Dyes were once extracted from the bark and roots (Buck 1957:187), the oily kernel was burned for light (Buck 1957:107), or eaten as a relish after baking (Buck 1957:48), and net floats and dugout canoes were made from the soft wood (Buck 1957:297). Charred *kukui* nutshells, ranging in percent sorted sample weight from 0.4 to 1.1, were identified in the samples from sites T-140,

50-10-18-23355, and T-164. Charcoal resembling *kukui* wood, ranging in percent sorted sample weight from 0.9 to 1.1, were found in samples from sites T-140, 50-10-18-23355, and T-164. Charcoal resembling *kukui* kernel, found in field catalog 11 from Manini'ōwali Bay, constitutes 1.7 percent of the sorted sample weight.

Antidesma pulvinatum Hillebr. (*Hame*) These endemic trees are 2-12 m tall and are occasional in dry to mesic forests on O'ahu, Moloka'i, Maui, and Hawai'i. This species is found in elevations ranging from 30 to 1200 m with the extremes in elevation occurring on Hawai'i Island. The wood was once used as anvils for beating and preparing *olonā* (*Touchardia*) fibers and the fruit yielded a red dye (Wagner et al. 1990:601). Wood charcoal resembling *hame*, found in the sample from sites T-140 and T-164, constitutes 0.1 and 0.8 percent sorted sample weight, respectively.

Chamaecyze spp. (*'Akoko*) The distribution of the 15 endemic shrubs and small trees in this genus range from coastal environments to upper forest zones on the main Hawaiian Islands (Wagner et al. 1990:602-617); (Rock 1974:243-262) and was valued for firewood by the Hawaiians (Hillebrand 1965:396). The milky sap was once considered a possible source for rubber (Rock 1974:261). *'Akoko* wood charcoal was identified in all seven samples analyzed. The percent sorted sample weight ranges from 3.9 in field catalog 11 of Manini'ōwali Bay to 59.8 in field catalog 7 of site 50-10-18-23355.

Fabaceae

Acacia koa A. Gray (*Koa*) One of the largest endemic trees in Hawai'i, *koa* may attain 35 m in height at higher elevations (Wagner et al. 1990:641-642) and not branch until 12 m or more above the ground (Rock 1974:175). This straight trunk was especially useful for canoes as well as paddles, and surfboards (Malo 1951:126, 223). *Koa* trees which are also found at lower elevations in the dry regions, have a distribution range of 60 to 2,060 m on all the main islands except Ni'ihau and Kaho'olawe (Wagner et al. 1990:641). *Koa* wood charcoal constitutes 0.7 percent sorted weight of the sample from site T-164.

Senna sp. One native shrub, *Senna gaudichaudii* (*kolomona*), and three naturalized species of *Senna* are found on Hawai'i. *Kolomona* has been recorded primarily from leeward sites, but also rocky coastal sites, disturbed *hala* (*Pandanus*) forest, dry forest, and occasionally lower parts of the mesic forest. The naturalized species include *S. obtusifolia* (*habucha*), *S. occidentalis* (*coffee senna*), and *S. pendula* (Wagner et al. 1990:698-702). Wood charcoal, resembling *Senna* and constituting 9.5 percent sorted sample weight, was found in field catalog 11 from Manini'ōwali Bay.

Malvaceae

Hibiscus sp. This genus of 200 or so diverse species is primarily native to tropical and subtropical regions of the world. In the Hawaiian Islands, 10 shrub to small tree species are found in the wild. Of these, three are naturalized historic introductions and 7 are native species, including *H. tiliaceus* (*hau*) (Wagner et al. 1990:881–889). The distinctive anatomy of *hau* is excluded from this group in reference to the charcoal taxon. Wood charcoal resembling *Hibiscus*, found in field catalog 3 from site 50–10–18–23355, constitutes 1.5 percent of the sorted sample weight.

Sida fallax Walp. (*'ilima*) This indigenous shrub was planted in the past as it is today near houses to provide flowers for *lei* making (Neal 1965:553). It has been found growing naturally along coasts, on open lava fields, in dry to mesic forests on all of the main Hawaiian islands (Wagner et al. 1990:898). The entire plant had many uses for the native Hawaiians. The erect stems were tied to the frame of the sleeping house upon which *pili* grass (*Heteropogon contortus*) was lashed. Whole *'ilima* bushes tied together were also used to secure mounds of taro plantings in swampy areas. The prostrate coastal *'ilima* was used as floor coverings under mats (Handy and Handy 1972:228). The roots and flowers were used medicinally (Neal 1965:553). Wood charcoal resembling *'ilima*, found in samples from sites T-140, T-164, and Manini'ōwali Bay, range in percent sorted sample weight from 0.9 to 4.4.

Moraceae

Artocarpus altilis (Perkins. ex Z) Fosb. (*'Ulu*) Only one variety of this Polynesian introduction is found in the Hawaiian Islands, but as many as 75 varieties may be found in the Pacific (D. Ragone personal communication). The Hawaiian variety which seldom bear seeds was cultivated by suckers in the valleys of the lowlands (Handy and Handy 1972:152). The wood of the 12 to 18 m or more tall trees was once used in the construction of house doors and bodies of canoes; the bark of the young shoot was made into rough *tapa* (Malo 1951:21, 48). Drums were sometimes made from the trunk (Buck 1957:396). The latex was used as caulking for canoes and birdlime and the fruit was baked or pounded into *poi* (Neal 1965:302–304). Wood charcoal resembling *'ulu* constitutes 0.5 percent sorted weight of the sample from site T-164.

Myoporaceae

Myoporum sandwicense A. Gray (*Naio*) The habit of this indigenous tree ranges from a shrub 1 m tall in coastal areas to a 15 m tall tree at higher elevation. Its elevational distribution has been documented as 0 to 2,380 m on all the main Hawaiian Islands except Kaho'olawe (Wagner et al. 1990:928–929). The fragrant wood was once used by Hawaiians for house posts (Buck 1957:83) and was harvested during the sandalwood trade with China when the supply of native sandalwood became low (Rock 1974:429). Wood charcoal resembling *naio* was found in four

samples. The percent sorted sample weight range from 1.2 in field catalog 1 of site T-140 to 36.3 in field catalog 11 of Manini'ōwali Bay.

Myrsinaceae

Myrsine lanaiensis Hillebr. (*Kōlea*) These endemic small trees stand 3–6 m tall and inhabit the dry forest to occasionally mesic forest with an elevational range of 300 to 1,000 m on all the main islands except Ni'ihau and Kaho'olawe (Wagner et al. 1990:941–942). Wood charcoal closely resembling *kōlea* constitutes 0.6 percent sorted weight in field catalog 9 of site T-164.

Myrtaceae

Metrosideros polymorpha Gaud. (*'Ōhi'a lehua*) This endemic species ranges in habit from prostrate shrubs to tall trees and in distribution from sea level to 2200 m elevation in many ecological situations on all of the main Hawaiian Islands (Wagner et al. 1990:967). The hard wood was once used for making spears and mallets, idols, posts and rafters for houses, and enclosures around temples (Buck 1957:87); (Malo 1951:20); (Neal 1965:638). A single piece of wood charcoal resembling *'ōhi'a lehua*, constituting 0.1 percent sorted sample weight, was identified from site T-140.

Oleaceae

Nestegis sandwicensis (A.Gray) Degener, I. Degener & L. Johnson (*Olopuā*) This endemic tree which may be up to 25 m tall is found scattered to locally common in dry to mesic forests at 30–1,300 m elevation on all the main islands except Ni'ihau and Kaho'olawe (Wagner et al. 1990:992). In ancient times, the wood was made into adze handles, spears, and digging sticks (Neal 1965:677). The wood, which burns with a hot flame even when green, may have been used as kindling (Malo 1951:25). *Olopuā* wood charcoal, found in the samples from sites T-140 and 50-10-18-23355, constitutes 0.9 percent sorted sample weight in both samples.

Pittosporaceae

Pittosporum sp. (*Hō'awa*) There are four endemic species of this genus found on the island of Hawai'i. Two species, *Pittosporum hawaiiense* and *P. hosmeri*, are small trees found in the mesic to wet forests while *P. confertiflorum* and *P. terminalioides* occur in dry to mesic forests (Wagner et al. 1990:1041, 1047). Wood charcoal resembling *hō'awa* constitutes 0.3 percent sorted weight of the sample from site T-164.

Rosaceae

Osteomeles anthyllidifolia Lindl. ('*Ūlei*) This indigenous plant can often be found sprawling among the rocks along the coasts but may become an erect shrub up to 3 m tall in other environments. *Osteomeles* is found on all the main islands except Ni'ihau and Kaho'olawe and ranges in distribution from sea level to 2300 m in elevation (Wagner et al. 1990:1104–1105). In the past, the hard wood was used to make digging sticks ('*ō'ō*), fishing spears, carrying poles ('*auamo*), and a musical bow ('*ukeke*) (Buck 1957:12, 357, 14, 388). The flexible smaller branches were bent into hoops for fishnets (Neal 1965:387). Wood charcoal resembling '*ūlei* was found in four samples and ranges in percent sorted sample weight from 1.1 to 3.7.

Rubiaceae

Boea timonioides (Hook. f.) Hbd. ('*Ahakea*) This endemic tree which may be up to 10 m tall occurs in dry to occasionally mesic forest at 250 to 580 m elevation in the Puna and South Kona districts of Hawai'i and on Maui (Wagner et al. 1990:1118). The yellow wood was made into *poi* boards, paddles, and rims on canoes (Malo 1951:20). Wood charcoal resembling '*ahakea* constitutes 0.4 percent sorted sample weight in field catalog 3 from site 50–10–18–23355.

Coprosma spp. (*Pilo*) The 13 endemic species range in habit from scandant shrubs to trees 15 m tall and occur in mesic and wet forests, bogs and subalpine shrubland on all the main Hawaiian Islands except Kaho'olawe and Ni'ihau. Of the nine species are found on Hawai'i only *Coprosma cymosa* is found in mesic forests (Wagner et al. 1990:1121–1131). Wood charcoal resembling *pilo* was found in three samples. The percent sorted sample weight ranges from 0.1 to 3.0.

Psychotria sp. (*Kōpiko*) This large genus is distributed over tropical regions of both the New and Old Worlds. The 11 species of *Psychotria* in Hawai'i are small to medium sized endemic trees which are found in the mesic to wet forests. Two species, *P. hawaiiensis* (*kōpiko 'ula*) and *P. mauiensis* ('*ōpiko*), are known from Hawai'i. These species range from shrubs to trees up to 20 m tall and occur in mesic to wet and sometimes dry to mesic forests (Wagner et al. 1990:1160–1170). The wood was previously used as firewood and to make *kapa* logs (Malo 1951:21). Wood charcoal resembling *kōpiko* was found in three samples with the percent sorted sample weight ranging from 0.1 to 0.3.

Sapindaceae

Dodonaea viscosa Jacq. ('*A'ali'i*) These indigenous shrubs or small trees are 2–8 m tall and range in distribution from coastal dunes to dry, mesic, and wet forest, at 3 to 2,350 m elevations (Wagner et al. 1990:1227–1228). The red papery fruit capsule clusters and leaves of some varieties were made into *lei* (Pukui and Elbert 1986:3). The trunks were once used for house posts (Buck 1957:279). Wood charcoal resembling '*a'ali'i* was found in all seven samples analyzed. The

percent sorted sample weight ranges from 8.9 in field catalog 11 to 52.5 in field catalog 10, both from Manini'ōwali Bay.

Thymelaeaceae

Wikstroemia spp. ('*Akia*) The 12 endemic species of this genus are mainly shrubs although trees up to 6 m tall may be found on bare 'a'ā lava flows, in open dry, mesic or wet forests (Wagner et al. 1990:1285–1291). *Wikstroemia phyllyreifolia*, *W. pulcherrima*, and *W. sandwicensis* are common in dry forests on Hawai'i. The bark was a source of fibers for ropes and braids (Hillebrand 1965:384) and the juice from pounded roots, bark, and leaves were used to capture fish by narcotizing them (Neal 1965:616). Wood charcoal resembling '*akia* constitutes 12.8 percent sorted weight of field catalog 11 from Kua Bay.

Table 25. Summary of charcoal taxa identifications

Cat.	Taxon	Part	Count	Weight (g)	% Weight
1	<i>Aleurites moluccana</i>	Nutshell	2	0.13	0.4
	<i>Aleurites moluccana</i>	Wood	3	0.27	0.9
	cf. <i>Antidesma pulvinatum</i>	Wood	1	0.04	0.1
	cf. <i>Bidens</i> sp.	Wood	32	2.26	7.8
	<i>Chamaesyce</i> sp.	Wood	95	8.55	29.6
	<i>Chenopodium oahuense</i>	Wood	19	1.98	6.9
	<i>Cocos nucifera</i>	Wood	3	0.23	0.8
	cf. <i>Coprosma</i> sp.	Wood	21	1.78	6.2
	<i>Diospyros sandwicensis</i>	Wood	16	2.4	8.3
	cf. <i>Dodonaea viscosa</i>	Wood	45	4.74	16.5
	<i>Lagenaria siceraria</i>	Wood	1	0.01	<0.1
	<i>Metrosideros polymorpha</i>	Wood	1	0.02	0.1
	<i>Myoporum sandwicense</i>	Wood	4	0.36	1.2
	<i>Nestegis sandwicensis</i>	Wood	2	0.25	0.9
	<i>Nototrichium sandwicensis</i>	Wood	5	0.95	3.3
	<i>Osteomeles anthyllidifolia</i>	Wood	9	1.07	3.7
	cf. <i>Psychotria</i> sp.	Wood	4	0.68	2.4
	<i>Sida fallax</i>	Wood	3	0.27	0.9
	cf. <i>Tetraplasandra</i> sp.	Wood	1	0.08	0.3
	Unknown 4	Wood	16	2.76	9.6
TOTAL			283	28.83	100
3	<i>Aleurites moluccana</i>	Nutshell	1	0.06	1.1
	<i>Aleurites moluccana</i>	Wood	2	0.07	1.3

Continued on next page

Table 25—Continued

Cat.	Taxon	Part	Count	Weight (g)	% Weight
	cf. <i>Bidens</i> sp.	Wood	10	0.36	6.7
	cf. <i>Bobea</i> sp.	Wood	1	0.02	0.4
	<i>Chamaesyce</i> sp.	Wood	15	0.77	14.2
	<i>Chenopodium oahuense</i>	Wood	4	0.16	3
	<i>Diospyros sandwicensis</i>	Wood	5	0.3	5.6
	cf. <i>Dodonaea viscosa</i>	Wood	20	1.24	23
	cf. <i>Hibiscus</i> sp.	Wood	3	0.08	1.5
	<i>Myoporum sandwicense</i>	Wood	2	0.09	1.7
	<i>Nestegis sandwicensis</i>	Wood	1	0.05	0.9
	<i>Osteomeles anthyllidifolia</i>	Wood	2	0.07	1.3
	cf. <i>Psychotria</i> sp.	Wood	5	0.16	3
	Unknown 3	Wood	8	0.7	13
	Unknown 4	Wood	8	1.27	23.5
	TOTAL		87	5.4	100.2
6	<i>Chamaesyce</i> sp.	Wood	11	0.77	25.6
	<i>Chenopodium oahuense</i>	Wood	1	0.06	2
	cf. <i>Coprosma</i> sp.	Wood	10	0.52	17.3
	cf. <i>Dodonaea viscosa</i>	Wood	8	1.64	54.5
	Unknown 5	Wood	1	0.02	0.7
	TOTAL		31	3.01	100.1
7	<i>Chamaesyce</i> sp.	Wood	15	2.57	59.8
	cf. <i>Dodonaea viscosa</i>	Wood	14	1.48	34.4
	Unknown 6	Wood	8	0.25	5.8
	TOTAL		37	4.3	100
9	<i>Acacia koa</i>	Wood	5	0.2	0.7
	<i>Aleurites moluccana</i>	Nutshell	1	0.18	0.6
	cf. <i>Aleurites moluccana</i>	Wood	6	0.33	1.1
	cf. <i>Antidesma pulvinatum</i>	Wood	9	0.51	1.8
	<i>Artocarpus altilis</i>	Wood	1	0.14	0.5
	cf. <i>Bidens</i> sp.	Wood	69	5.46	19
	<i>Calophyllum inophyllum</i>	Wood	8	0.23	0.8
	<i>Chamaesyce</i> spp.	Wood	62	5.21	18.1
	<i>Chenopodium oahuense</i>	Wood	6	0.66	2.3
	cf. <i>Coprosma</i> sp.	Wood	6	1.06	3.7
	<i>Cordyline fruticosa</i>	Wood	1	0.05	0.2
	<i>Diospyros sandwicensis</i>	Wood	12	1.17	4.1
	cf. <i>Dodonaea viscosa</i>	Wood	53	6.88	23.9
	<i>Lagenaria siceraria</i>	Rind	1	0.03	0.1
	<i>Myoporum sandwicense</i>	Wood	19	1.92	6.7
	cf. <i>Myrsine lanaiensis</i>	Wood	2	0.19	0.6
	<i>Osteomeles anthyllidifolia</i>	Wood	12	0.9	3.1
	cf. <i>Pittosporum</i> sp.	Wood	2	0.08	0.3

Continued on next page

Table 25—Continued

Cat.				Weight	%
#	Taxon	Part	Count	(g)	Weight
	cf. <i>Psychotria</i> sp.	Wood	1	0.03	0.1
	<i>Sida fallax</i>	Wood	14	0.93	3.2
	Unknown 3	Wood	4	0.46	1.6
	Unknown 4	Wood	21	2.01	7
	Unknown 5	Wood	1	0.1	0.3
	Not identified	Parenchyma	1	0.06	0.2
	TOTAL		312	28.79	100
10	<i>Chamaesyce</i> sp.	Wood	8	0.2	12.7
	<i>Chenopodium oahuense</i>	Wood	9	0.32	20.2
	cf. <i>Dodonaea viscosa</i>	Wood	21	0.83	52.5
	<i>Perrottetia sandwicensis</i>	Wood	2	0.02	1.3
	cf. <i>Sida fallax</i>	Wood	2	0.07	4.4
	Unknown 2	Wood	3	0.05	3.2
	Unknown 3	Wood	7	0.09	5.7
	TOTAL		52	1.58	100
11	<i>Aleurites moluccana</i>	Kernel	1	0.03	1.7
	<i>Chamaesyce</i> sp.	Wood	2	0.07	3.9
	<i>Chenopodium oahuense</i>	Wood	5	0.23	12.8
	cf. <i>Cocos nucifera</i>	Wood	1	<0.01	0.6
	cf. <i>Dodonaea viscosa</i>	Wood	8	0.16	8.9
	<i>Myoporum sandwicense</i>	Wood	3	0.65	36.3
	<i>Osteomeles anthyllidifolia</i>	Wood	3	0.02	1.1
	cf. <i>Senna</i> sp.	Wood	4	0.17	9.5
	cf. <i>Wikstroemia</i> sp.	Wood	11	0.23	12.8
	Unknown 1	Wood	8	0.22	12.3
	TOTAL		46	1.79	99.9

Discussion

The charcoal samples analyzed in this study consist of six Polynesian introductions and possibly 23 native woody taxa. The Polynesian introductions consist of four trees, one shrub, and one vine. The native taxa include 10 shrubs and 13 trees. These taxa have been found in environments ranging from coastal to alpine. Coconut, *kamani* and *āheahea* are known to grow in coastal environments but most of the taxa occur in mesic to dryland habitats.

Table 26. Occurrence of taxa among charcoal samples

Taxon	Cat. #	1	3	6	7	9	10	11	TOTAL
<i>Acacia koa</i>						0.7			0.7
<i>Aleurites moluccana</i> nutshell		0.4	1.1			0.6			2.1
cf. <i>Aleurites moluccana</i> kernel								1.7	1.7
cf. <i>Aleurites moluccana</i>		0.9	1.3			1.1			3.3
cf. <i>Antidesma pulvinatum</i>		0.1				1.8			1.9
<i>Artocarpus altilis</i>						0.5			0.5
cf. <i>Bidens</i> sp.		7.8	6.7			19			33.5
cf. <i>Bohea</i> sp.			0.4						0.4
cf. <i>Calophyllum inophyllum</i>						0.8			0.8
<i>Chamaesyce</i> spp.		29.6	14.2	25.6	59.8	18.1	12.7	3.9	163.9
<i>Chenopodium oahuense</i>		6.9	3	3		2.3	20.2	12.8	48.2
cf. <i>Cocos nucifera</i>		0.8						0.6	1.4
cf. <i>Coprosma</i> sp.		6.2		17.3		3.7			27.2
<i>Cordyline fruticosa</i>						0.2			0.2
<i>Diospyros sandwicensis</i>		8.3	5.6			4.1			18
cf. <i>Dodonaea viscosa</i>		16.5	23	54.5	34.4	23.9	52.5	8.9	213.7
cf. <i>Hibiscus</i> sp.			1.5						1.5
<i>Lagenaria siceraria</i>		<0.1				0.1			0.1
<i>Metrosideros polymorpha</i>		0.1							0.1
<i>Myoporum sandwicense</i>		1.2	1.7			6.7		36.3	45.9
cf. <i>Myrsine lanaiensis</i>						0.6			0.6
<i>Nestegis sandwicensis</i>		0.9	0.9						1.8
<i>Nototrichium sandwicensis</i>		3.3							3.3
<i>Osteomeles anthyllidifolia</i>		3.7	1.3			3.1		1.1	9.2
<i>Perrottetia sandwicensis</i>							1.3		1.3
cf. <i>Pittosporum</i> sp.						0.3			0.3
cf. <i>Psychotria</i> sp.		2.4	3			0.1			5.5
cf. <i>Senna</i> sp.								9.5	9.5
<i>Sida fallax</i>		0.9				3.2	4.4		8.5
cf. <i>Tetraplasandra</i> sp.		0.3							0.3
cf. <i>Wikstroemia</i> sp.								12.8	12.8
Unknown 1								12.3	12.3
Unknown 2							3.2		3.2
Unknown 3			13			1.6	5.7		20.3
Unknown 4		9.6	23.5			7			40.1
Unknown 5				0.7		0.3			1
Unknown 6					5.8				5.8
Parenchyma						0.2			0.2

Appendix G

^{14}C Date Calibration

This appendix presents the results of the ^{14}C calibration in graphical form, as produced by the BCal software package (Buck et al. 1999).

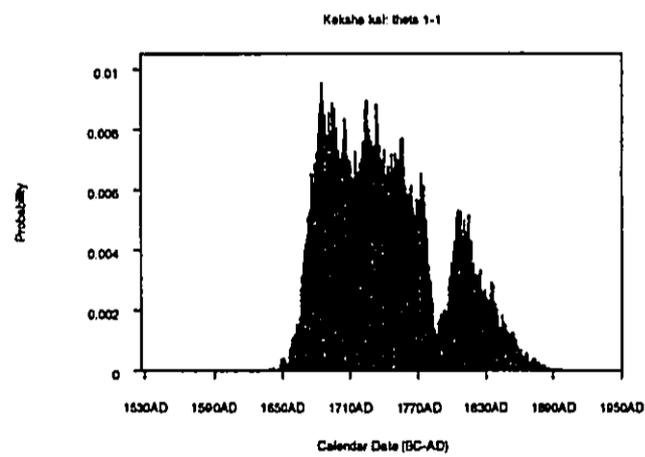


Figure 185. Posterior probability distribution for Beta-167580, looted cave site T-140 feature B. The dated material is *Aleurites moluccana* nutshell.

