

**Archaeological Inventory Survey  
Queen Liliuokalani Trust Property**

**Land of Keahuolu, North Kona District,  
Island of Hawaii**

**PHRI**

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Island of Hawaii

(TMK:3-7-4-8:Por.2,12)

by

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## SUMMARY

At the request of Mr. Lee Sichter of Belt, Collins and Associates, on behalf of their client, Queen Lilioukalani Trust (QLT), Paul H. Rosendahl, Ph.D. Inc. (PHRI) conducted a surface and limited subsurface archaeological inventory survey of the c. 1,100-acre proposed Queen Lilioukalani Trust Property project area, located in the Land of Keahuolu, North Kona District, Island of Hawaii (TMK:3-7-4-8:Por.2,12). The survey field work was conducted July 10-27, 1989 and January 22-29, 1990, and consisted of a 100%-coverage pedestrian survey augmented with an aerial reconnaissance survey. During the survey, 239 sites with 1,810+ component features were identified. State Inventory of Historic Places (SIHP) site numbers\* were assigned to 237 sites. Two sites, Mamalahoa Trail (Site 00002) and Kuakini Wall (Site 07276) had been previously assigned SIHP numbers.

The predominant feature types identified within the project area are pahoehoe excavations, rock mounds, and modified blisters or outcrops, which together comprise 76% of all features (1,374 of 1,810). These and other features such as small terraces, low platforms, C-shapes, enclosures, and rubble walls are representative of agricultural activities, which account for 85-90% of all identified features.

Among the 239 identified sites, 84 are assessed as having information value that has been mitigated during this survey; no further work is determined necessary for these 84 sites. Further data collection only is recommended for 123 sites which appear to have value only for information content. Twenty-five sites are recommended for interpretive development, following further data collection. All of these sites except two are located within the area designated as an archaeological preserve by QLT. As a group, these sites possess a generally high cultural value as well. Eight of the sites recommended for interpretive development have features that are provisionally assessed as having cultural value, due to the possible presence of burials. Two sites, Mamalahoa Trail and Kuakini Wall, are assessed as having interpretive and cultural value, in addition to their information value.

Six cave sites are recommended for further data collection, stabilization, and preservation "as is," due to the presence of human skeletal remains. Finally, one shrine is recommended for preservation "as is."

In addition to site-specific recommendations concerning further treatment of the information obtainable within the project area, it is recommended that a systematic sampling program be designed and implemented during the data collection phase. Such a program should provide a more workable and accurate means of documenting the numerous features that are present within the project area.

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\* State Inventory