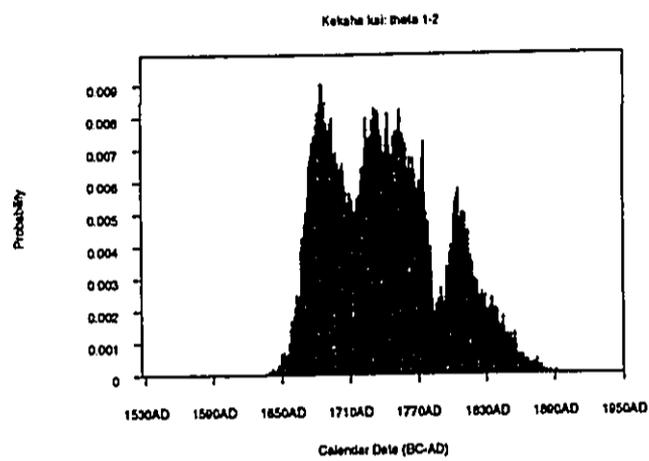


Figure 186. Posterior probability distribution for Beta-167581, looted cave site T-140 feature B. The dated material is *Aleurites moluccana* nutshell.

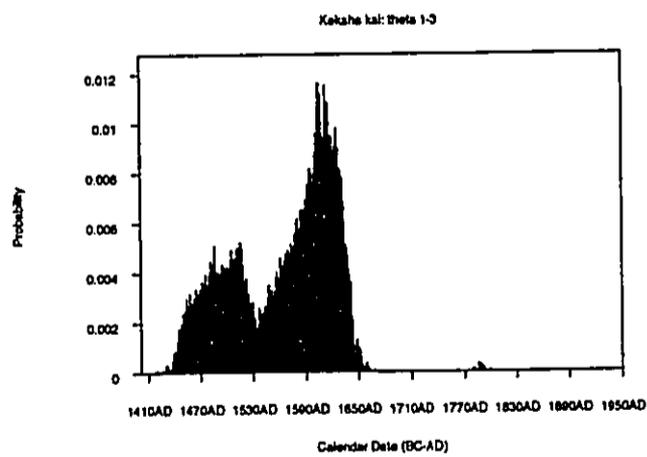


Figure 187. Posterior probability distribution for Beta-167582, looted cave site T-140 feature B. The dated material is *Aleurites moluccana* nutshell.

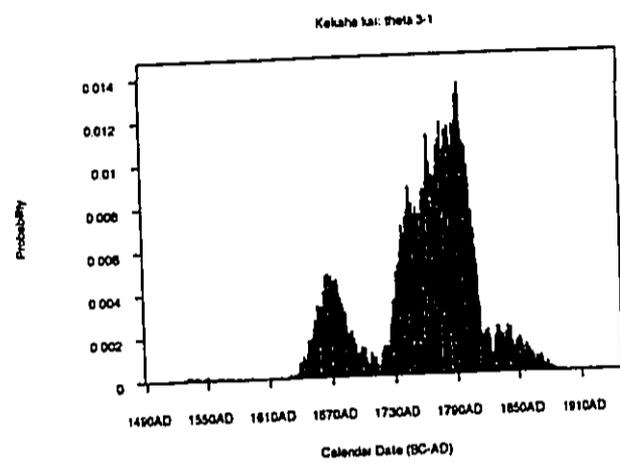


Figure 188. Posterior probability distribution for Beta-167583, looted cave site 50-10-18-23355, feature 23. The dated material is *Aleurites moluccana* nutshell.

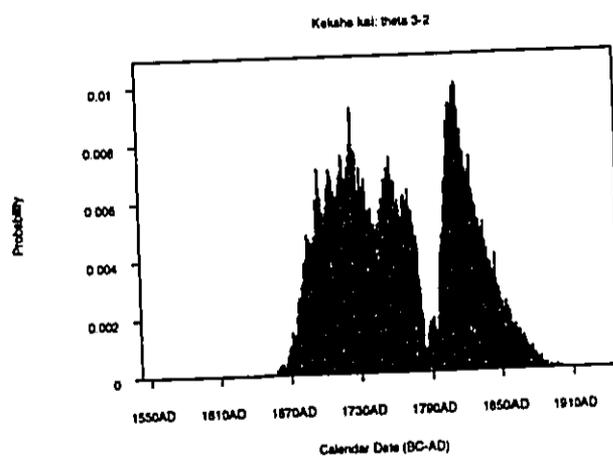


Figure 189. Posterior probability distribution for Beta-167584, looted cave site 50-10-18-23355, feature 23. The dated material is *Aleurites moluccana* nutshell.

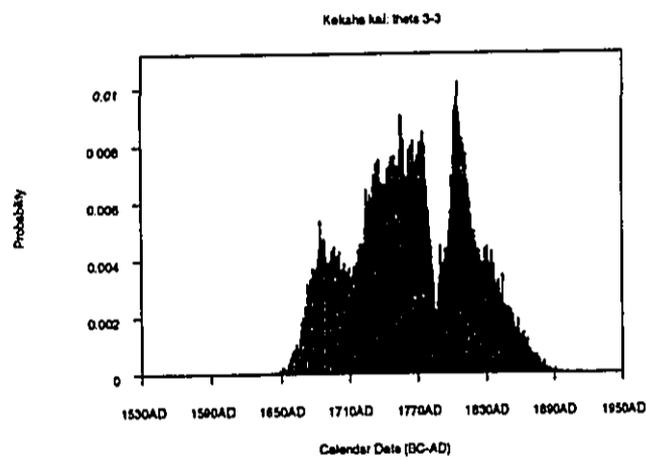


Figure 190. Posterior probability distribution for Beta-167585, looted cave site 50-10-18-23355, feature 23. The dated material is *Aleurites moluccana* nutshell.

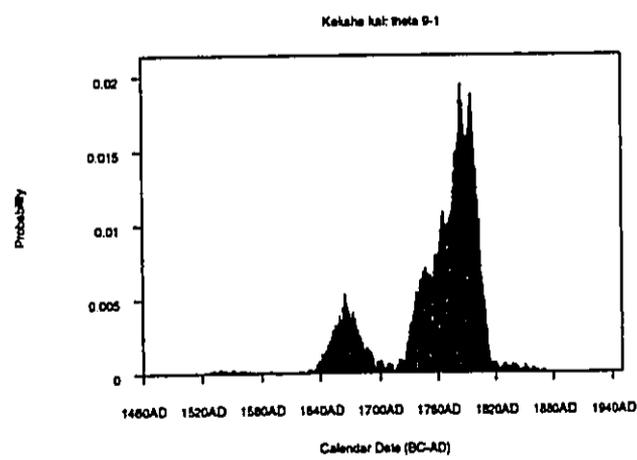


Figure 191. Posterior probability distribution for Beta-167586, looted cave site T-164 feature A. The dated material is *Aleurites moluccana* nutshell.

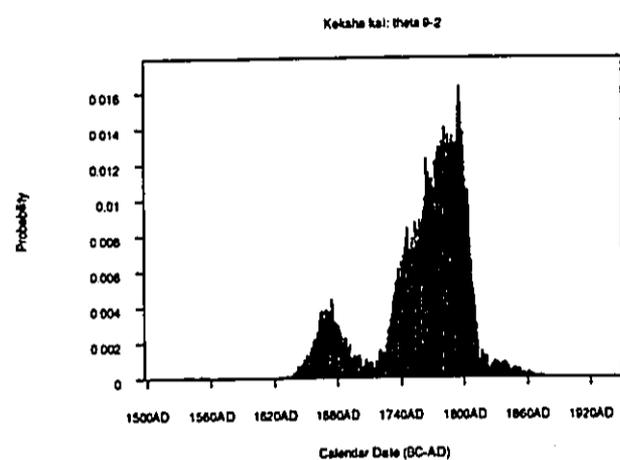


Figure 192. Posterior probability distribution for Beta-167587, looted cave site T-164 feature A. The dated material is *Aleurites moluccana* nutshell.

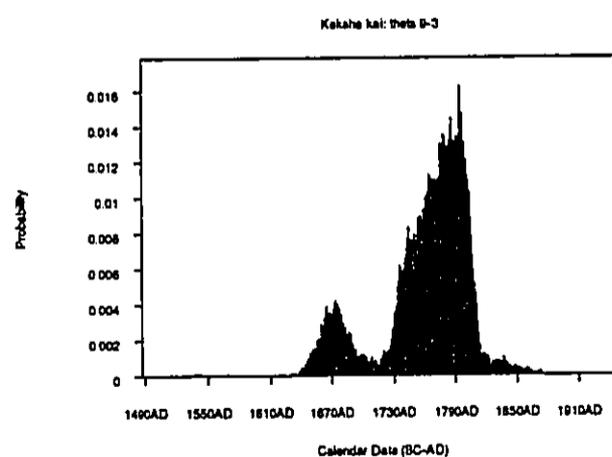


Figure 193. Posterior probability distribution for Beta-167588, looted cave site T-164 feature A. The dated material is *Aleurites moluccana* nutshell.

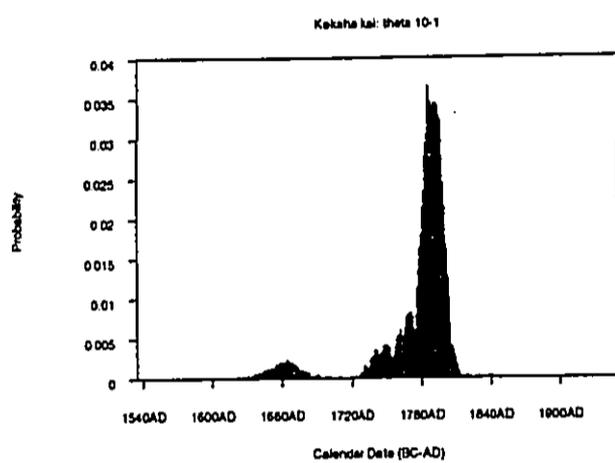


Figure 194. Posterior probability distribution for Beta-167589, Manini'owali Bay dune profile, layer II (see fig. 41 a). The dated material is *Chamaesyce* sp.

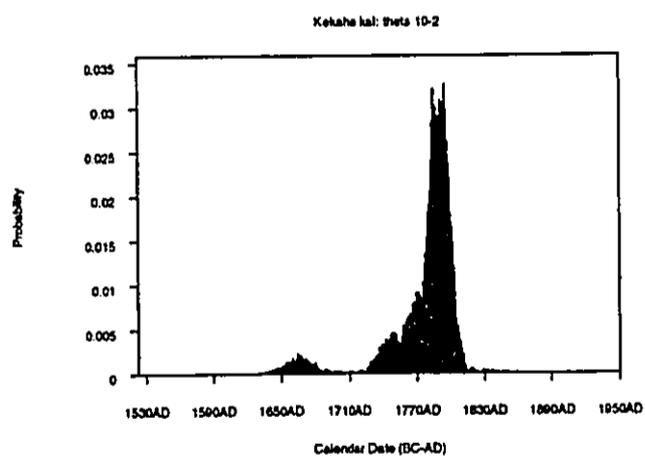


Figure 195. Posterior probability distribution for Beta-167590, Manini'owali Bay dune profile, layer II (see fig. 41 a). The dated material is *Chenopodium oahuense*.

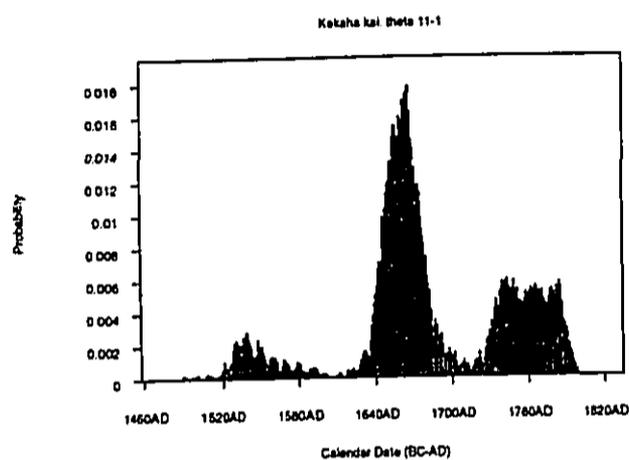


Figure 196. Posterior probability distribution for Beta-167591, Manini'ōwali Bay dune profile, layer III (see fig. 41 b). The dated material is *Chamaesyce* sp.

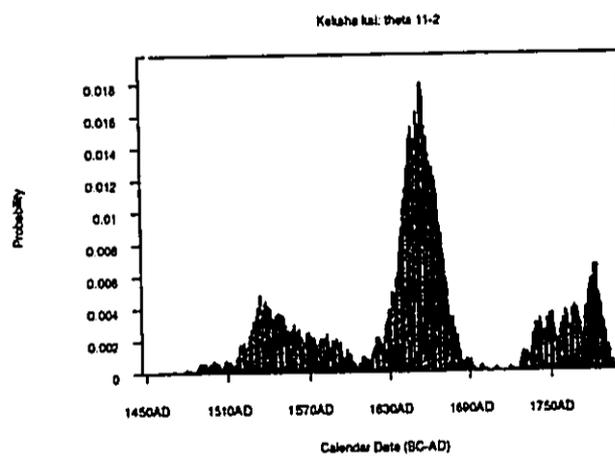


Figure 197. Posterior probability distribution for Beta-167592, Manini'ōwali Bay dune profile, layer III (see fig. 41 b). The dated material is *Chenopodium oahuense*.



Appendix H

Comparative Faunal Assemblages

This appendix provides descriptive information and references for the sites used in the comparative faunal analysis. Site locations are shown on figure 178, page 268 and a summary of site information is provided in table 12, page 267.

'Anaeho'omalu Group

This area, near the boundary of the Kona and Kohala districts, contains numerous *pāhoehoe* pits, which yielded raw material for scoria abrader manufacture and rocks for construction of surface architectural features.

Jensen (1990) recovered relatively rich vertebrate faunal collections from excavations in three temporary habitation caves at 'Anaeho'omalu, sites 50-10-10-11239, -11243, and -11244. The remains were collected from nested 0.25 in. and 0.125 in. mesh screens, then counted and weighed in the laboratory. The measurement unit for the vertebrate faunal remains is not indicated in the table (Jensen 1990:table A-5), but the entries are all integers, which is typical of count data. Therefore, the data are treated as NISP in the analysis. The vertebrate faunal remains are reported to the taxon level.¹

Site 50-10-10-11239

Site 11239 is a complex of three blister caves at 'Anaeho'omalu Point. Excavations were carried out at feature C, the largest of the three. All the caves are interpreted as temporary habitation sites. Four 1 m² and three 0.5 m² units were excavated to depths between 20 and 80 cm below surface.

This site is labeled "A1" in figure 179, page 270.

¹The methods section only indicates that vertebrate remains were "sorted, counted, and weighed by major category (e.g., bivalves, gastropods, fish, mammal, etc.)" (Jensen 1990:23). No explanation is given for the taxon level identifications provided in table A-5.

Site 50-10-10-11243

Site 11243 is a complex of features including caves, cairns, terraces, petroglyphs, and abrader manufacturing stations. Excavations were carried out at feature D, a temporary habitation cave. Four 1 m² units were excavated to depths of 15–20 cm below surface in a “non-stratified, largely undifferentiated midden accumulation” (Jensen 1990:35).

This site is labeled “A2” in figure 179, page 270.

Site 50-10-10-11244

Site 11244 consists of a cave and a terrace. Excavations were carried out in feature A, a temporary habitation cave with an undifferentiated midden deposit 5–15 cm thick. Five 1 m² units were excavated.

This site is labeled “A3” in figure 179, page 270.

Field System Group

Sites in this group come from Ka'ūpūlehu, Hōlualoa, and Pua'a 1 *ahupua'a*. Ka'ūpūlehu contains a large concentration of *pāhoehoe* pits; there are more than 2,100 of them in the *makai* portion of the *ahupua'a* (Carter 1985:17), and they extend *mauka* to the Māmalahoa Highway (Goodfellow and Head 1995). Goodfellow and Head (1995) report faunal remains from site 50-10-28-17938, located a short distance *makai* of the Māmalahoa Highway, as NISP. Faunal remains were collected from 0.125 in. mesh screens, identified by Alan C. Ziegler, and reported at the taxon level.

Excavations at two cave sites investigated during realignment of Kuakini Highway *mauka* of Kailua town in Hōlualoa and Pua'a 1 *ahupua'a* yielded sizeable collections of vertebrate faunal remains Schilt (1984). The sites are located among gardens of the Kona field system and are classified here as temporary habitations, but the intensity of habitation was relatively great in comparison to many other temporary habitation sites in the comparative analysis. The sites are located on Hualālai volcano lava flows greater than 10,000 years old (Wolfe and Morris 1996) and *pāhoehoe* pits are not present. The vertebrate faunal remains were collected from 0.125 in. mesh screens, identified by Sara Collins, and reported as NISP and weight by taxon.

Site 50-10-28-17938

Excavations were carried out at two lava tube caves in features A1 and A2, site 50-10-28-17938, a complex of 23 features, including a possible burial platform, enclosures, terraces, and trails in addition to the lava tube caves (Goodfellow and Head 1995:A-21–A-31). The caves are classified as temporary habitations (Goodfellow and Head 1995:64). One excavation unit in feature A1 yielded a single, 43 cm thick layer of white silt. One or two excavation units were placed in feature A2.² A stratigraphic section with one 43 cm thick layer is described.

²A single unit is described in the text (Goodfellow and Head 1995:A-26) but faunal remains are reported from two units (Goodfellow and Head 1995:60).

This site is labeled "F2" in figure 179, page 270.

Site 50-10-37-5151

This is a small cave site, 50-Ha-D6-21 in the Bishop Museum site numbering system, with three periods of use (Schilt 1984:79-89). An initial period of short-term, sporadic use c. A.D. 1500-1600, represented by an 8-10 cm thick deposit at the back of the cave, was followed sometime after A.D. 1600 by a period of frequent or seasonally lengthy use that persisted into the early historic period. The c. 25 cm thick cultural layer yielded a relatively rich and diverse collection of vertebrate faunal remains. Artifacts representing a broad range of activities, including fishing, recreation, personal adornment and use and manufacture of tools, were also recovered. The cave was used briefly in the twentieth century, as evidenced by a surface scatter of historic artifacts.

This site is labeled "F1" in figure 179, page 270.

Site 50-10-37-5157

This site, 50-Ha-D7-27 in the Bishop Museum site numbering system, yielded a relatively rich collection of vertebrate faunal remains (Schilt 1984:89-98). A two period occupation sequence began A.D. 1400-1650 with an 8-40 cm thick deposit dominated by volcanic glass artifacts. The second period, which began A.D. 1650-1700, saw major structural modifications to the cave and an increase in the quantity and diversity of cultural remains from the 35-65 cm thick deposit. The cave was abandoned by early historic times. The site probably represents temporary habitation by agricultural field workers, although the presence of domestic and recreational artifacts indicates the duration of occupation episodes was likely fairly long.

This site is labeled "F3" in figure 179, page 270.

Upland Group

The upland group includes high elevation cave sites at Pōhakuloa and the slopes of Mauna Kea. Reinman and Pantaleo (1998) report relatively large vertebrate faunal collections from three cave sites in the upland saddle region of Pōhakuloa. All collections are from the surface and are total samples not passed through screens in the field. Material from the rock-lined hearth, site 50-10-30-19495 feature A, was water-screened through window mesh in the laboratory and the vertebrate remains collected at that time (Reinman and Pantaleo 1998:34).

McCoy (1986) reports vertebrate faunal remains from Hopukani rockshelter site 50-10-22-16238 at the Mauna Kea adze quarry. The faunal remains, reported as NISP and minimum number of individuals, are from surface collections and excavation of two 0.5 m² units.

Site 50-10-31-19490

Site 50-10-31-19490 is a complex of 11 features, including lava tube shelters, a C-shape enclosure, *ahu*, and trails (Reinman and Pantaleo 1998:43-51). The vertebrate faunal remains derive from feature C, a lava tube with two chambers, each of which contained a variety of well-preserved cultural materials, most notably a pair of *ti* leaf sandals (*kāma'a*). Bird bone, *'ōpihi* shell, kukui nut shell and other organic and inorganic remains were found concentrated along wall crevices.

This site is labeled "U3" in figure 179, page 270.

Site 50-10-31-19495

Site 50-10-31-19495 is a large lava tube shelter with a modified ramp entrance leading to a rock-lined hearth and an ash concentration (Reinman and Pantaleo 1998:60-62). The vertebrate faunal collection derives from the contents of the hearth and a scatter of material around it. Unidentified ash from the hearth returned a ^{14}C date of 460 ± 60 ; this sample contains an unknown but potentially 200-250 year in-built age. Unidentified wood charcoal from the surface of the lava tube cave yielded a conventional ^{14}C age of 120 ± 70 .

This site is labeled "U2" in figure 179, page 270.

Site 50-10-31-19497

Site 19497 is a large lava tube shelter with several interior features that was probably used repeatedly (Reinman and Pantaleo 1998:66-68). The vertebrate faunal remains come from feature C, a ledge on the west wall of the cave, 4 m long by 1 m wide. The collection represents a sample from the south end of the ledge.

This site is labeled "U4" in figure 179, page 270.

Site 50-10-22-16238

Excavations at Hopukani rockshelter revealed "a continuous sequence of short-term occupations denoted by relative dense accumulations of tool-manufacturing debitage, food residues, and a variety of features related to maintenance activities" (McCoy 1986:74). Four ^{14}C dates on unidentified charcoal yielded dates interpreted as indicating use of the rockshelter A.D. 1300-1700. Due to the presence of unknown but possibly 200-250 year in-built age of the dated charcoal, a conservative estimate for the initial use of the rockshelter site is the mid-fifteenth century.

This site is labeled "U1" in figure 179, page 270.

Kekaha Group

Dye (2002) excavated three temporary habitation sites immediately *mauka* of the northern portion of the project area. This is an area with numerous *pāhoehoe* pits and no evidence to suggest that they served as abrader quarries like the pits at 'Anaeho'omalū.

Vertebrate faunal remains were collected from 0.125 in. mesh screen, identified by Alan C. Ziegler, and reported as NISP and weight.

Based on 6 ¹⁴C dates on *kukui* nutshell and seabird bones from site 50-10-18-5354, Dye (2002) inferred that the site was in use by the mid-sixteenth century and that it continued to be used for about 250 years until the early historic period. Pantaleo et al. (1992) excavated a 0.25 m² unit near the center of the sediment deposit in site 50-10-18-5341.³ ¹⁴C dates on unidentified wood charcoal apparently collected from the screen yielded results that place use of the enclosure in the traditional Hawaiian period sometime after the end of the fourteenth century A.D. Because the dated material was not collected from a provenience securely associated with an event and was not identified prior to dating to control for in-built age, it is not possible to infer more from the dating results than that the enclosure was used sometime in the last four centuries of the traditional Hawaiian period.

Site 50-10-18-5349, although not directly dated, is believed to be of similar age.

Site 50-10-18-5341

Site 50-10-18-5341 is a complex consisting of a rectangular enclosure with a paved entrance, a lava tube shelter, and five *pāhoehoe* pits (Pantaleo et al. 1992:42).⁴ A 1 m² test unit was placed in the southeast corner of the enclosure, where it would potentially expose the bases of the south and east walls (Dye 2002:28 ff.). Excavation revealed two stratigraphic layers, only the uppermost of which contained cultural material in primary context. A small vertebrate faunal collection was made.

This site is labeled "K1" in figure 179, page 270.

Site 50-10-18-5349

Site 5349 consists of five lava tube shelters and 41 *pāhoehoe* pits. One of the lava tube shelters, feature 41, contained a relatively rich cultural deposit before it was looted sometime prior to the inventory survey (Pantaleo et al. 1992:63). During data recovery, a shallow deposit of cultural material was found beneath a boulder near the feature's entrance (Dye 2002:32 ff.). This was removed entirely by hand because a trowel or whisk broom couldn't be used in the tight space beneath the boulder. The small collection made from this remnant deposit included a shell button, a piece of worked shell, vertebrate and invertebrate faunal remains, *kukui* nutshell and wood charcoal.

This site is labeled "K2" in figure 179, page 270.

Site 50-10-18-5354

Site 5354 consists of two lava tube shelters in a low *pāhoehoe* ridge running *mauka-makai*, only one of which, feature 2, contains a substantial cultural deposit (Dye 2002:34 ff.). Vertebrate faunal remains were collected from a 1 m² test unit with a thin cultural

³A figure of the southeast profile (Pantaleo et al. 1992:85) shows a section 1 m long, twice the longest dimension of the test unit described in the text.

⁴The *pāhoehoe* pits are located between 35 and 75 m from the other two features. They have no obvious functional or spatial association with the enclosure and the lava tube shelter.

deposit and four collection locations near the edges of the lave tube where preservation was excellent. The faunal collection made at this site is one of the largest from the Kona coast, but contains a large number of fish scales due to the excellent preservation. This site is labeled "K3" in figure 179, page 270.

Glossary

Entries for Hawaiian words are excerpted or paraphrased, where possible, from the *Hawaiian Dictionary* (Pukui and Elbert 1971), or from Lucas (1995). Geological and geographical terms are from American Geological Institute (1976) and Clark (1998). Archaeological terms are from Bray and Trump (1982) and Mignon (1993).

'a'ā Basaltic lava flows typified by a rough, jagged, spinose, clinkery surface. See also *pāhoehoe*.

'ilima An indigenous shrub, *Sida fallax*.

'inamona Relish made of the cooked kernel of *kukui* mashed with salt. See also *kukui*.

'ōpihi A limpet, *Cellana* sp.

aeolian Associated with Aeolus, the Greek god of the winds, hence related to wind action, i.e. borne, deposited, produced, or eroded by wind.

ahupua'a Traditional Hawaiian land division usually extending from the uplands to the sea.

akua God, goddess, spirit, ghost, devil, image, corpse.

ala Path, trail, road.

alaloa Highway, main road, belt road around an island, a long road.

anchialine A type of shoreline pond or pool without surface connection to the sea but having waters of measurable salinity and showing tidal fluctuations.

anthropogenic Of, relating to, or involving the impact of man on nature.

bipolar reduction A lithic reduction technique in which a piece of material is placed on an anvil and struck with a hammerstone. It is especially useful for working small sized raw material.

Contact The arrival of Captain James Cook in 1778 and the beginning of the social changes that brought about the end of traditional Hawai'i.

- detritus** Material produced by the disintegration and weathering of rocks that has been moved from its site of origin, or a deposit of such material.
- evenness** The order of abundance values of classes in a collection or population, a measure of diversity.
- heiau** Traditional Hawaiian place of worship.
- heiau luakini** Large temple where ruling chiefs prayed and human sacrifices were offered.
- helmet conch** A large gastropod marine shell, *Cassis cornuta*, that lives in sand at depths of 3 to 65 m.
- in situ** In the natural or original position.
- kahakai** Beach, seashore, seacoast, seaside, strand.
- kahuna** Priest, sorcerer, magician, wizard, minister, expert in any profession.
- kaiāulu** Community, neighborhood, village.
- kalana** Division of land smaller than a *moku* or district. See also *moku*.
- kama'āina** Native-born, one born in a place, host.
- kāne** Male, husband, male sweetheart, man; brother-in-law of a woman.
- kauhale** Group of houses comprising a Hawaiian home, formerly consisting of men's eating house, women's eating house, sleeping house, cooking house, canoe house, etc. Term was later used even if the home included but a single house, and is sometimes used for hamlet or settlement.
- kilo i'a** A man who observes fish movements from a high place and directs fishermen; to so act.
- ko'a** Shrine, often consisting of circular piles of coral or stone, built along the shore or by ponds or streams, used in ceremonies as to make fish multiply; also built on bird islands, and used in ceremonies to make birds multiply.
- kukui** The candlenut, *Aleurites moluccana*.
- leho** Cowrie shell, *Cypraea* spp..
- māhele** Land division of 1848.
- makai** Seaward.
- milo** A tree or arborescent shrub, *Thespesia populnea*, either indigenous or introduced by Polynesians for its wood and fiber.
- moku** District, island, section; forest, grove.

- mua*** Men's eating house.
- nehe*** A member of the genus *Lipochaeta*, which includes 20 species of perennial or rarely annual herbs endemic to the Hawaiian Islands.
- niu*** The coconut palm, *Cocos nucifera*.
- o'io'ina*** Resting place for travelers, such as a shady tree or rock.
- pāhoehoe*** Basaltic lava flows typified by smooth, billowy, or ropy surface. See also 'a'ā.
- pāhoehoe*** Basaltic lava flows typified by smooth, billowy, or ropy surface. See also 'a'ā.
- papa*** Flat surface, stratum, layer, level, foundation, story of a building.
- pipipi*** A marine shell, *Nerita picea*, common in the intertidal zone.
- project** The archaeological inventory survey. See also undertaking.
- pu'u*** Any kind of a protuberance from a pimple to a hill; hill, peak, cone, hump, mound, bulge, heap, pile, etc.
- pua kala*** An endemic perennial herb, *Argemone glauca*.
- richness** The number of classes in a collection or population, a measure of diversity.
- scarp** An escarpment, cliff, or steep slope along the margin of a plateau, mesa, terrace, or bench.
- scoria** A markedly vesicular rock with a texture that is partly glassy and partly crystalline, formed by the frothing of magma as its gases expand near the surface.
- shatter** Lithic debitage which is often angular, blocky, and lacks common flake attributes such as a bulb of percussion, striking platform, or distinguishable ventral and dorsal surfaces.
- site** The fundamental unit of archaeological investigation, consisting of a concentration on the landscape of material evidence of past human activity.
- storm wave** A large sea wave caused by a hurricane wind or severe gale.
- suitable dating material** An identified sample of wood charcoal, selected to include short-lived species, twigs, or sapwood collected from a context that is in a clearly defined association with a confidently identified traditional Hawaiian cultural feature (Dye 1998:22).
- tidal wave** The periodic variations of sea level produced by the gravitational attractions of the sun and moon.

total unit A sample collected directly from the archaeological context without screening.

tsunami A great sea wave produced by a submarine earthquake or volcanic eruption. Often confused with tidal wave.

undertaking Development of the planned public park improvements. See also project.

wahine Woman, lady, wife; sister-in-law, female cousin-in-law of a man.

wiliwili An endemic tree with reddish, papery bark, *Erythrina sandwicensis*.

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Archaeological Inventory Survey of Portions of Kekaha Kai State Park

Volume II

Over-size Maps

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December 2002

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CORRECTION

THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

Archaeological Inventory Survey of Portions of Kekaha Kai State Park

Volume II

Over-size Maps

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Honolulu, Hawaii 96813-4307
December 2002

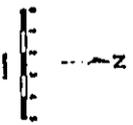
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Site 50-10-18-23355
 Features 1-46
 Kakaia Bay, Hawaii Island



Explanation of Map Symbols

	100 Fathoms		100 Fathoms
	50 Fathoms		50 Fathoms
	20 Fathoms		20 Fathoms
	10 Fathoms		10 Fathoms
	5 Fathoms		5 Fathoms
	2 Fathoms		2 Fathoms
	1 Fathom		1 Fathom
	0.5 Fathom		0.5 Fathom
	0.25 Fathom		0.25 Fathom
	0.125 Fathom		0.125 Fathom
	0.0625 Fathom		0.0625 Fathom
	0.03125 Fathom		0.03125 Fathom
	0.015625 Fathom		0.015625 Fathom
	0.0078125 Fathom		0.0078125 Fathom
	0.00390625 Fathom		0.00390625 Fathom
	0.001953125 Fathom		0.001953125 Fathom
	0.0009765625 Fathom		0.0009765625 Fathom
	0.00048828125 Fathom		0.00048828125 Fathom
	0.000244140625 Fathom		0.000244140625 Fathom
	0.0001220703125 Fathom		0.0001220703125 Fathom
	0.00006103515625 Fathom		0.00006103515625 Fathom
	0.000030517578125 Fathom		0.000030517578125 Fathom
	0.0000152587890625 Fathom		0.0000152587890625 Fathom
	0.00000762939453125 Fathom		0.00000762939453125 Fathom
	0.000003814697265625 Fathom		0.000003814697265625 Fathom
	0.0000019073486328125 Fathom		0.0000019073486328125 Fathom
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Site SO-10-18-23355
 Features 47-82
 Kapaemahu Bay, Hawaii I Island



Explanation of Map Symbols

	100	Shaded area
	101	Shaded area
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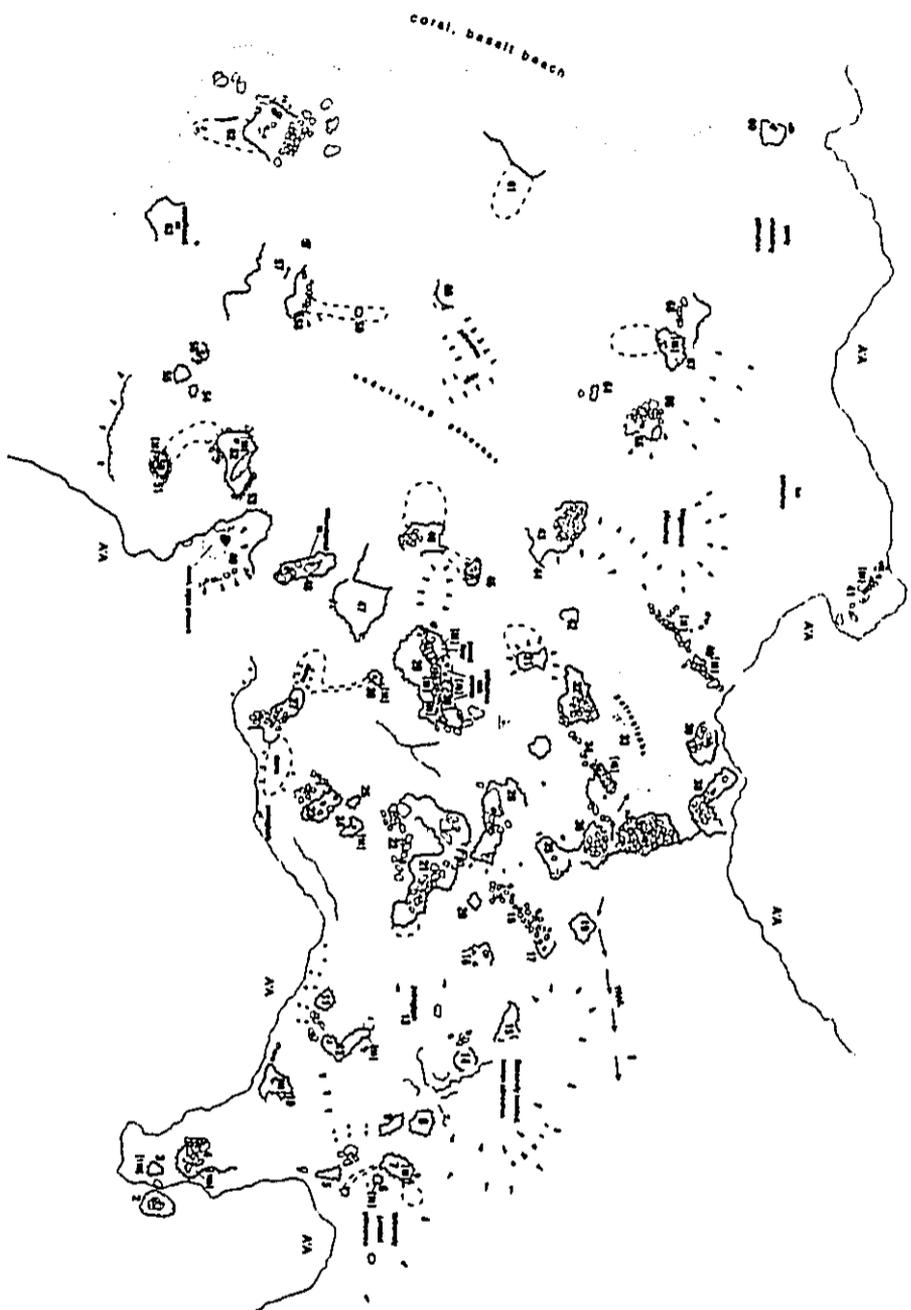


Site 50-10-16-23355
 Features 83-100
 Kalaupapa Bay, Hawaii Island

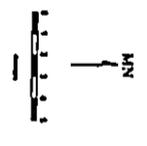


Explanation of Map Symbols

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	202	Water



Site 50-10-18-16059
 Features 1-69
 Kakaia Bay, Hawaii Island

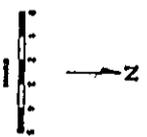


Explanation of Map Symbols

	(10) Boundary		(10) Point of Interest
	(11) Road		(11) Point of Interest
	(12) Boundary		(12) Point of Interest
	(13) Boundary		(13) Point of Interest
	(14) Boundary		(14) Point of Interest
	(15) Boundary		(15) Point of Interest
	(16) Boundary		(16) Point of Interest
	(17) Boundary		(17) Point of Interest
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	(30) Boundary		(30) Point of Interest

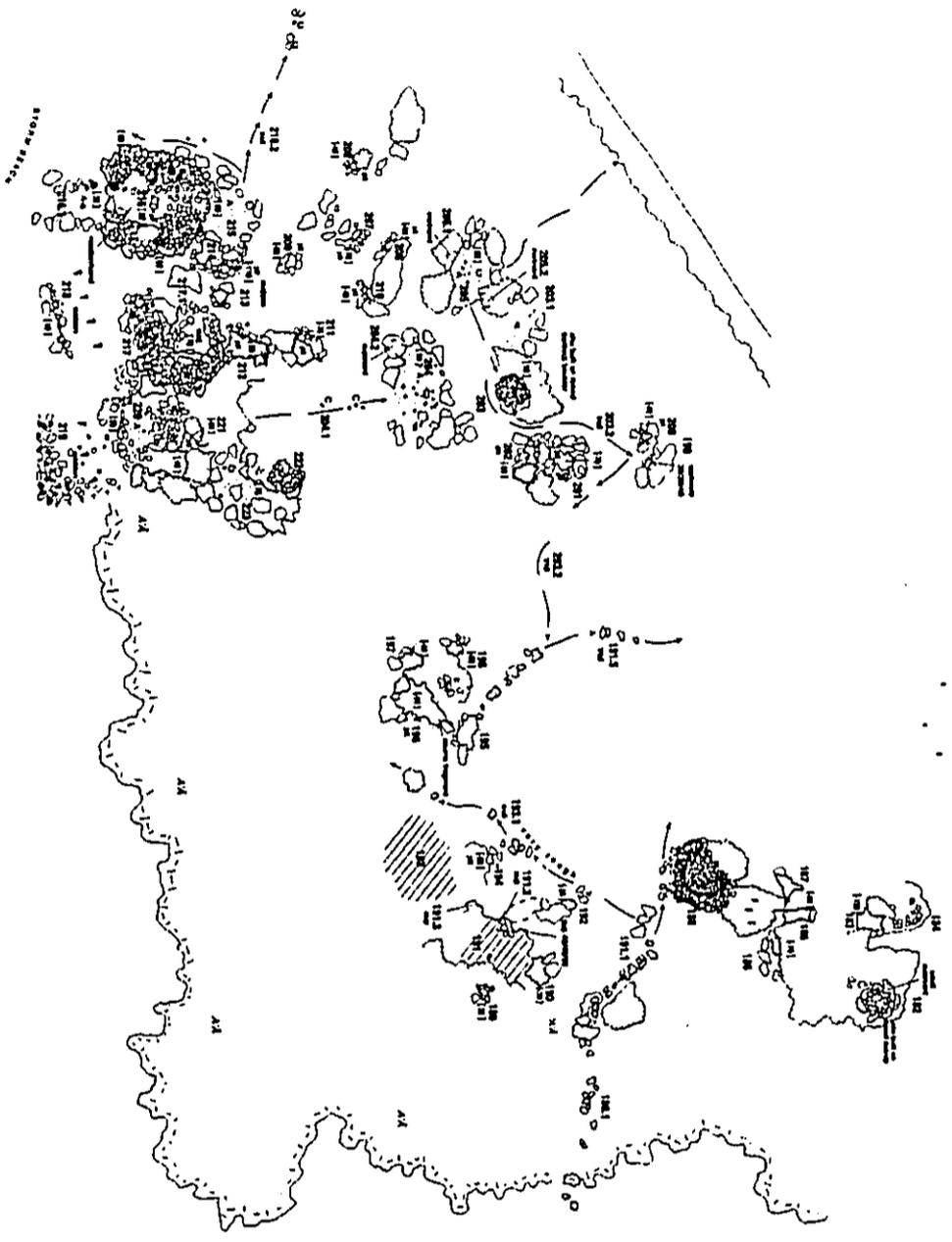


Site 50-10-18-16059
 Features 70-99
 Kakapa Bay, Hawaii Island

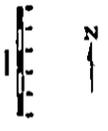


Explanation of Map Symbols

	100 Building		100 Parking lot
	101 Road		101 Fence
	102 Utility pole		102 Tree
	103 Fence post		103 Tree
	104 Fence post		104 Tree
	105 Fence post		105 Tree
	106 Fence post		106 Tree
	107 Fence post		107 Tree
	108 Fence post		108 Tree
	109 Fence post		109 Tree
	110 Fence post		110 Tree
	111 Fence post		111 Tree
	112 Fence post		112 Tree
	113 Fence post		113 Tree
	114 Fence post		114 Tree
	115 Fence post		115 Tree
	116 Fence post		116 Tree
	117 Fence post		117 Tree
	118 Fence post		118 Tree
	119 Fence post		119 Tree
	120 Fence post		120 Tree

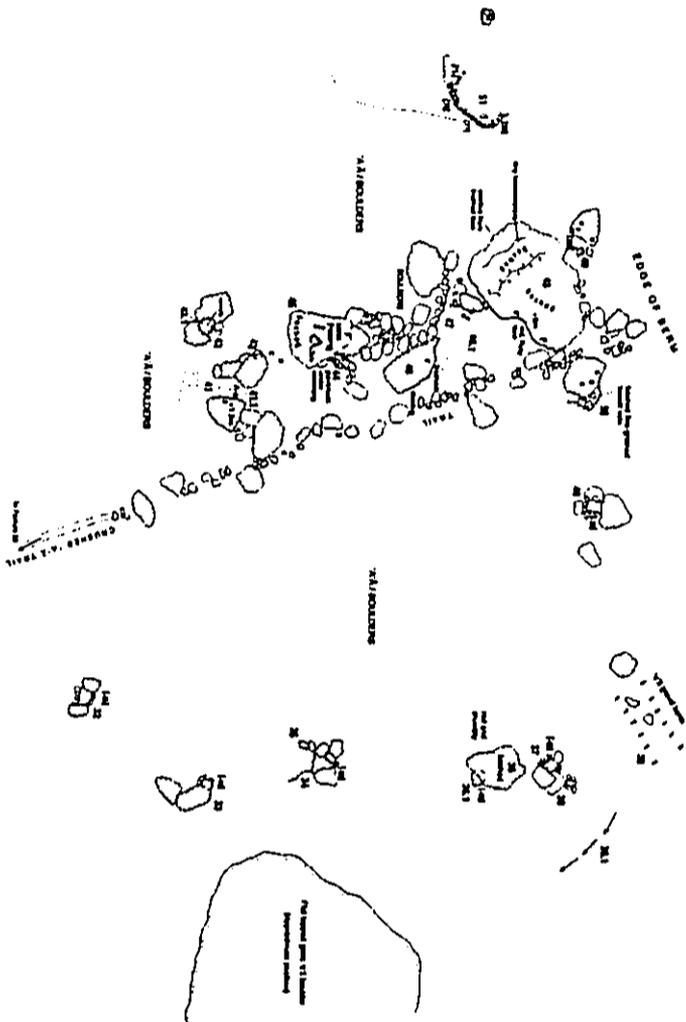


Site 23355
Features 182-225
Kakapa Bay, Hawaii Island

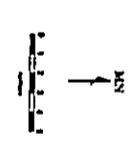


Explanation of Map Symbols

	100' Contour Interval		100' Spot Elevation
	200' Contour Interval		200' Spot Elevation
	300' Contour Interval		300' Spot Elevation
	400' Contour Interval		400' Spot Elevation
	500' Contour Interval		500' Spot Elevation
	600' Contour Interval		600' Spot Elevation
	700' Contour Interval		700' Spot Elevation
	800' Contour Interval		800' Spot Elevation
	900' Contour Interval		900' Spot Elevation
	1000' Contour Interval		1000' Spot Elevation
	1100' Contour Interval		1100' Spot Elevation
	1200' Contour Interval		1200' Spot Elevation
	1300' Contour Interval		1300' Spot Elevation
	1400' Contour Interval		1400' Spot Elevation
	1500' Contour Interval		1500' Spot Elevation
	1600' Contour Interval		1600' Spot Elevation
	1700' Contour Interval		1700' Spot Elevation
	1800' Contour Interval		1800' Spot Elevation
	1900' Contour Interval		1900' Spot Elevation
	2000' Contour Interval		2000' Spot Elevation
	2100' Contour Interval		2100' Spot Elevation
	2200' Contour Interval		2200' Spot Elevation
	2300' Contour Interval		2300' Spot Elevation
	2400' Contour Interval		2400' Spot Elevation
	2500' Contour Interval		2500' Spot Elevation
	2600' Contour Interval		2600' Spot Elevation
	2700' Contour Interval		2700' Spot Elevation
	2800' Contour Interval		2800' Spot Elevation
	2900' Contour Interval		2900' Spot Elevation
	3000' Contour Interval		3000' Spot Elevation
	3100' Contour Interval		3100' Spot Elevation
	3200' Contour Interval		3200' Spot Elevation
	3300' Contour Interval		3300' Spot Elevation
	3400' Contour Interval		3400' Spot Elevation
	3500' Contour Interval		3500' Spot Elevation
	3600' Contour Interval		3600' Spot Elevation
	3700' Contour Interval		3700' Spot Elevation
	3800' Contour Interval		3800' Spot Elevation
	3900' Contour Interval		3900' Spot Elevation
	4000' Contour Interval		4000' Spot Elevation
	4100' Contour Interval		4100' Spot Elevation
	4200' Contour Interval		4200' Spot Elevation
	4300' Contour Interval		4300' Spot Elevation
	4400' Contour Interval		4400' Spot Elevation
	4500' Contour Interval		4500' Spot Elevation
	4600' Contour Interval		4600' Spot Elevation
	4700' Contour Interval		4700' Spot Elevation
	4800' Contour Interval		4800' Spot Elevation
	4900' Contour Interval		4900' Spot Elevation
	5000' Contour Interval		5000' Spot Elevation

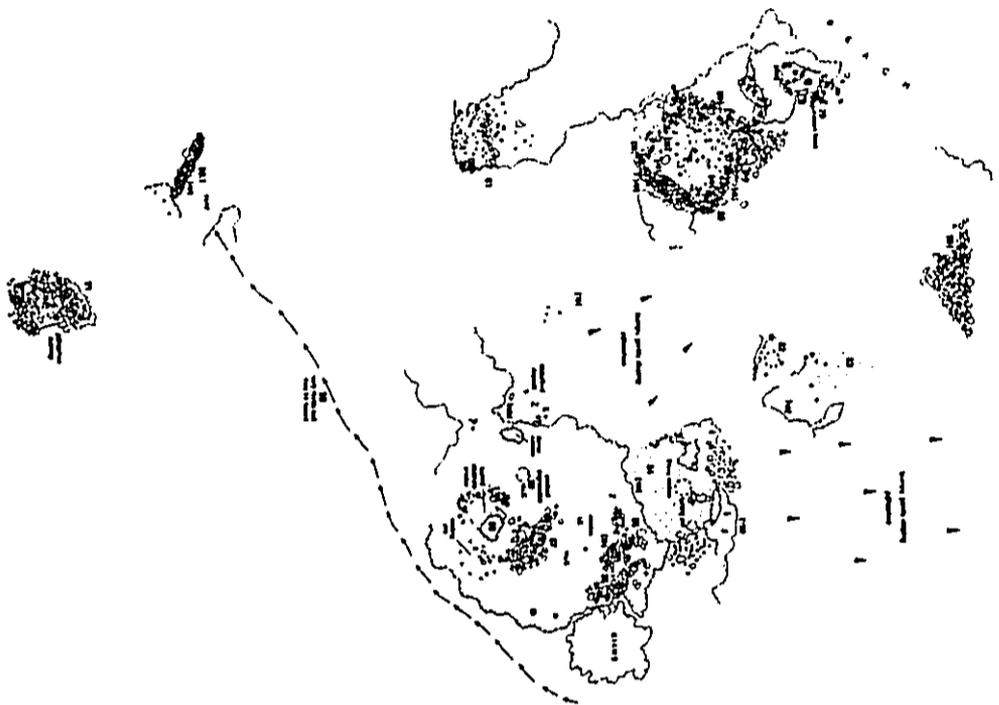


She 23336
 Features 32-51
 Manhi'owali, Hawaii Island

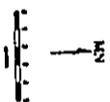


Explanation of Map Symbols

	10 fathoms depth		100 fathoms depth
	20 fathoms depth		200 fathoms depth
	30 fathoms depth		300 fathoms depth
	40 fathoms depth		400 fathoms depth
	50 fathoms depth		500 fathoms depth
	60 fathoms depth		600 fathoms depth
	70 fathoms depth		700 fathoms depth
	80 fathoms depth		800 fathoms depth
	90 fathoms depth		900 fathoms depth
	100 fathoms depth		1000 fathoms depth
	110 fathoms depth		1100 fathoms depth
	120 fathoms depth		1200 fathoms depth
	130 fathoms depth		1300 fathoms depth
	140 fathoms depth		1400 fathoms depth
	150 fathoms depth		1500 fathoms depth
	160 fathoms depth		1600 fathoms depth
	170 fathoms depth		1700 fathoms depth
	180 fathoms depth		1800 fathoms depth
	190 fathoms depth		1900 fathoms depth
	200 fathoms depth		2000 fathoms depth
	210 fathoms depth		2100 fathoms depth
	220 fathoms depth		2200 fathoms depth
	230 fathoms depth		2300 fathoms depth
	240 fathoms depth		2400 fathoms depth
	250 fathoms depth		2500 fathoms depth
	260 fathoms depth		2600 fathoms depth
	270 fathoms depth		2700 fathoms depth
	280 fathoms depth		2800 fathoms depth
	290 fathoms depth		2900 fathoms depth
	300 fathoms depth		3000 fathoms depth
	310 fathoms depth		3100 fathoms depth
	320 fathoms depth		3200 fathoms depth
	330 fathoms depth		3300 fathoms depth
	340 fathoms depth		3400 fathoms depth
	350 fathoms depth		3500 fathoms depth
	360 fathoms depth		3600 fathoms depth
	370 fathoms depth		3700 fathoms depth
	380 fathoms depth		3800 fathoms depth
	390 fathoms depth		3900 fathoms depth
	400 fathoms depth		4000 fathoms depth
	410 fathoms depth		4100 fathoms depth
	420 fathoms depth		4200 fathoms depth
	430 fathoms depth		4300 fathoms depth
	440 fathoms depth		4400 fathoms depth
	450 fathoms depth		4500 fathoms depth
	460 fathoms depth		4600 fathoms depth
	470 fathoms depth		4700 fathoms depth
	480 fathoms depth		4800 fathoms depth
	490 fathoms depth		4900 fathoms depth
	500 fathoms depth		5000 fathoms depth

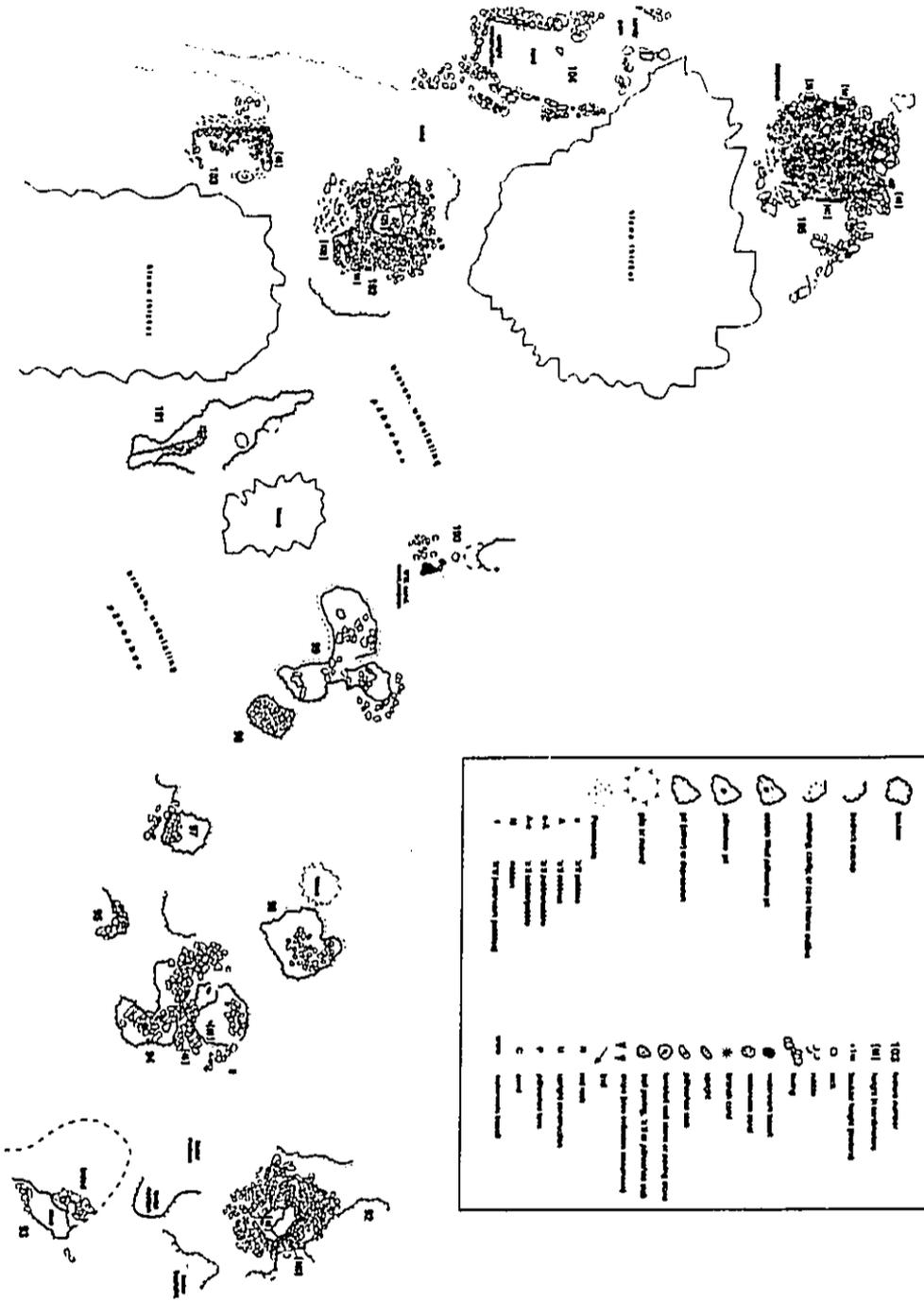


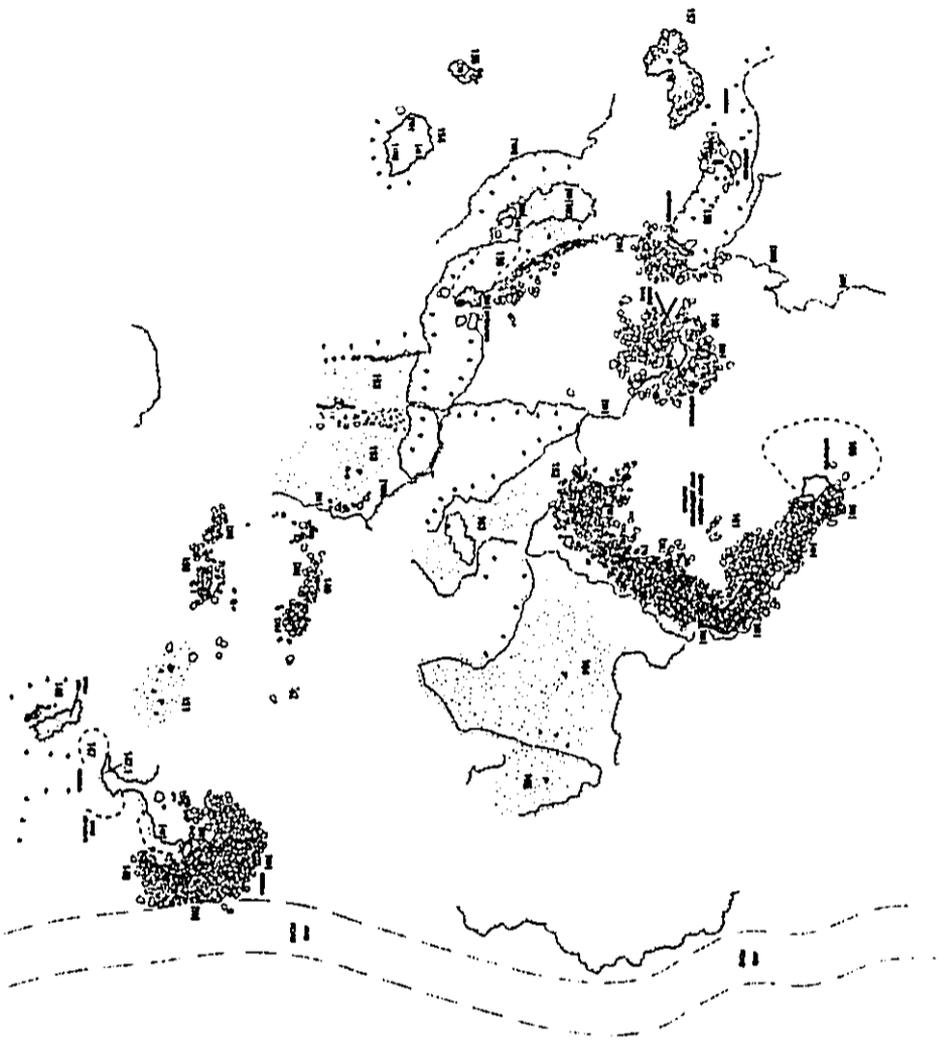
Site 23356
Features 78-91
Manihōwahi, Hawaii Island



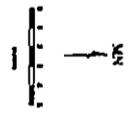
Explanation of Map Symbols

	100	Feature 78-91
	101	Feature 78-91
	102	Feature 78-91
	103	Feature 78-91
	104	Feature 78-91
	105	Feature 78-91
	106	Feature 78-91
	107	Feature 78-91
	108	Feature 78-91
	109	Feature 78-91
	110	Feature 78-91
	111	Feature 78-91
	112	Feature 78-91
	113	Feature 78-91
	114	Feature 78-91
	115	Feature 78-91
	116	Feature 78-91
	117	Feature 78-91
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	119	Feature 78-91
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	197	Feature 78-91
	198	Feature 78-91
	199	Feature 78-91
	200	Feature 78-91



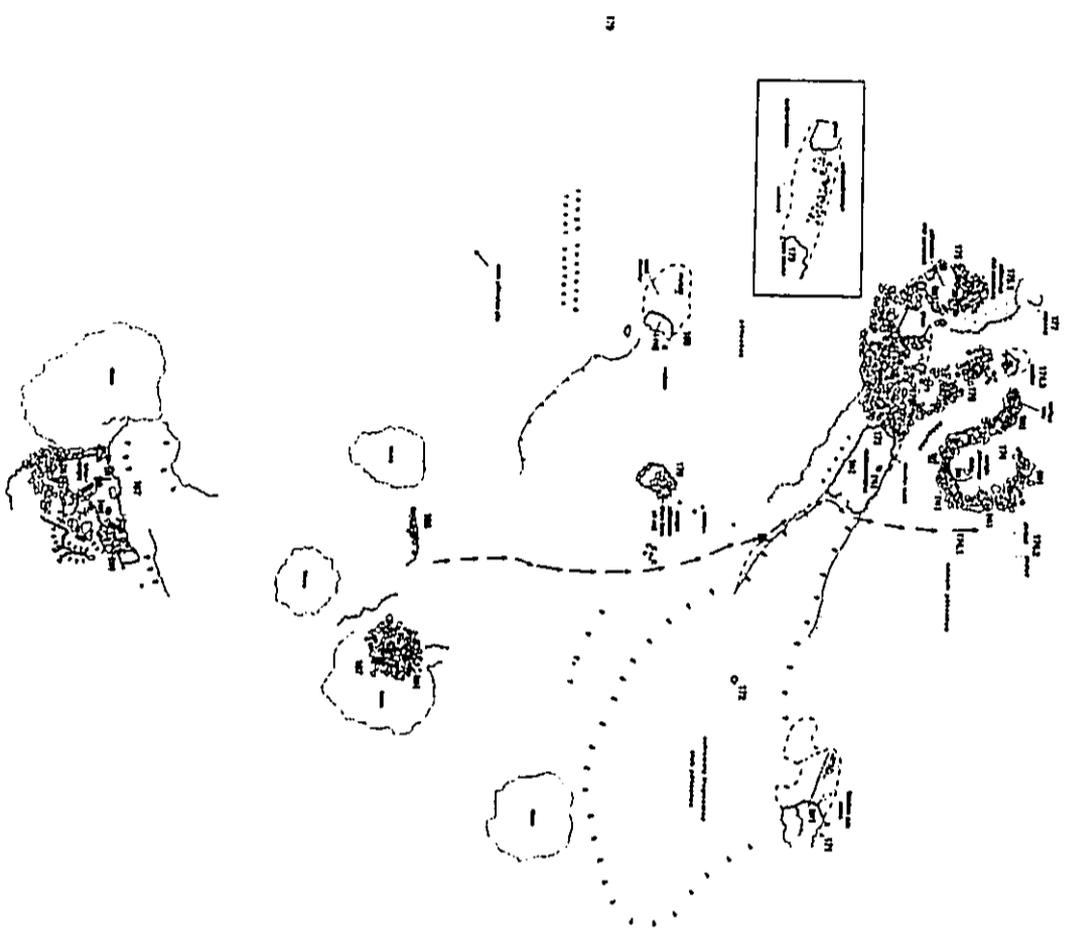


Site 23356
 Features 146-165
 Manihōwahi, Hawaii Island

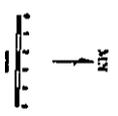


Explanation of Map Symbols

	140 Dotted pattern
	141 Solid black area
	142 Dashed line
	143 Solid line
	144 Dotted pattern
	145 Dotted pattern
	146 Dotted pattern
	147 Dotted pattern
	148 Dotted pattern
	149 Dotted pattern
	150 Dotted pattern
	151 Dotted pattern
	152 Dotted pattern
	153 Dotted pattern
	154 Dotted pattern
	155 Dotted pattern
	156 Dotted pattern
	157 Dotted pattern
	158 Dotted pattern
	159 Dotted pattern
	160 Dotted pattern
	161 Dotted pattern
	162 Dotted pattern
	163 Dotted pattern
	164 Dotted pattern
	165 Dotted pattern



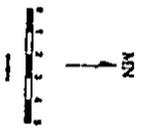
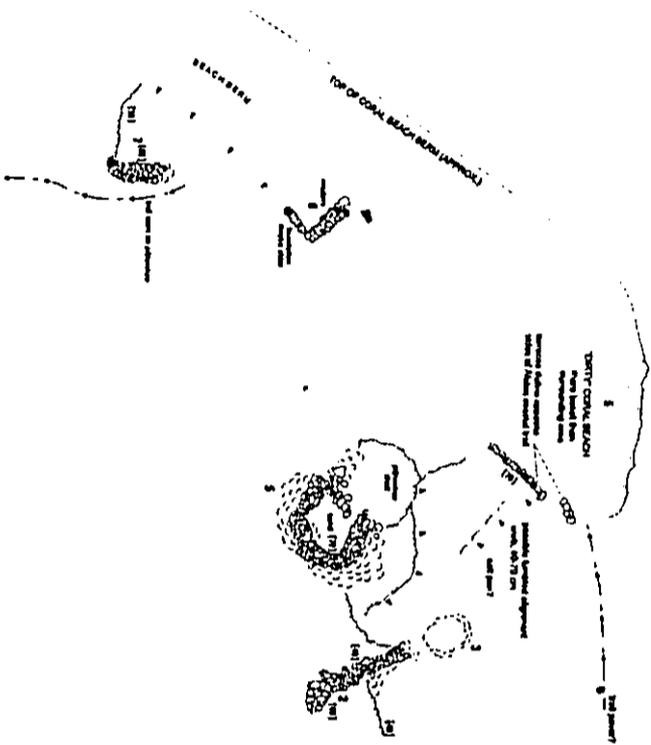
Site 23356
 Features 166-179
 Maui, Hawaii, Hawaiian Islands



Explanation of Map Symbols

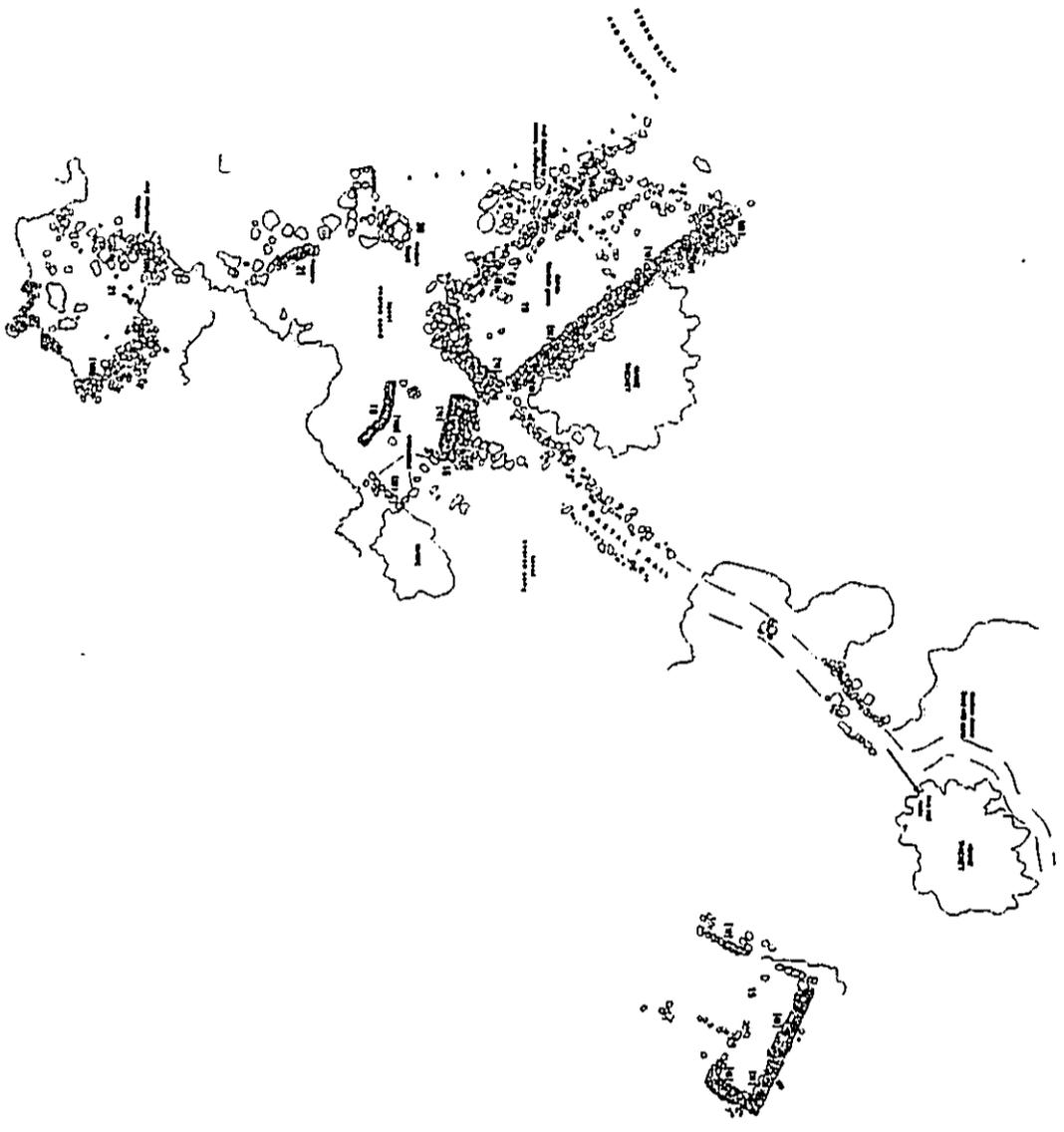
	166 Boundary		179 Shaded Area
	167 Boundary		178 Circle with Dot
	168 Boundary		177 Square with Dot
	169 Triangle with Dot		176 Circle with Cross
	170 Square with Cross		175 Circle with Vertical Line
	171 Circle with Horizontal Line		174 Circle with Diagonal Line
	172 Circle with Diagonal Line		173 Circle with Horizontal Line
	173 Circle with Vertical Line		174 Circle with Diagonal Line
	174 Circle with Horizontal Line		175 Circle with Vertical Line
	175 Circle with Diagonal Line		176 Circle with Horizontal Line
	176 Circle with Vertical Line		177 Circle with Diagonal Line
	177 Circle with Horizontal Line		178 Circle with Vertical Line
	178 Circle with Diagonal Line		179 Circle with Horizontal Line

Site 23357
 Features 1-7
 Punaioa Point, Hawaii Island



Explanation of Map Symbols

	100	Stippled Area
	101	Beach Strip
	102	Top of Coastal Bluff (approx.)
	103	Feature 1
	104	Feature 2
	105	Feature 3
	106	Feature 4
	107	Feature 5
	108	Feature 6
	109	Feature 7
	110	North Arrow
	111	Scale Bar

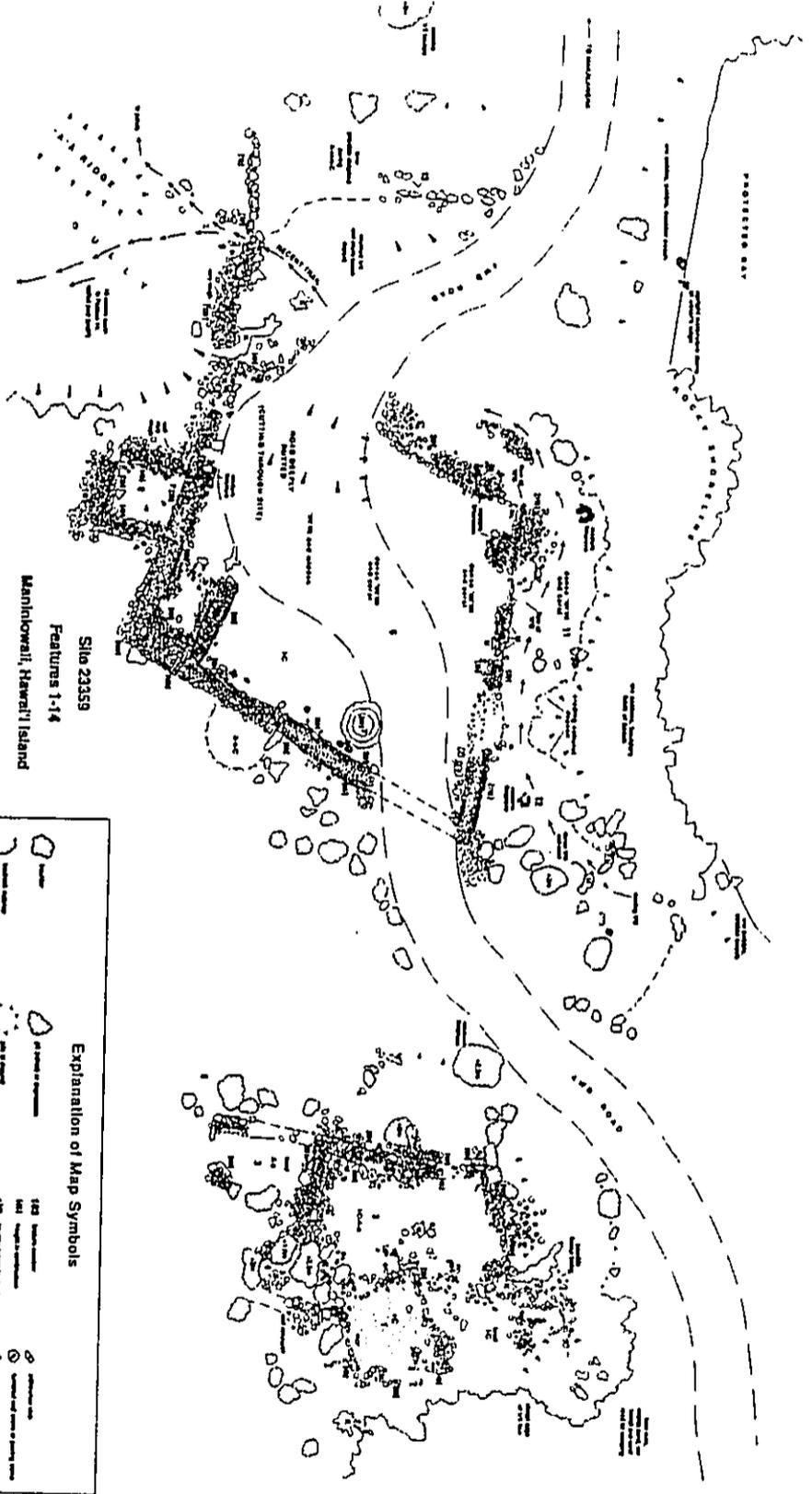


Site 23357
 Features 15-22
 Punaloa Point, Hawaii I Island



Explanation of Map Symbols

	100 Meter contour		Well
	500 Meter contour		Water tank
	1000 Meter contour		Water tank (1000 Gallons)
	1500 Meter contour		Water tank (500 Gallons)
	2000 Meter contour		Water tank (250 Gallons)
	2500 Meter contour		Water tank (125 Gallons)
	3000 Meter contour		Water tank (62.5 Gallons)
	3500 Meter contour		Water tank (31.25 Gallons)
	4000 Meter contour		Water tank (15.625 Gallons)
	4500 Meter contour		Water tank (7.8125 Gallons)
	5000 Meter contour		Water tank (3.90625 Gallons)
	5500 Meter contour		Water tank (1.953125 Gallons)
	6000 Meter contour		Water tank (0.9765625 Gallons)
	6500 Meter contour		Water tank (0.48828125 Gallons)
	7000 Meter contour		Water tank (0.244140625 Gallons)
	7500 Meter contour		Water tank (0.1220703125 Gallons)
	8000 Meter contour		Water tank (0.06103515625 Gallons)
	8500 Meter contour		Water tank (0.030517578125 Gallons)
	9000 Meter contour		Water tank (0.0152587890625 Gallons)
	9500 Meter contour		Water tank (0.00762939453125 Gallons)
	10000 Meter contour		Water tank (0.003814697265625 Gallons)
	10500 Meter contour		Water tank (0.0019073486328125 Gallons)
	11000 Meter contour		Water tank (0.00095367431640625 Gallons)
	11500 Meter contour		Water tank (0.000476837158203125 Gallons)
	12000 Meter contour		Water tank (0.0002384185791015625 Gallons)
	12500 Meter contour		Water tank (0.00011920928955078125 Gallons)
	13000 Meter contour		Water tank (0.000059604644775390625 Gallons)
	13500 Meter contour		Water tank (0.0000298023223876953125 Gallons)
	14000 Meter contour		Water tank (0.00001490116119384765625 Gallons)
	14500 Meter contour		Water tank (0.000007450580596923828125 Gallons)
	15000 Meter contour		Water tank (0.0000037252902984619140625 Gallons)
	15500 Meter contour		Water tank (0.00000186264514923095703125 Gallons)
	16000 Meter contour		Water tank (0.000000931322574615478515625 Gallons)
	16500 Meter contour		Water tank (0.0000004656612873077392578125 Gallons)
	17000 Meter contour		Water tank (0.00000023283064365386962890625 Gallons)
	17500 Meter contour		Water tank (0.000000116415321826934814453125 Gallons)
	18000 Meter contour		Water tank (0.000000582076609134674072265625 Gallons)
	18500 Meter contour		Water tank (0.0000002910383045673370361328125 Gallons)
	19000 Meter contour		Water tank (0.00000014551915228366851806640625 Gallons)
	19500 Meter contour		Water tank (0.000000072759576141834259033203125 Gallons)
	20000 Meter contour		Water tank (0.0000000363797880709171295166015625 Gallons)
	20500 Meter contour		Water tank (0.00000001818989403545856475830078125 Gallons)
	21000 Meter contour		Water tank (0.000000009094947017729282379150390625 Gallons)
	21500 Meter contour		Water tank (0.0000000045474735088646411895751953125 Gallons)
	22000 Meter contour		Water tank (0.00000000227373675443232059478759765625 Gallons)
	22500 Meter contour		Water tank (0.000000001136868377216160297393798828125 Gallons)
	23000 Meter contour		Water tank (0.0000000005684341886080801486968994140625 Gallons)
	23500 Meter contour		Water tank (0.00000000028421709430404007434844970703125 Gallons)
	24000 Meter contour		Water tank (0.000000000142108547152020037174224853515625 Gallons)
	24500 Meter contour		Water tank (0.0000000000710542735760100185871124267578125 Gallons)
	25000 Meter contour		Water tank (0.00000000003552713678800500929355621337890625 Gallons)
	25500 Meter contour		Water tank (0.000000000017763568394002504646778106689453125 Gallons)
	26000 Meter contour		Water tank (0.0000000000088817841970012523233890533447265625 Gallons)
	26500 Meter contour		Water tank (0.0000000000044408920985006261616945266723828125 Gallons)
	27000 Meter contour		Water tank (0.00000000000222044604925031308084726333619140625 Gallons)
	27500 Meter contour		Water tank (0.000000000001110223024625156440423631668095703125 Gallons)
	28000 Meter contour		Water tank (0.0000000000005551115123125782202118158340478515625 Gallons)
	28500 Meter contour		Water tank (0.000000000000277555756156289110105907917023928125 Gallons)
	29000 Meter contour		Water tank (0.0000000000001387778780781445550529539585119640625 Gallons)
	29500 Meter contour		Water tank (0.00000000000006938893903907227752647697925598203125 Gallons)
	30000 Meter contour		Water tank (0.000000000000034694469519536138763238489627991015625 Gallons)
	30500 Meter contour		Water tank (0.0000000000000173472347597680693816192448139955078125 Gallons)
	31000 Meter contour		Water tank (0.00000000000000867361737988403469080962240799775390625 Gallons)
	31500 Meter contour		Water tank (0.000000000000004336808689942017345404811207998876953125 Gallons)
	32000 Meter contour		Water tank (0.0000000000000021684043449710086727024056039994384765625 Gallons)
	32500 Meter contour		Water tank (0.00000000000000108420217248550433635120280199971923828125 Gallons)
	33000 Meter contour		Water tank (0.000000000000000542101086242752168175601400999859619140625 Gallons)
	33500 Meter contour		Water tank (0.0000000000000002710505431213760840878007004999298095703125 Gallons)
	34000 Meter contour		Water tank (0.00000000000000013552527156068804204390035024996490478515625 Gallons)
	34500 Meter contour		Water tank (0.0000000000000000677626357803440210219501751249932473928125 Gallons)
	35000 Meter contour		Water tank (0.00000000000000003388131789017201051097508756249662369140625 Gallons)
	35500 Meter contour		Water tank (0.000000000000000016940658945086005254987543781248311845703125 Gallons)
	36000 Meter contour		Water tank (0.0000000000000000084703294725430026274937718906241559234478125 Gallons)
	36500 Meter contour		Water tank (0.00000000000000000423516473627150131374688594531207796172390625 Gallons)
	37000 Meter contour		Water tank (0.000000000000000002117582368135750656873442972656103980861953125 Gallons)
	37500 Meter contour		Water tank (0.0000000000000000010587911840678753284386714863280519904309375 Gallons)
	38000 Meter contour		Water tank (0.00000000000000000052939559203393766421933574316402599521546875 Gallons)
	38500 Meter contour		Water tank (0.000000000000000000264697796016968832109667871582012997607734375 Gallons)
	39000 Meter contour		Water tank (0.0000000000000000001323488980084844160548339357910064988038671875 Gallons)
	39500 Meter contour		Water tank (0.0000000000000000000661744490042422080274169678955032494019339375 Gallons)
	40000 Meter contour		Water tank (0.0000000000000000000330872245021211040137084839477516247009669375 Gallons)
	40500 Meter contour		Water tank (0.00000000000000000001654361225106055200685424197237581235048346875 Gallons)
	41000 Meter contour		Water tank (0.00000000000000000000827180612553027600342712098618790627241734375 Gallons)
	41500 Meter contour		Water tank (0.00000000000000000000413590306276513800171356049309395136208671875 Gallons)
	42000 Meter contour		Water tank (0.00000000000000000000206795153138256900085678024654697568103389375 Gallons)
	42500 Meter contour		Water tank (0.000000000000000000001033975765691284500428390123273487840516946875 Gallons)
	43000 Meter contour		Water tank (0.0000000000000000000005169878828456422502141950616367439202584734375 Gallons)
	43500 Meter contour		Water tank (0.00000000000000000000025849394142282112501070975081683719602923671875 Gallons)
	44000 Meter contour		Water tank (0.000000000000000000000129246970711410562505354875040818598014618359375 Gallons)
	44500 Meter contour		Water tank (0.0000000000000000000000646234853557052812502677237502040900730917796875 Gallons)
	45000 Meter contour		Water tank (0.00000000000000000000003231174267785264062513386187501020450364588984375 Gallons)
	45500 Meter contour		Water tank (0.000000000000000000000016155871338926320312669309375051022501822944921875 Gallons)
	46000 Meter contour		Water tank (0.0000000000000000000000080779356694631601563346593750255112509114724609375 Gallons)
	46500 Meter contour		Water tank (0.00000000000000000000000403896783473158007816673296875012755625455736046875 Gallons)
	47000 Meter contour		Water tank (0.000000000000000000000002019483917365790039083366484375063778127278680234375 Gallons)
	47500 Meter contour		Water tank (0.0000000000000000000000010097419586828950195416832421875031889063639401171875 Gallons)
	48000 Meter contour		Water tank (0.00000000000000000000000050487097934144750977209162109375015944531819700859375 Gallons)
	48500 Meter contour		Water tank (0.000000000000000000000000252435489670723754886045810546875079722659098504296875 Gallons)
	49000 Meter contour		Water tank (0.0000000000000000000000001262177448353618774430229052734375039861329542521484375 Gallons)
	49500 Meter contour		Water tank (0.00000000000000000000000006310887241768093872165145263671875019930662712607421875 Gallons)
	50000 Meter contour		Water tank (0.0000000000000000000000000315544362088404693608257263183937509965331135630371875 Gallons)
	50500 Meter contour		Water tank (0.00000000000000000000000001577721810442023468041286315919375049826655678151859375 Gallons)
	51000 Meter contour		Water tank (0.000000000000000000000000007888609052210117340206431579593750249133278390759296875 Gallons)
	51500 Meter contour		Water tank (0.0000000000000000000000000039443045261050586701032157897968750124566663953796484375 Gallons)
	52000 Meter contour		Water tank (0.00000000000000000000000000197215226305252933505160789489843750622833319768982421875 Gallons)
	52500 Meter contour		Water tank (0.0000000000000000000000000009860761315262646675258039474492187503114166598949121875 Gallons)
	53000 Meter contour		Water tank (0.000000000000000000000000000493038065763132333762901973724609375015570829949474609375 Gallons)
	53500 Meter contour		Water tank (0.0000000000000000000000000002465190328815616688114509868624609375077854149747373046875 Gallons)
	54000 Meter contour		Water tank (0.0000000000000000000000000001232595164407808344057254934312304687503892707487368671875 Gallons)
	54500 Meter contour		Water tank (0.00000000000000000000000000006162975822039041720286274671561523437501946353741868359375 Gallons)
	55000 Meter contour		



Silo 23359
Features 1-14
Manihowai, Hawaii Island

Explanation of Map Symbols

	100	Contour line		Water tower
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well
	100	Contour line		Well

REDUCED IN FILE

Archaeological Inventory Survey of Portions

**Volume II
Oversize Maps**

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December 2002

y of Portions of Kekaha Kai State Park

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ecember 2002

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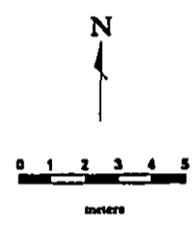
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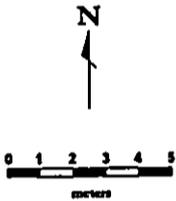
Site 50-10-18-23355
 Features 1-46
 Kakapa Bay, Hawai'i Island



Explanation of Map Symbols			
	boulder	103	feature number
	bedrock outcrop	(80)	height in centimeters
	overhang, cavity, or cave interior outline	+1m	boulder height (meters)
	cobble filled pāhoehoe pit	○	rock
	pāhoehoe pit	⋈	trillite
	pit (other) or depression	⊙	waterworn basalt
	pile or mound	⊕	waterworn coral
	'a' 'a' pebbles	✱	branch coral
	'A' 'A' cobbles	⊞	upright
	'a-A' 'a' pebble/cobble	⊟	pāhoehoe slab
	'A-a' 'A' cobble/pebble	⊠	tumbled wall stone or paving stone
	midden	⊡	trill paving, 'a' 'a' or pāhoehoe slab
	'i' 'i' (waterworn pebbles)	▽	slope (size indicates steepness)
		↘	trail
		R	red rock
		U	upright construction
		P	pāhoehoe lava
		C	coral
		wrb	waterworn basalt



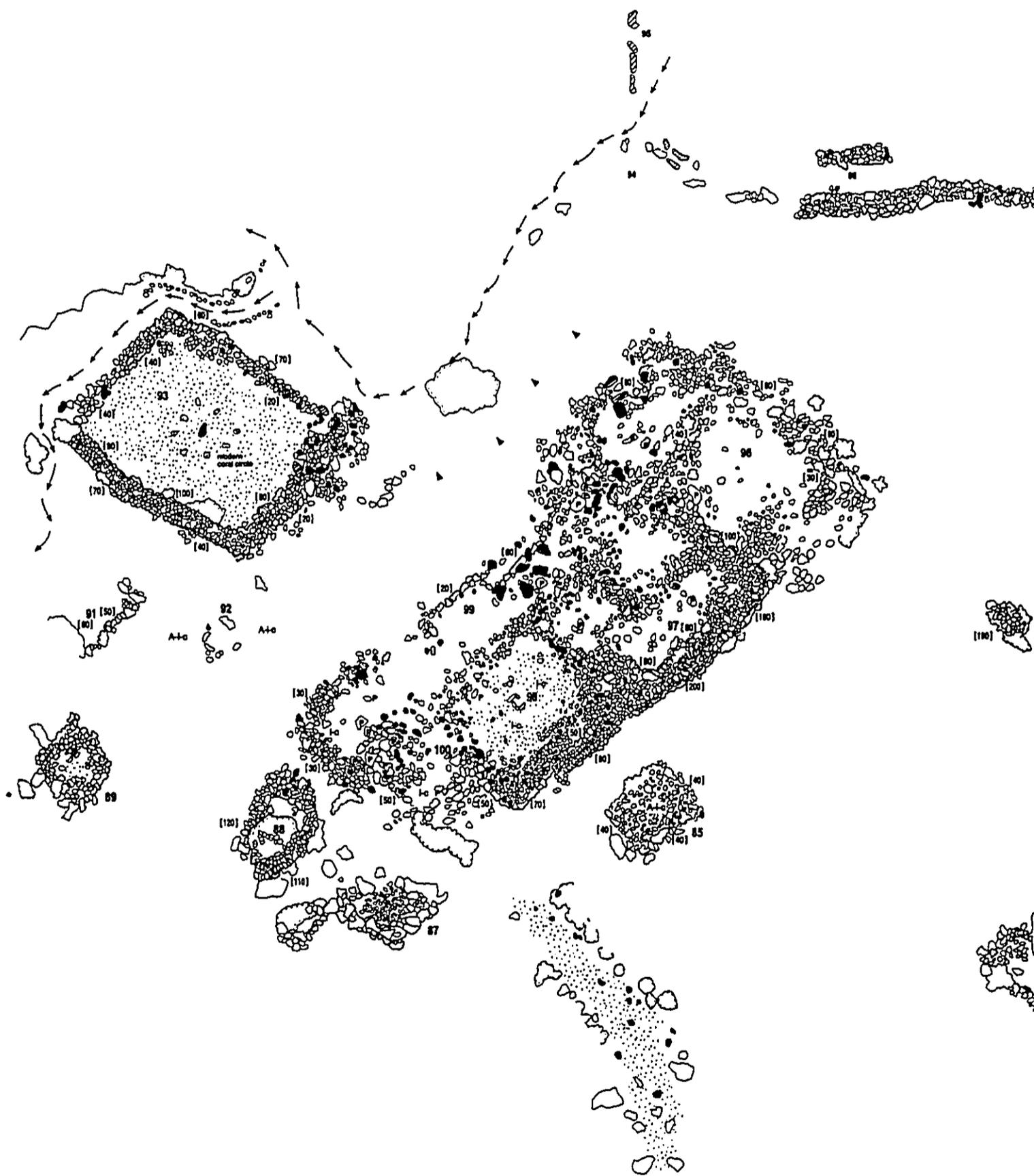
Site 50-10-18-23355
 Features 47-82
 Kakapa Bay, Hawai'i Island



Explanation of Map Symbols

	boulder		feature number
	bedrock outcrop		height in centimeters
	overhang, cavity, or cave interior outline		boulder height (meters)
	cobble filled pahoehoe pit		rock
	pahoehoe pit		rubble
	pit (other) or depression		tacing
	pile or mound		waterworn basalt
	Pavements		waterworn coral
a	'a'i pebbles		branch coral
A	'a'i cobbles		upright
a-A	'a'i pebble/cobble		pahoehoe slab
A-a	'a'i cobble/pebble		tumbled wall stone or paving stone
M	midden		trail paving, 'a'i or pahoehoe slab
I	'i'i (waterworn pebbles)		slope (size indicates steepness)
			trail
			red rock
			upright construction
			pahoehoe lava
			coral
			waterworn basalt

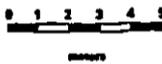
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Site 50-10-18-23355
 Features 83-100
 Kakapa Bay, Hawai'i Island



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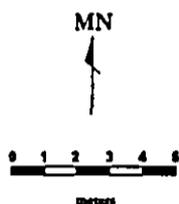
Explanation of Map Symbols

	boulder	103	feature number
	bedrock outcrop	(80)	height in centimeters
	overhang, cavity, or cave interior outline	+1m	boulder height (meters)
	cobble filled pahoehoe pit	○	rock
	pahoehoe pit	⋄	rubble
	pit (other) or depression	⊖	tearing
	pile or mound	●	waterworn basalt
	Pavements	⊙	waterworn coral
a	1/8 pebbles	*	branch coral
A	1/4 cobbles	⊖	upright
a-A	1/8 pebble/cobble	⊖	pahoehoe slab
A-a	1/4 cobble/pebble	⊖	tumbled wall stone or paving stone
M	midden	⊖	trail paving, 1/8 or pahoehoe slab
I	W (waterworn pebbles)	∇	slope (size indicates steepness)
		∇	trail
		R	red rock
		U	upright construction
		P	pahoehoe lava
		C	coral
		wrb	waterworn basalt



MAPS

Site 50-10-18-16059
 Features 1-69
 Kakapa Bay, Hawai'i Island



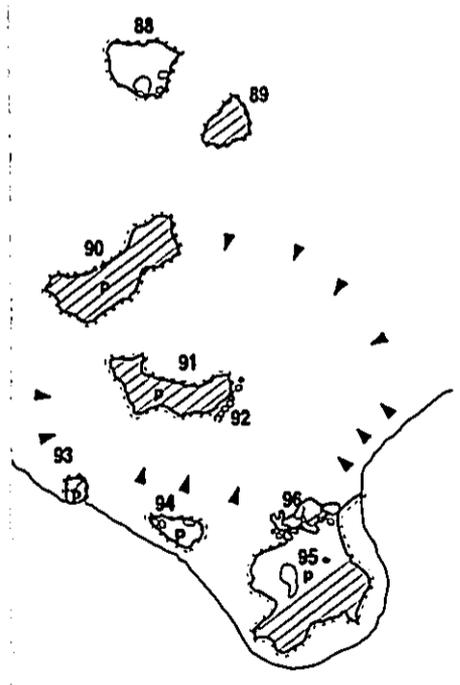
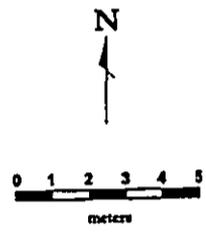
Explanation of Map Symbols

	boulder		103 feature number
	bedrock outcrop		[80] height in centimeters
	overhang, cavity, or cave interior outline		+1m boulder height (meters)
	cobble filled pāhoehoe pit		○ rock
	pāhoehoe pit		⋈ rubble
	pit (other) or depression		⋈ facing
	pile or mound		● waterworn basalt
	Pavements		⊙ waterworn coral
	1/8 pebbles		* branch coral
	1/4 cobbles		⊖ upright
	1/8 pebble/cobble		⊖ pāhoehoe slab
	1/4 cobble/pebble		⊖ tumbled wall stone or paving stone
	midden		⊖ trail paving, 1/8 or pāhoehoe slab
	1/8 (waterworn pebbles)		∇ slope (size indicates steepness)
			→ trail
			R red rock
			U upright construction
			P pāhoehoe lava
			C coral
			web waterworn basalt

MAPS

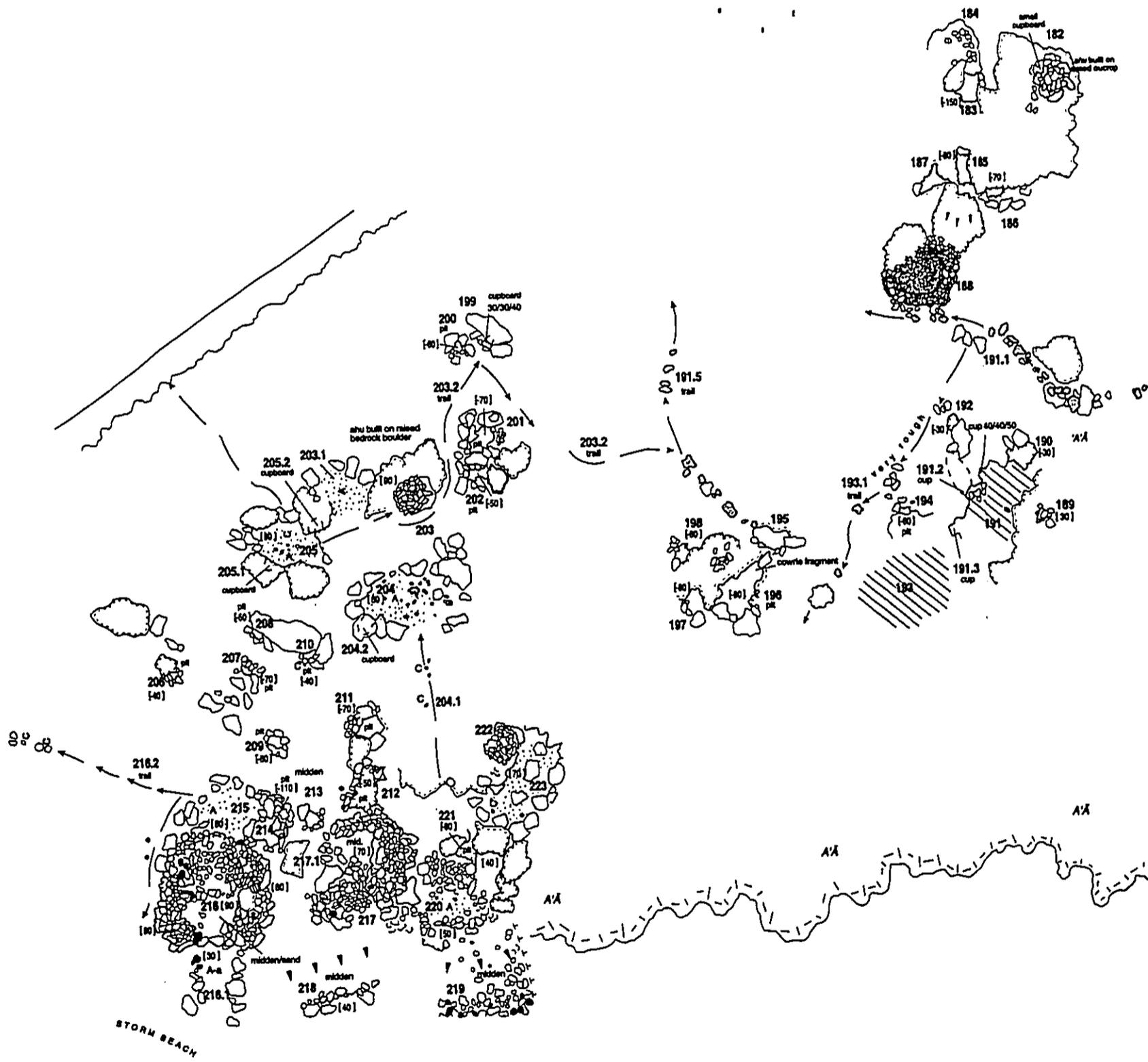


Site 50-10-18-16059
 Features 70-99
 Kakapa Bay, Hawai'i Island

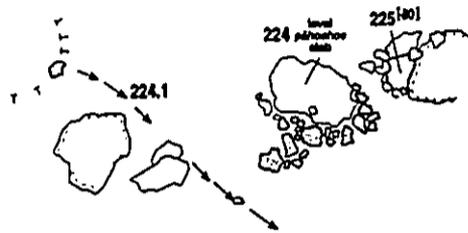
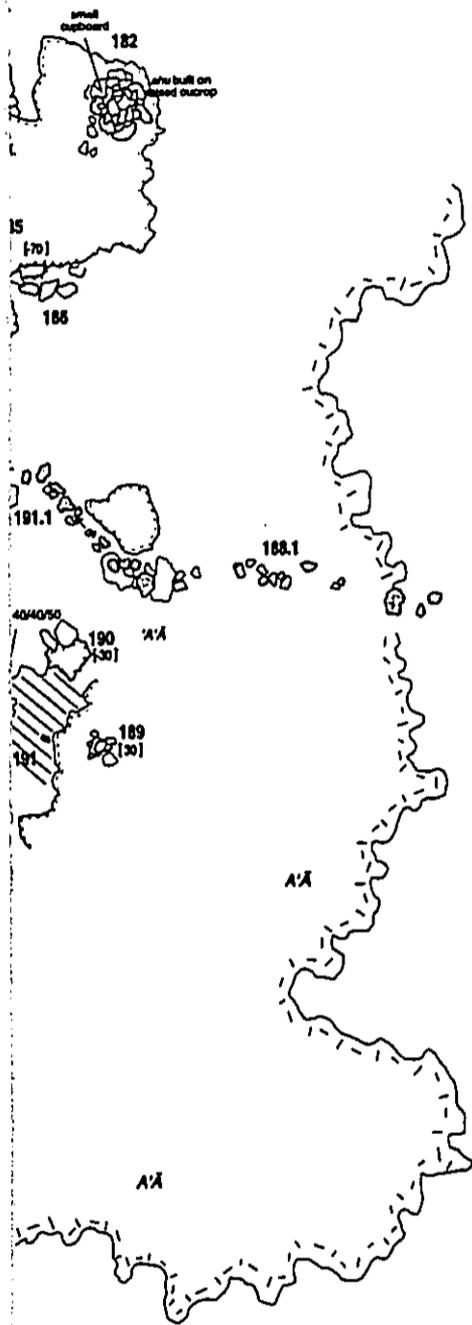


Explanation of Map Symbols

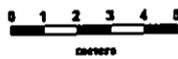
	boulder	103	feature number
	bedrock outcrop	[60]	height in centimeters
	overhang, cavity, or cave interior outline	<1m	boulder height (meters)
	cobble filled pāhoehoe pit	○	rock
	pāhoehoe pit	⋈	rubble
	pit (other) or depression		facing
	pile or mound		waterworn basalt
	Pavements		waterworn coral
s	'a'i pebbles		branch coral
A	'a'i cobbles		upright
s-A	'a'i pebble/cobble		pāhoehoe slab
A-s	'a'i cobble/pebble		tumbled wall stone or paving stone
M	midden		trail paving, 'a'i or pāhoehoe slab
I	'a'i (waterworn pebbles)		slope (size indicates steepness)
			trail
		R	red rock
		U	upright construction
		P	pāhoehoe lava
		C	coral
		wrb	waterworn basalt



MAPS



Site 23355
Features 182-225
Kakapa Bay, Hawai'i Island



Explanation of Map Symbols

	boulder	103	feature number
	bedrock outcrop	(80)	height in centimeters
	overhang, cavity, or cave interior outline	+1m	boulder height (meters)
	cobble filled pāhoehoe pit	○	rock
	pāhoehoe pit	⋈	ruddle
	pit (other) or depression	⊖	icing
	pile or mound	●	waterworn basalt
	Pavements	⊙	waterworn coral
	a 'a' pebbles	*	branch coral
	A 'a' cobbles	⊖	upright
	a-A 'a' pebble/cobble	⊖	pāhoehoe slab
	A-a 'a' cobble/pebble	⊖	tumbled wall stone or paving stone
	midden	⊖	trail paving, 'a' or pāhoehoe slab
	l 'a' (waterworn pebbles)	∇	slope (size indicates steepness)
		—	trail
		R	red rock
		U	upright construction
		P	pāhoehoe lava
		C	coral
		wrb	waterworn basalt

MAPS



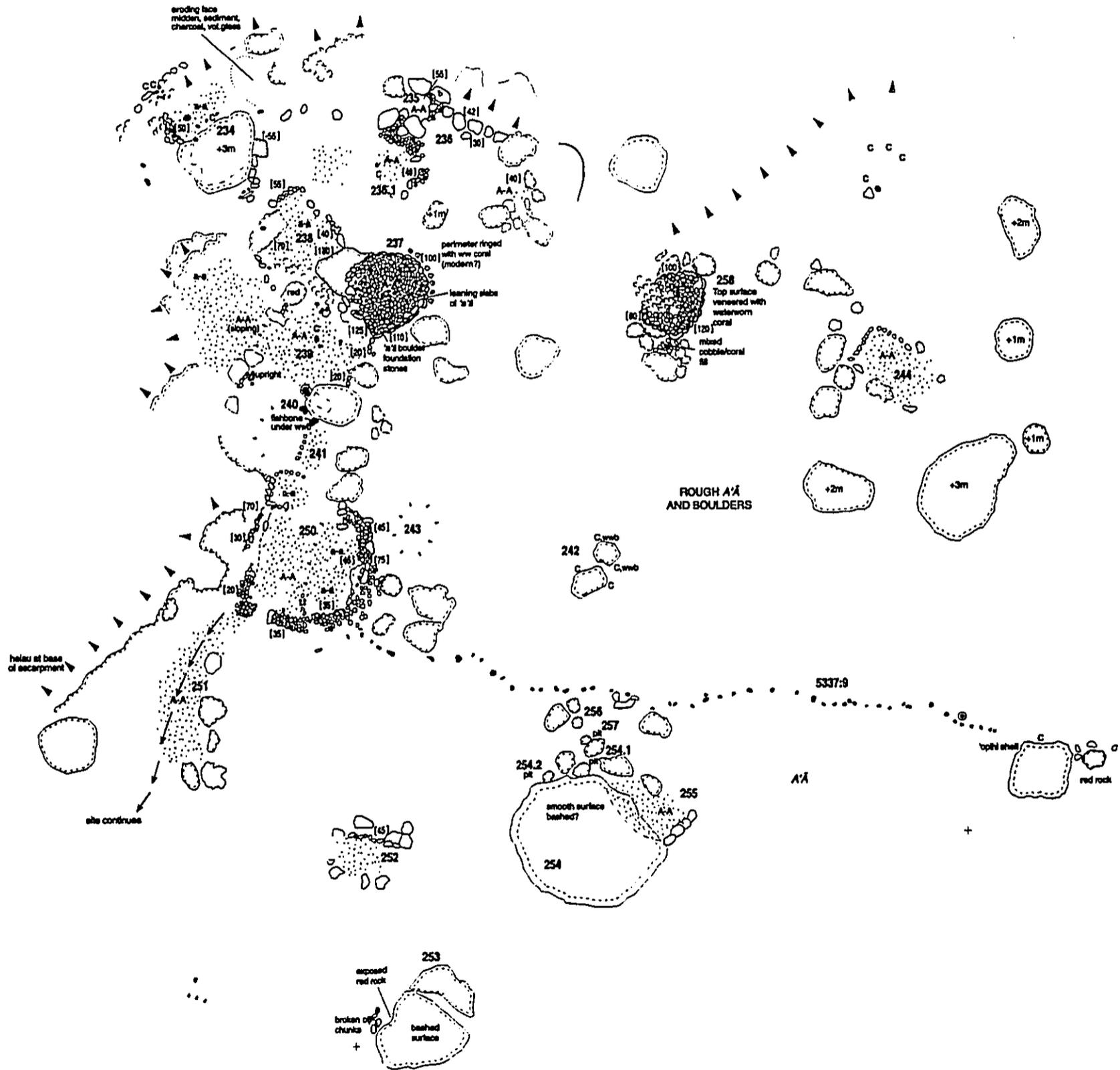
Site 23355
Features 229-230
Kakapa Bay, Hawai'i Island

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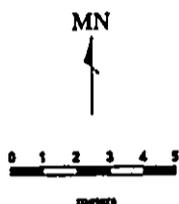
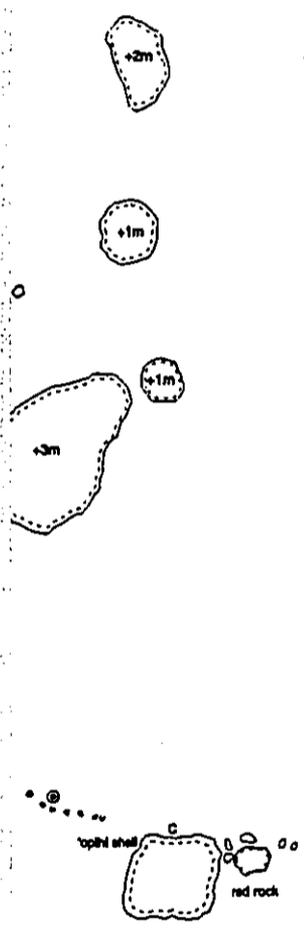
Explanation of Map Symbols

	boulder	103	feature number
	bedrock outcrop	[60]	height in centimeters
	overhang, cavity, or cave interior outline	+1m	boulder height (meters)
	cobble filled pāhoehoe pit		rock
	pāhoehoe pit		rubble
	pit (other) or depression		facing
	pile or mound		waterworn basalt
Pavements			waterworn coral
a	'a'i pebbles		branch coral
A	'a'i cobbles		upright
a-A	'a'i pebble/cobble		pāhoehoe slab
A-a	'a'i cobble/pebble		tumbled wall stone or paving stone
M	midden		trail paving, 'a'i or pāhoehoe slab
i	'a'i (waterworn pebbles)		slope (size indicates steepness)
			trail
		R	red rock
		U	upright construction
		P	pāhoehoe lava
		C	coral
		wwb	waterworn basalt



MAPS

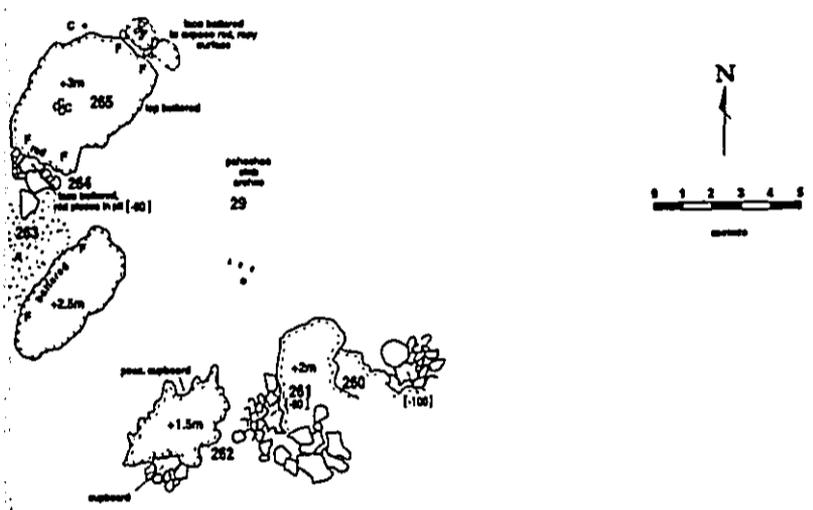
Site 23355
 Features 234-258
 Kakapa Bay, Hawai'i Island



Explanation of Map Symbols

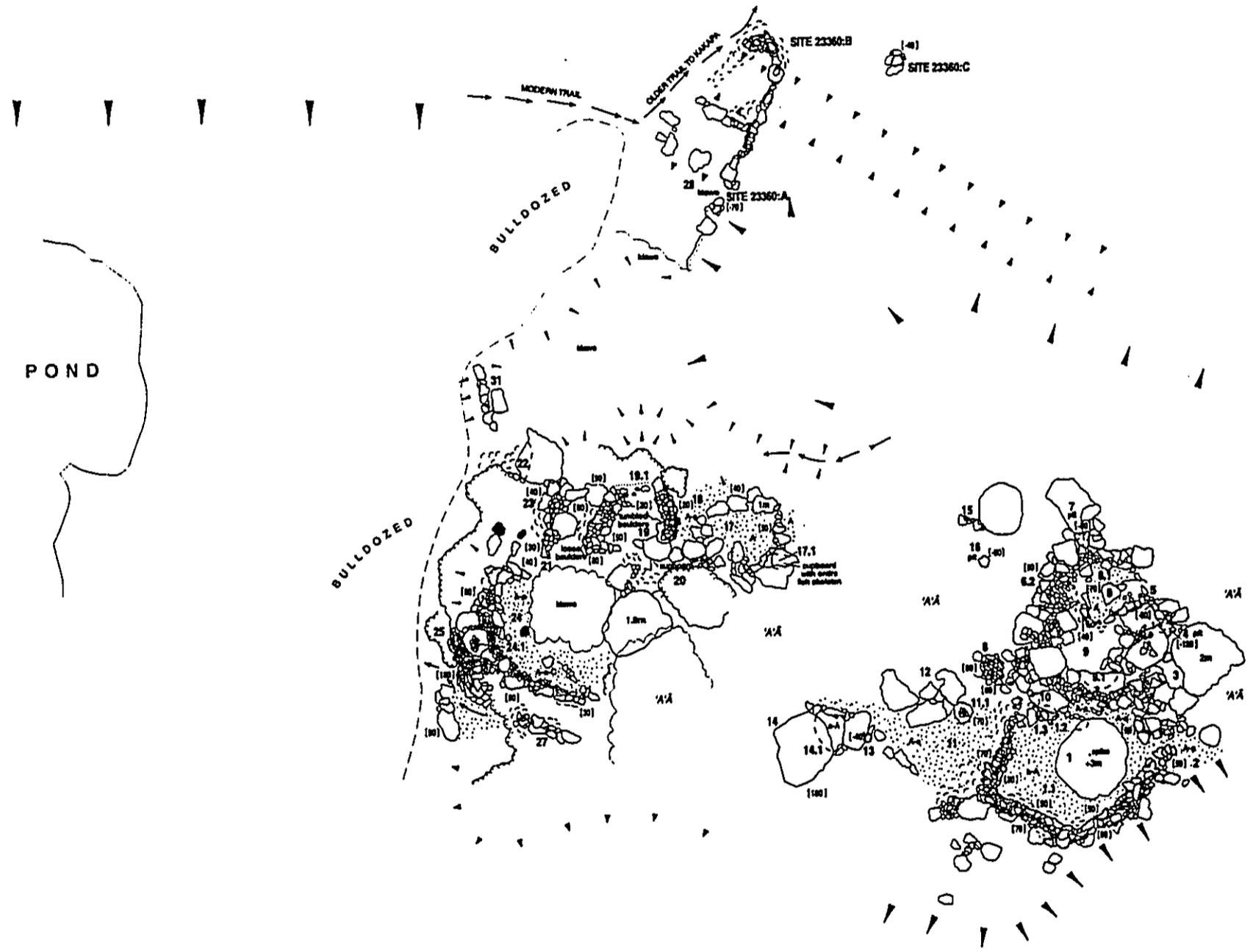
	boulder	103	feature number
	bedrock outcrop	(80)	height in centimeters
	overhang, cavity, or cave interior outline	+1m	boulder height (meters)
	cobble filled pahoehoe pit	○	rock
	pahoehoe pit		rubble
	pit (other) or depression		facing
	pile or mound		waterworn basalt
Pavements			waterworn coral
a	'a'i pebbles		branch coral
A	'a'i cobble		upright
a-A	'a'i pebble/cobble		pahoehoe slab
A-a	'a'i cobble/pebble		tumbled wall stone or paving stone
M	midden		trail paving, 'a'i or pahoehoe slab
I	'a'i (waterworn pebbles)		slope (size indicates steepness)
			trail
		R	red rock
		U	upright construction
		P	pahoehoe lava
		C	coral
		wrb	waterworn basalt

Site 23355
 Features 259-306
 Kakapa Bay, Hawai'i Island



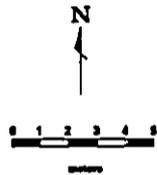
Explanation of Map Symbols

	boulder		feature number
	bedrock outcrop		height in centimeters
	overhang, cavity, or cave interior outline		boulder height (meters)
	cobble filled pāhoehoe pit		rock
	pāhoehoe pit		nubble
	pit (other) or depression		lacing
	pile or mound		waterworn basalt
	Pavements		waterworn coral
A	1/8" pebbles		branch coral
A	1/8" cobbles		upright
e-A	1/8" pebble/cobble		pāhoehoe slab
A-e	1/8" cobble/pebble		lunited wall stone or paving stone
M	midden		trail paving, 1/8" or pāhoehoe slab
I	1/8" (waterworn pebbles)		steps (size indicates steepness)
			trail
			red rock
			upright construction
			pāhoehoe lava
			coral
			waterworn basalt

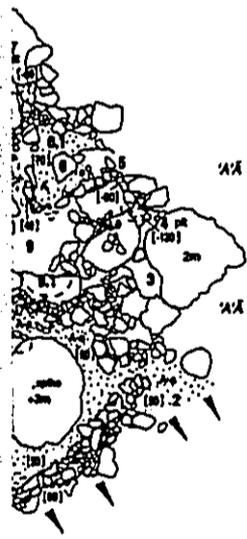


MAPS

Site 23356
Features 92-105
Manini'ōwali, Hawai'i Island

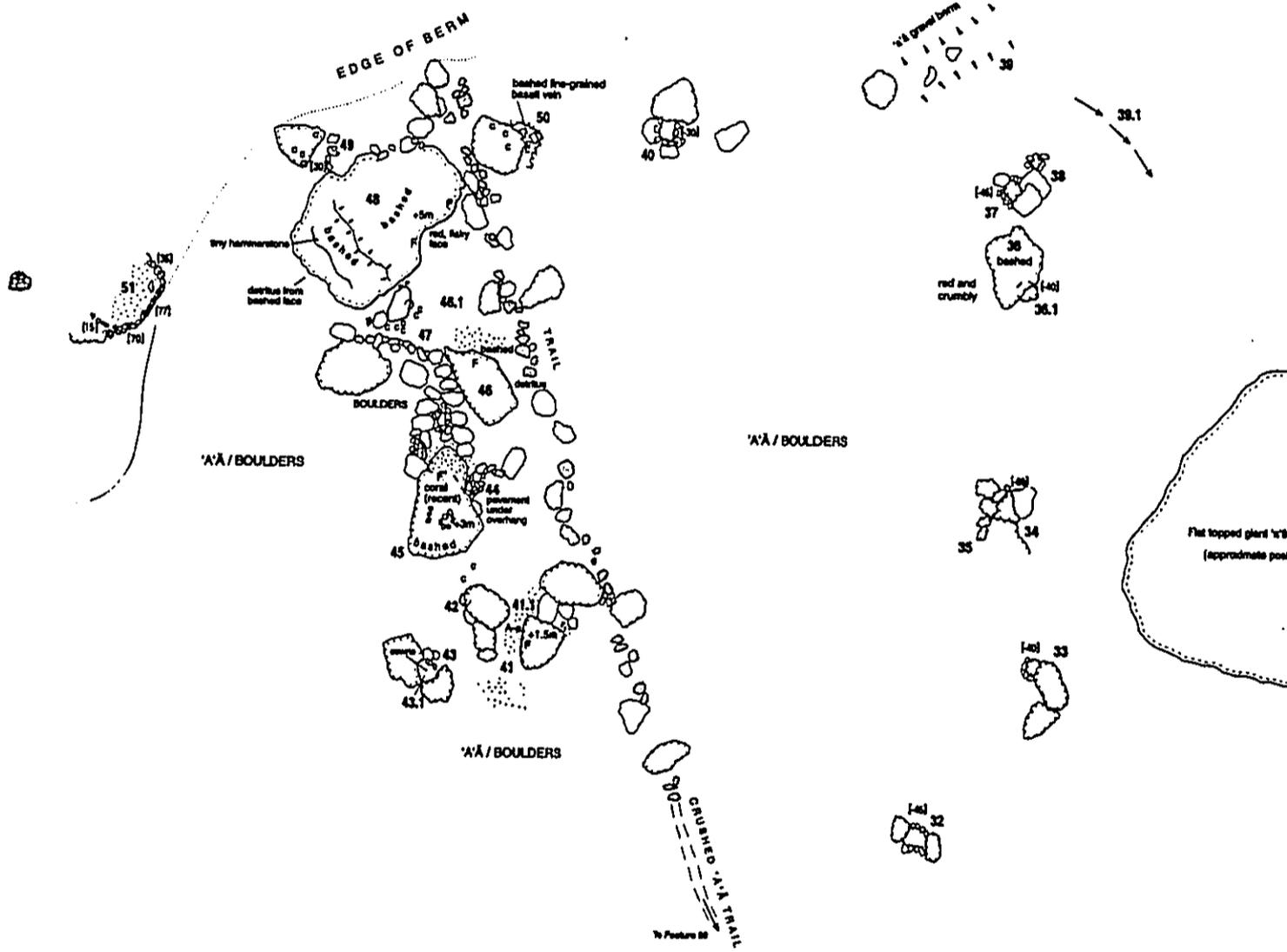


Site 23356, Features A-C also depicted



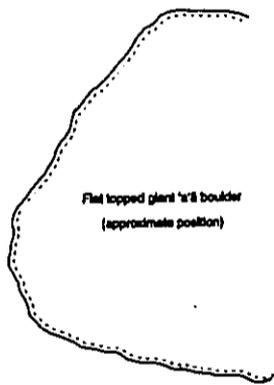
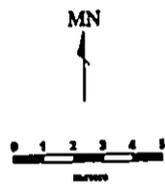
Explanation of Map Symbols	
	boulder
	bedrock outcrop
	overhang, cavity, or lava interior outline
	cobble filled pāhoehoe pit
	pāhoehoe pit
	pit (other) or depression
	pile or mound
	Pavements
a	1/8 pebbles
A	1/8 cobbles
a-A	1/8 pebble/cobble
A-a	1/8 cobble/pebble
M	ribbles
I	1/8 (waterworn pebbles)
103	feature number
(10)	height in centimeters
*1m	boulder height (meters)
○	rock
⋈	rubble
⊙	tidal
⊙	waterworn basalt
⊙	waterworn coral
*	branch coral
⊙	upright
⊙	pāhoehoe slab
⊙	knotted wall stone or paving stone
⊙	trial paving, 1/8 or pāhoehoe slab
∇	slope (also indicates steepness)
—	trail
R	red rock
U	upright construction
P	pāhoehoe lava
C	coral
wrb	waterworn basalt

MAPS



Site 23356
 Features 32-51
 Manini'ōwali, Hawa'i Island

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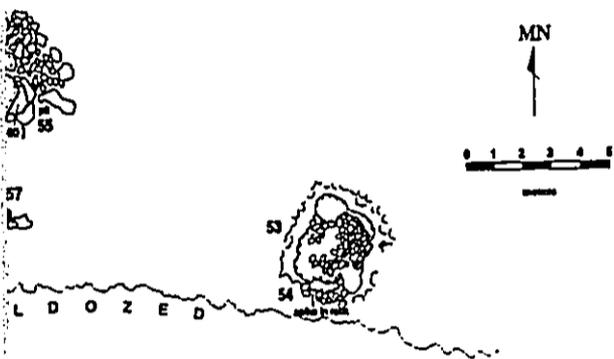
Explanation of Map Symbols

	boulder	103	feature number
	bedrock outcrop	[#]	height in centimeters
	overhang, cavity, or cave interior outline	+1m	boulder height (meters)
	cobble filled pāhoehoe pit	○	rock
	pāhoehoe pit		rubble
	pit (pāhoehoe) or depression		facing
	pile of mound		waterworn basalt
Pavements			waterworn coral
o	1/8 pebbles		branch coral
A	1/8 cobbles		upright
o-A	1/8 pebbles/cobble		pāhoehoe slab
A-o	1/8 cobble/pebble		lumbered wet stone or paving stone
M	reefline		trail paving, 1/8 or pāhoehoe slab
I	1/8 (waterworn pebbles)		slope (size indicates steepness)
			trail
		R	red rock
		U	upright construction
		P	pāhoehoe lava
		C	coral
		oab	waterworn basalt



MAPS

Site 23356
Features 53-77
Manini'ōwall, Hawai'i Island



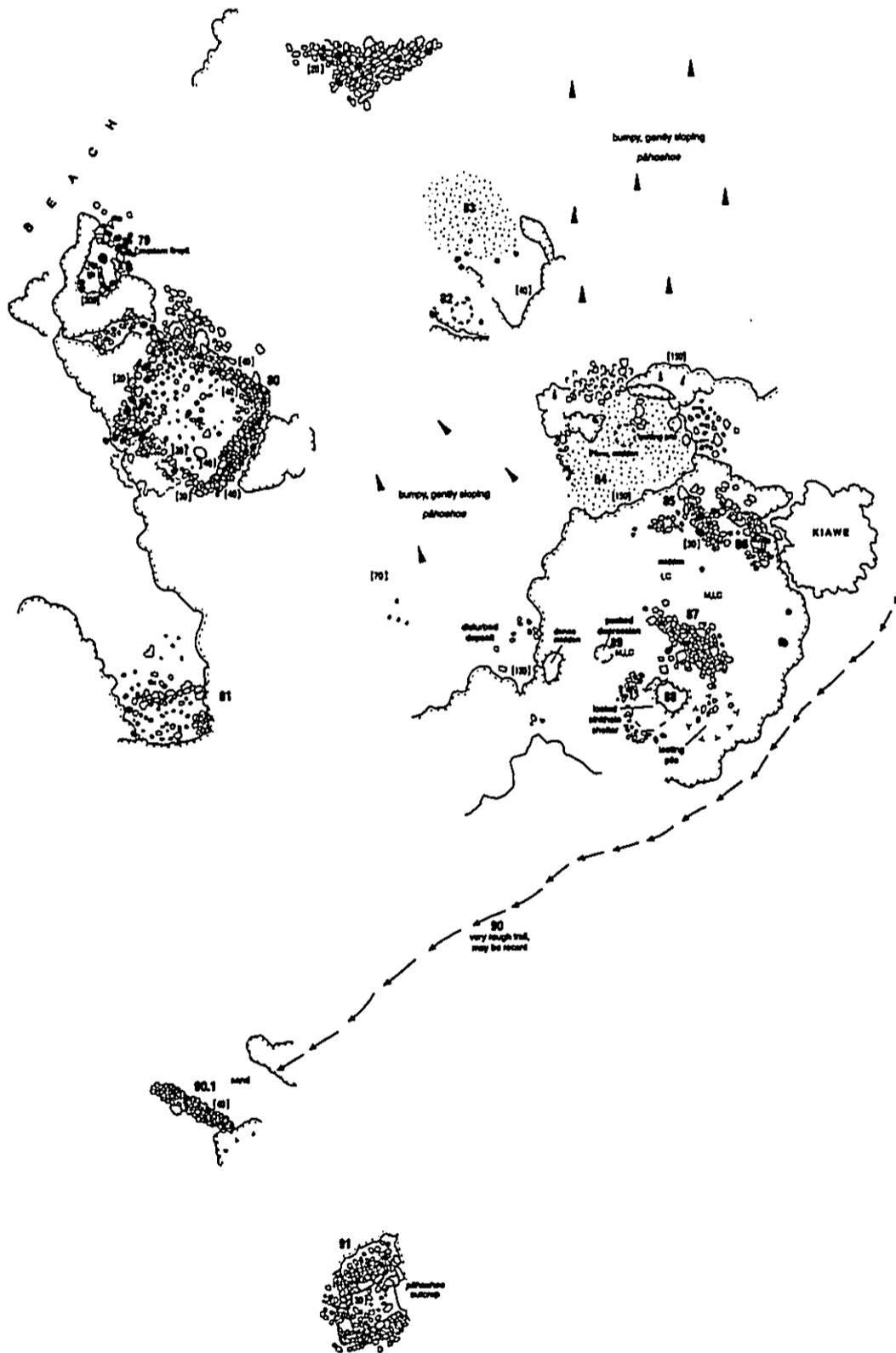
Explanation of Map Symbols

	boulder	103	feature number
	backrock outcrop	[H]	height in centimeters
	overhang, cavity, or cave interior outline	+1m	boulder height (meters)
	cobble filled pāhoehoe pit	○	rock
	pāhoehoe pit	○	nubble
	pit (other) or depression		lacing
	pile of material		waterworn basalt
			waterworn coral
a	1/8 pebbles		branch coral
A	1/2 cobbles		upright
a-A	1/8 pebble/cobble		pāhoehoe slab
A-a	1/2 cobble/pebble		tumbled and stone or paving stone
B	median		trif paving, 1/8 or pāhoehoe slab
I	1/8 (waterworn pebbles)		steps (also indicates steepness)
			trail
			red rock
			upright construction
			pāhoehoe lava
			coral
			waterworn basalt

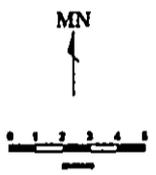
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12m

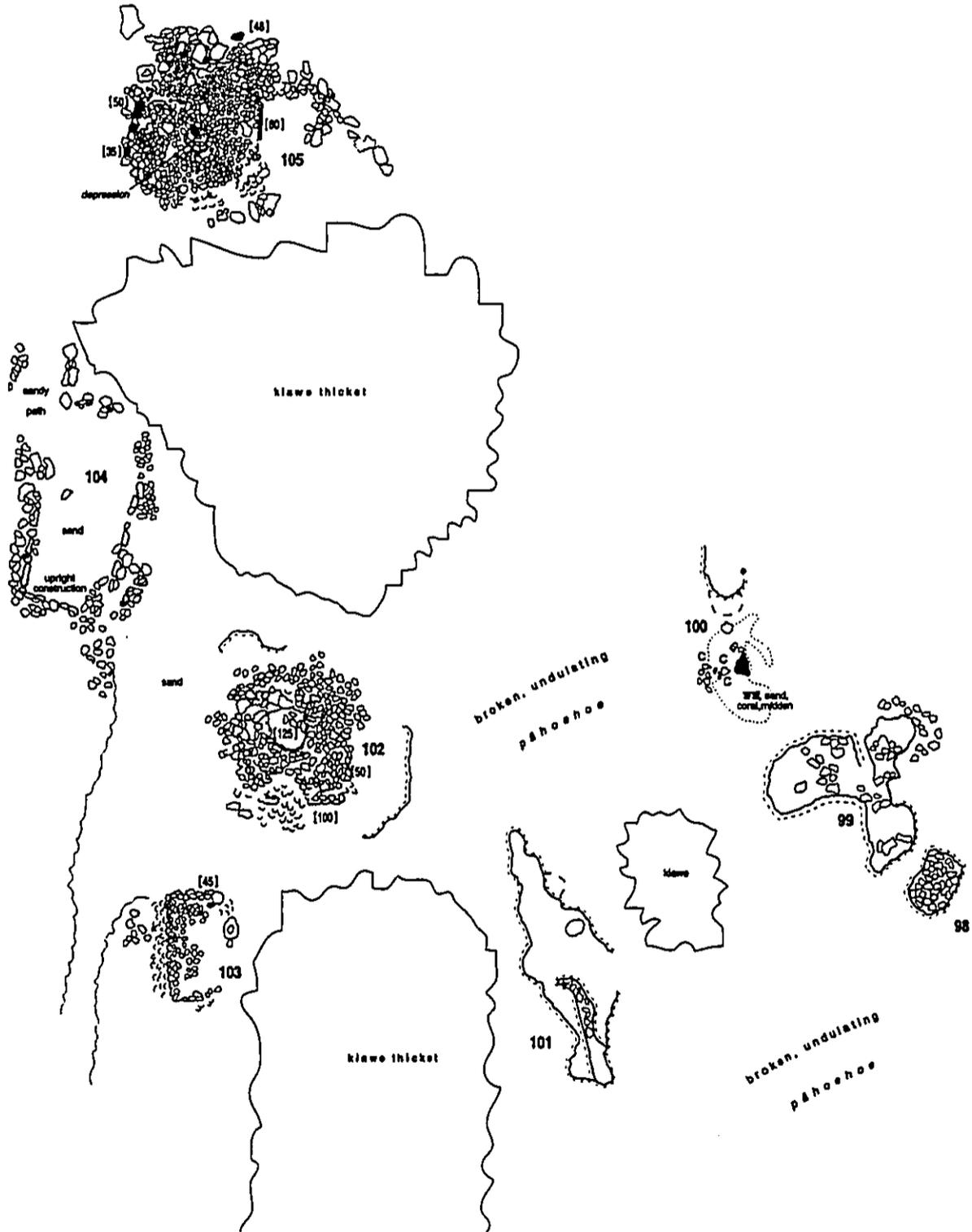
MAPS



Site 23356
Features 78-91
Manini'ōwali, Hawai'i Island

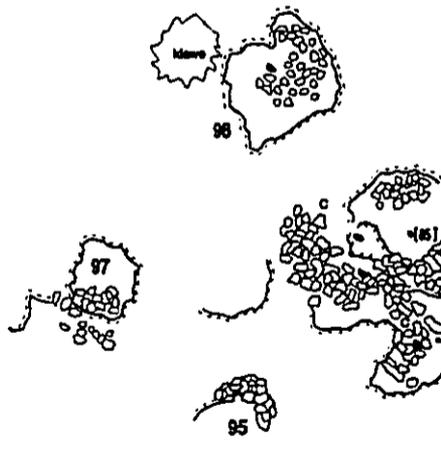


Explanation of Map Symbols	
	boulder
	bedrock outcrop
	overhang, cavity, or cave interior outline
	cobble filled pāhoehoe pit
	pāhoehoe pit
	pit (other) or depression
	pile or mound
	Pavements
a	1/2" pebbles
A	1/2" cobbles
a-A	1/2" pebbles/cobble
A-a	1/2" cobbles/pebbles
M	reddish
I	1/2" (waterworn pebbles)
103	feature number
[60]	height in centimeters
+1m	boulder height (meters)
○	rock
	rubble
	facing
	waterworn basalt
	waterworn coral
	branch coral
	upright
	pāhoehoe slab
	tumbled wall stone or paving stone
	trail paving, 1/2" or pāhoehoe slab
	slope (size indicates steepness)
	trail
R	red rock
U	upright construction
P	pāhoehoe lava
C	coral
swb	waterworn basalt



Explanation of Map Symbols

- boulder
- bedrock outcrop
- overhang, cavity, or cave interior outline
- cobble filled pāhoehoe pit
- pāhoehoe pit
- pit (other) or depression
- pile or mound
- Pavements**
 - 1/2 pebbles
 - 1/2 cobbles
 - 1/2 pebble/cobble
 - 1/2 cobble/pebble
 - midden
 - W (waterworn pebbles)



MAPS

Legend of Map Symbols

	103	feature number
	[60]	height in centimeters
	+1m	boulder height (meters)
	○	rock
	⋈	rubble
	⋈	facing
	●	waterworn basalt
	⊙	waterworn coral
	*	branch coral
	▭	upright
	▭	pāhoehoe slab
	⊙	tumbled wall stone or paving stone
	⊙	trail paving, 'ā'ī or pāhoehoe slab
	▽	slope (size indicates steepness)
	↘	trail
	R	red rock
	U	upright construction
	P	pāhoehoe lava
	C	coral
	wrb	waterworn basalt

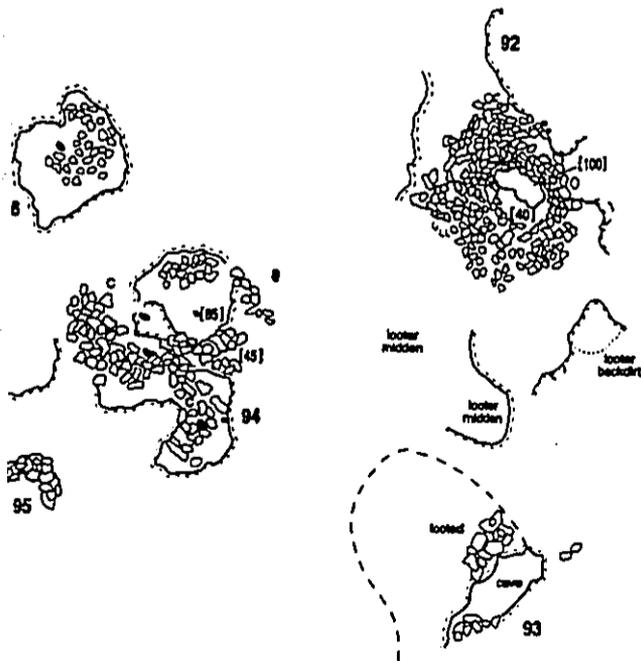
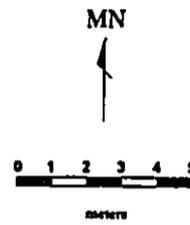
terior outline

bble

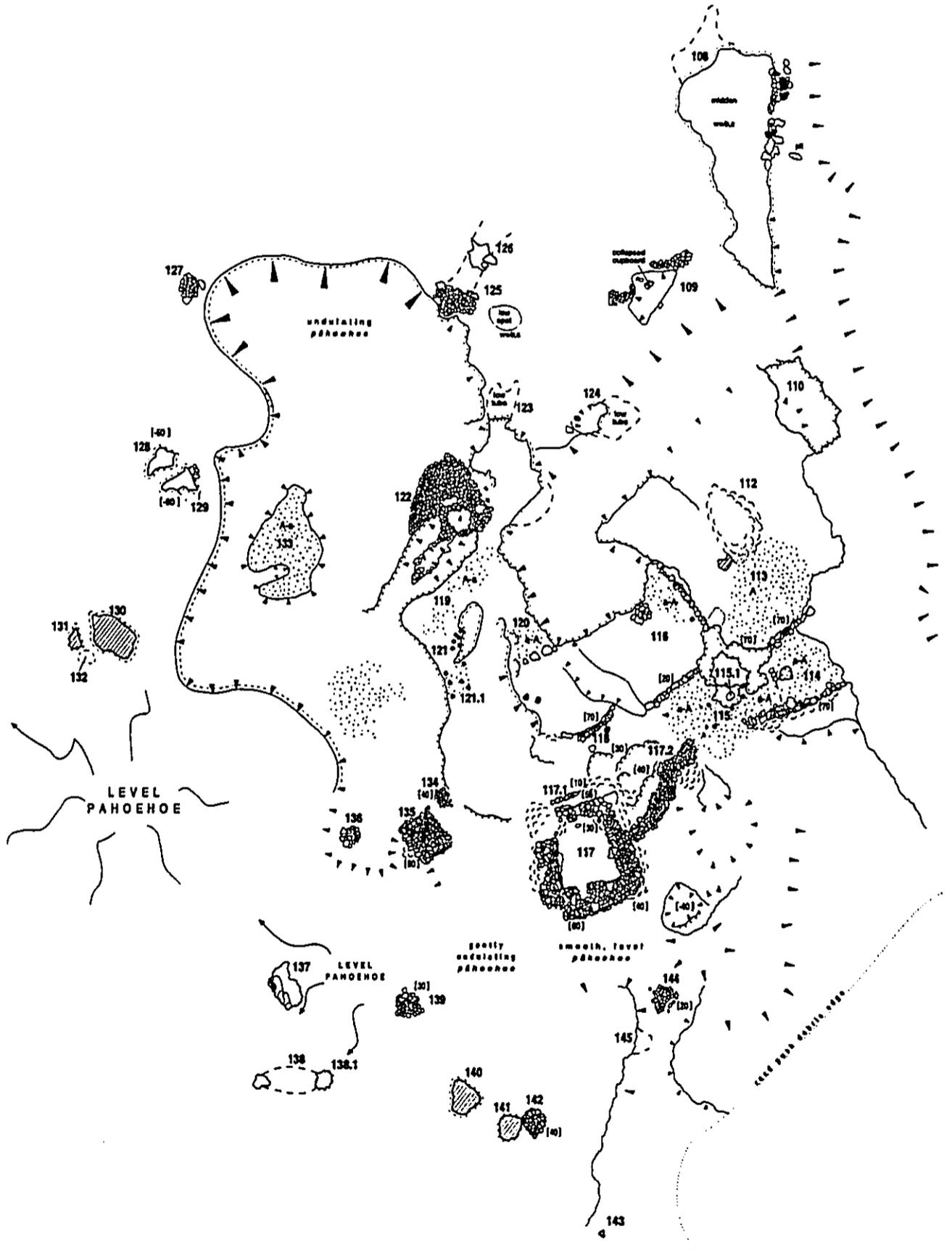
bble

m pebbles)

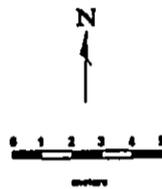
Site 23356
Features 92-105
Manini'ōwali, Hawai'i Island



MAPS



Site 23356
Features 106-145
Maniowall, Hawai'i Island



Explanation of Map Symbols	
 boulder  bedrock outcrop  overhang, cavity, or cave interior outline  cobble filled pāhoehoe pit  pāhoehoe pit  pit (other) or depression  pile or mound <p style="margin-left: 20px;">Pavements</p> <p style="margin-left: 20px;">a 'a' pebbles</p> <p style="margin-left: 20px;">A 'A' cobbles</p> <p style="margin-left: 20px;">a-A 'a'/'A' pebble/cobble</p> <p style="margin-left: 20px;">A-a 'A'/'a' cobble/pebble</p> <p style="margin-left: 20px;">M midden</p> <p style="margin-left: 20px;">I 'I' (waterworn pebbles)</p>	<p>103 feature number</p> <p>[80] height in centimeters</p> <p>+1m boulder height (meters)</p> <p>○ rock</p> <p>⋈ rubble</p> <p>⊖ facing</p> <p>● waterworn basalt</p> <p>⊙ waterworn coral</p> <p>* branch coral</p> <p>⊖ upright</p> <p>⊖ pāhoehoe slab</p> <p>⊖ tumbled wall stone or paving stone</p> <p>⊖ trail paving, 'a'/'A' or pāhoehoe slab</p> <p>∇ slope (size indicates steepness)</p> <p>↘ trail</p> <p>R red rock</p> <p>U upright construction</p> <p>P pāhoehoe lava</p> <p>C coral</p> <p>w/w waterworn basalt</p>



MAPS

Site 23356
 Features 146-165
 Manini'ōwali, Hawai'i Island



Explanation of Map Symbols

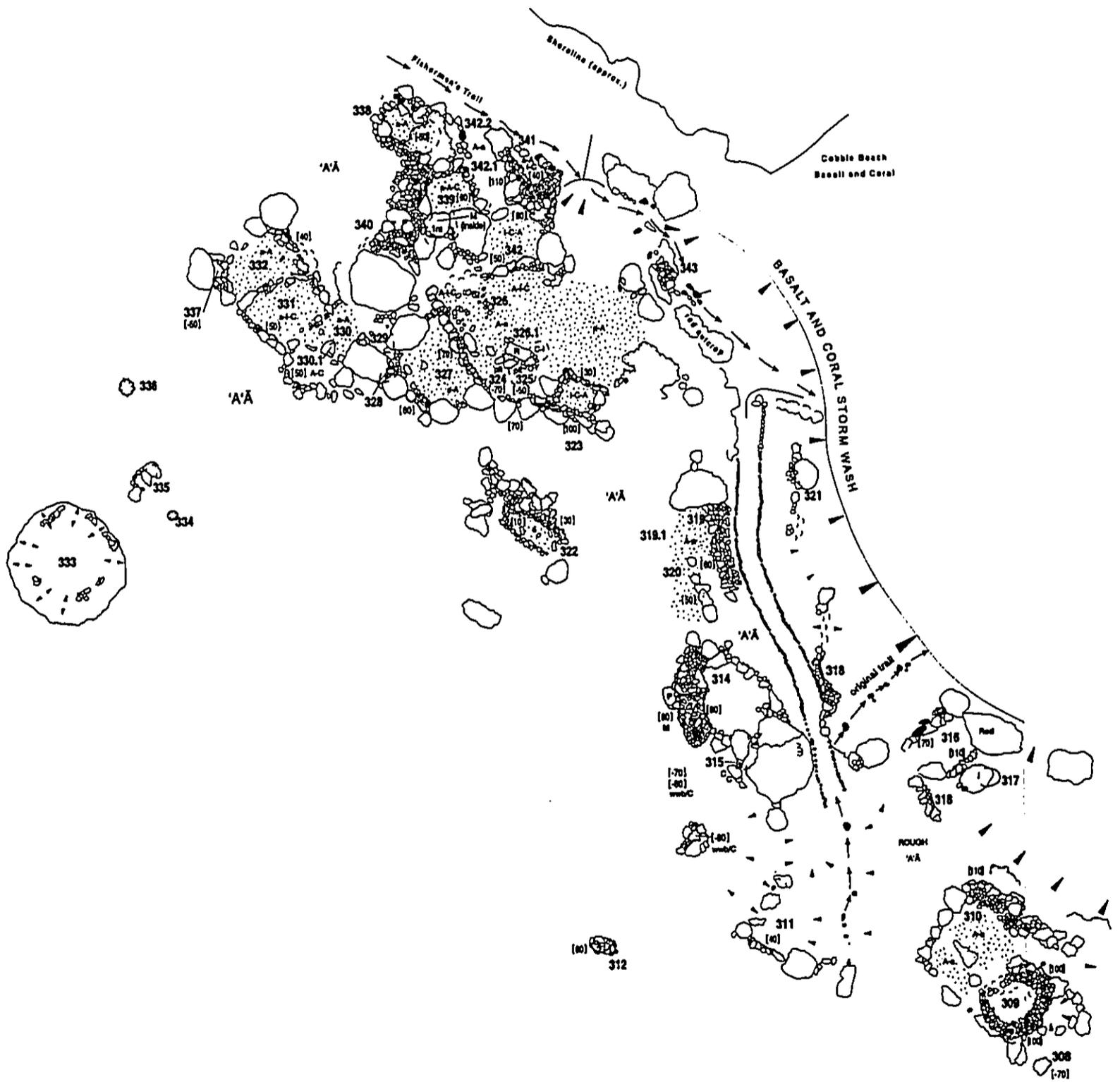
	boulder	103	feature number
	bedrock outcrop	[H]	height in centimeters
	overhang, cavity, or cave interior outline	+ 1m	boulder height (meters)
	cobble filled pāhoehoe pit	○	rock
	pāhoehoe pit	⋈	rubble
	pit (other) or depression	⋈	teal
	pile or mound	⊙	waterworn basalt
	Pavement	⊙	waterworn coral
o	1/8 pebbles	*	branch coral
A	1/8 cobbles	⊙	upright
o-A	1/8 pebbles/cobble	⊙	pāhoehoe slab
A-o	1/8 cobbles/pebbles	⊙	tumbled wall stone or paving stone
M	midden	⊙	trail paving, 1/8 or pāhoehoe slab
I	WW (waterworn pebbles)	∇	slope (size indicates steepness)
		↘	trail
		R	red rock
		U	upright construction
		P	pāhoehoe lava
		C	coral
		wwb	waterworn basalt

Site 23356
Features 166-179
Manini'ōwali, Hawai'i Island



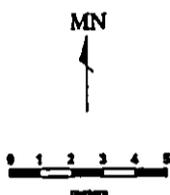
Explanation of Map Symbols

	boulder	103	feature number
	bedrock outcrop	[80]	height in centimeters
	overhang, cavity, or cave interior outline	+1m	boulder height (meters)
	cobble filled pāhoehoe pit	○	rock
	pāhoehoe pit	○	rubble
	pit (other) or depression		lacing
	pile or mound		waterworn basalt
	Pavements		waterworn coral
	1/2 pebbles		branch coral
	1/2 cobbles		upright
	1/2 pebble/cobble		pāhoehoe slab
	1/2 cobble/pebble		lambled wall stone or paving stone
	midden		trail paving, 1/2 or pāhoehoe slab
	1/2 (waterworn pebbles)		slope (size indicates steepness)
			trail
			red rock
			upright construction
			pāhoehoe lava
			coral
			waterworn basalt



MAPS

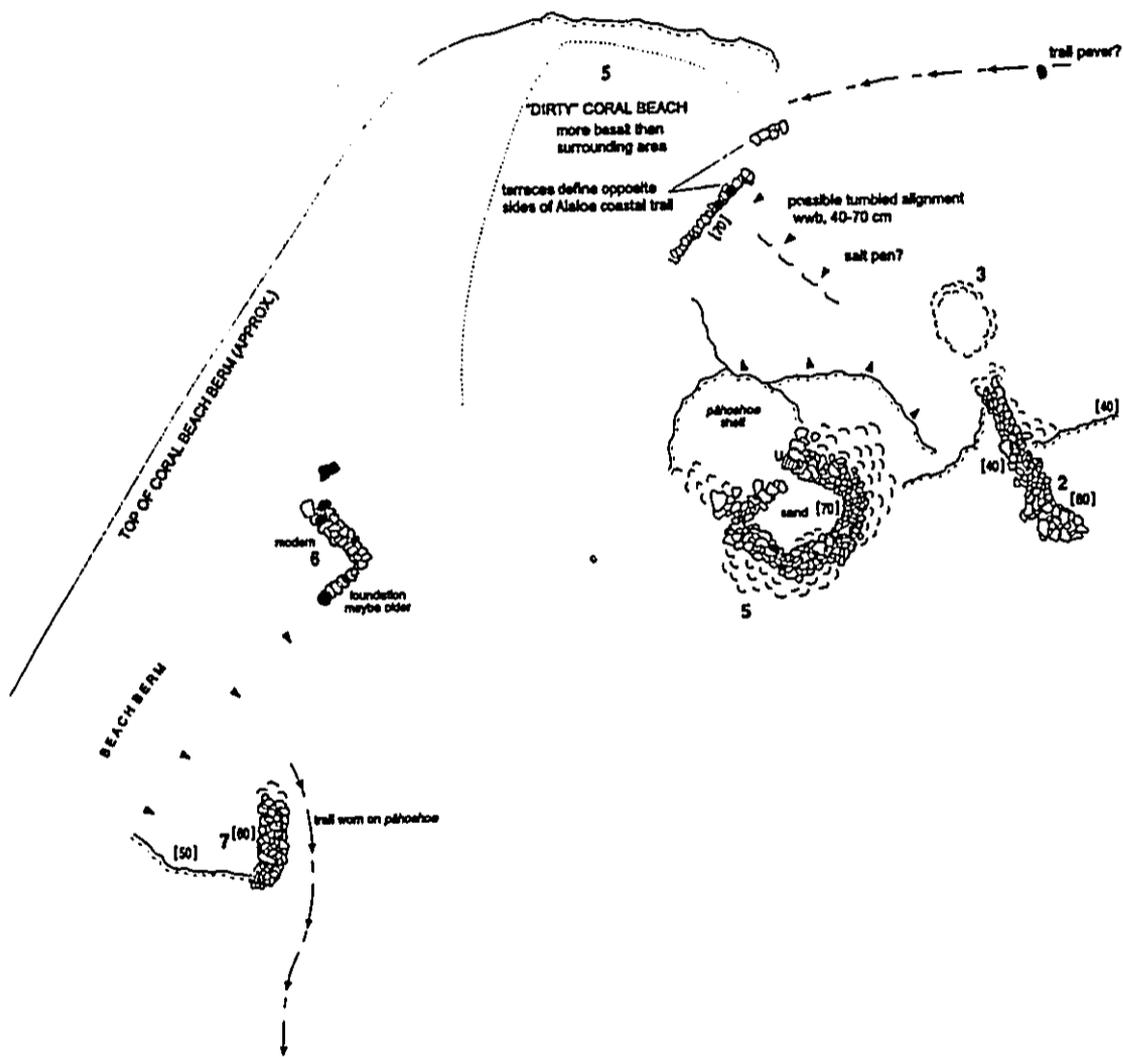
Site 50-10-18-23355
 Features 308-343
 Kakapa Bay, Hawai'i Island



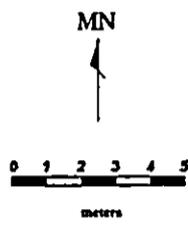
Explanation of Map Symbols	
	boulder
	bedrock outcrop
	overhang, cavity, or cave interior outline
	cobble filled pāhoehoe pit
	pāhoehoe pit
	pit (other) or depression
	pile or mound
Pavements	
	1/8 pebbles
	1/4 cobbles
	1/2 pebble/cobble
	1/2 cobble/pebble
	midden
	1/8 (waterworn pebbles)
	feature number
	height in centimeters
	+1m boulder height (meters)
	rock
	rubble
	icing
	waterworn basalt
	waterworn coral
	branch coral
	upright
	pāhoehoe slab
	tumbled wall stone or paving stone
	trail paving, 1/8 or pāhoehoe slab
	slope (size indicates steepness)
	trail
	red rock
	upright construction
	pāhoehoe leve
	coral
	waterworn basalt



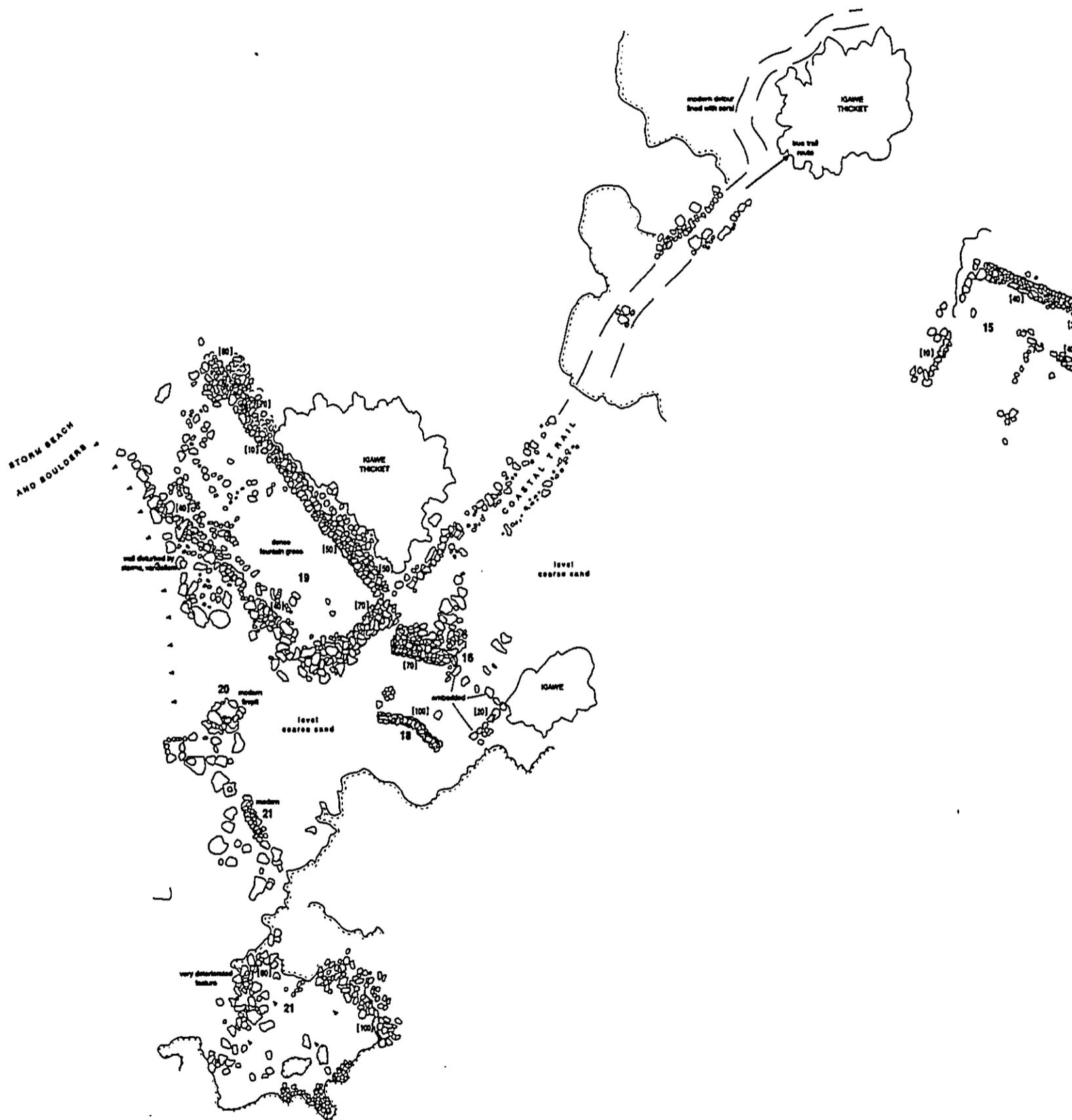
MAPS



Site 23357
Features 1-7
Punaloa Point, Hawai'i Island



Explanation of Map Symbols			
	boulder	103	feature number
	bedrock outcrop	[80]	height in centimeters
	overhang, cavity, or cave interior outline	+1m	boulder height (meters)
	cobble filled pāhoehoe pit	○	rock
	pāhoehoe pit	⋈	rubble
	pit (other) or depression	⊖	facing
	pile or mound	●	waterworn basalt
	Pavements	⊙	waterworn coral
	a 1/2 pebbles	*	branch coral
	A 1/2 cobbles	⊖	upright
	a-A 1/2 pebble/cobble	⊖	pāhoehoe slab
	A-a 1/2 cobble/pebble	⊖	tumbled wall stone or paving stone
	M midden	⊖	trail paving, 1/2 or pāhoehoe slab
	I waterworn pebbles	∇	slope (size indicates steepness)
		↘	trail
		R	red rock
		U	upright construction
		P	pāhoehoe lava
		C	coral
		wwb	waterworn basalt

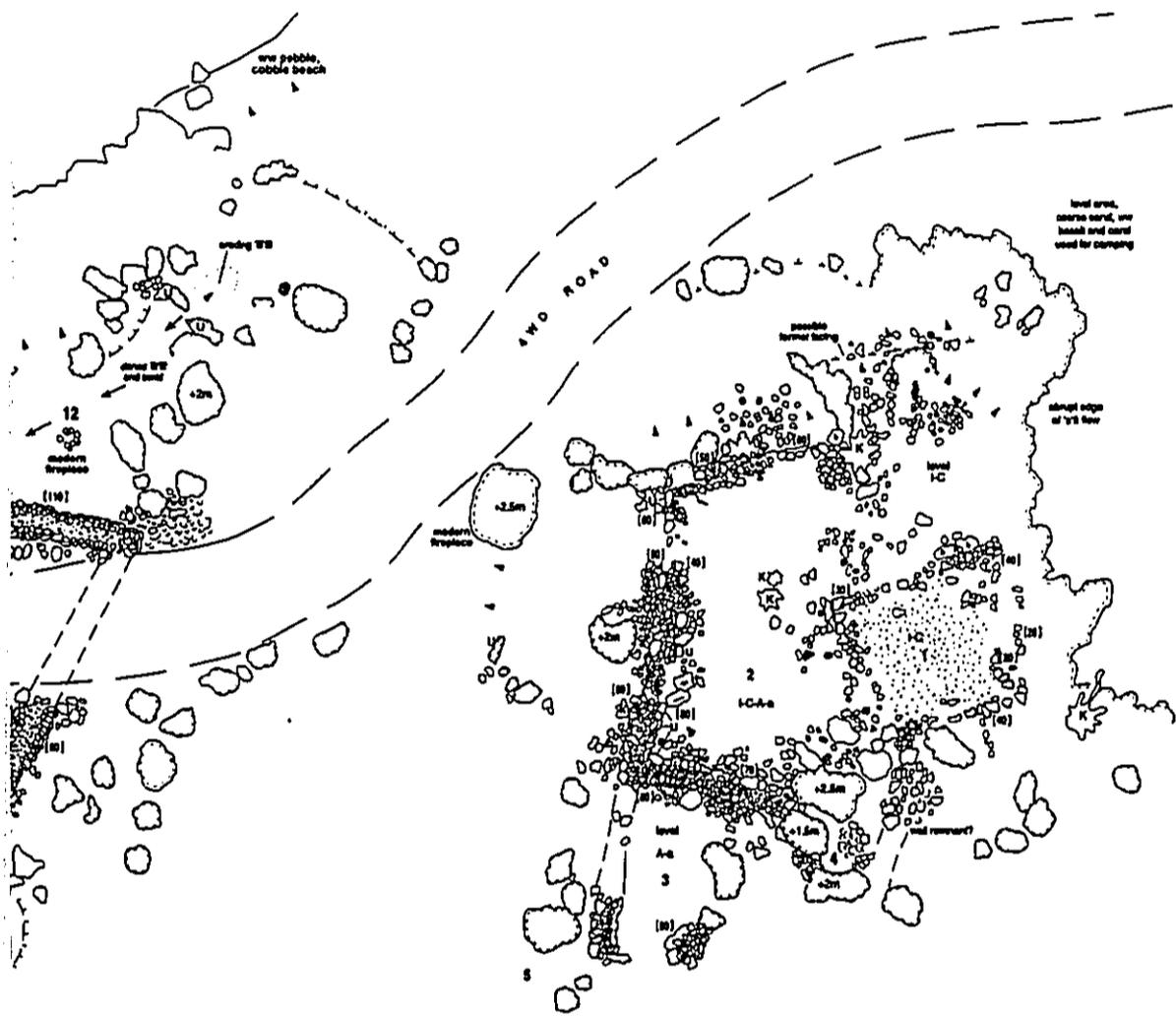


MAPS

Site 23357
Features 15-22
Punaloa Point, Hawai'i Island



Explanation of Map Symbols	
	boulder
	bedrock outcrop
	overhang, cavity, or cave interior outline
	cobble filled pāhoehoe pit
	pāhoehoe pit
	pit (other) or depression
	pile or mound
Pavements	
	'a' 'a' pebbles
	'A' 'A' cobbles
	'a-A' 'a' pebbles/cobbles
	'A-a' 'A' cobbles/pebbles
	'M' midden
	'I' 'I' (waterworn pebbles)
	103 feature number
	[100] height in centimeters
	+1m boulder height (meters)
	rock
	rubble
	facing
	waterworn basalt
	waterworn coral
	branch coral
	upright
	pāhoehoe slab
	tumbled wall stone or paving stone
	trail paving, 'a' or pāhoehoe slab
	slope (size indicates steepness)
	trail
	R red rock
	U upright construction
	P pāhoehoe leve
	C coral
	wrb waterworn basalt



Explanation of Map Symbols

	boulder		feature number		pāhoehoe slab
	bedrock outcrop		height in centimeters		tumbled wall stone or paving stone
	overhang, cavity, or cave interior outline		boulder height (meters)		trail paving, 1/2' or pāhoehoe slab
	cobble filled pāhoehoe pit		rock		slope (size indicates steepness)
	pāhoehoe pit		rubble		trail
	pit (other) or depression		facing		red rock
	pile or mound		waterworn basalt		upright construction
	Pavements		waterworn coral		pāhoehoe lava
	a 1/2' pebbles		branch coral		coral
	A 1/2' cobbles		upright		waterworn basalt
	a-A 1/2' pebble/cobble				
	A-a 1/2' cobble/pebble				
	M midden				
	I 1/2' (waterworn pebbles)				

nd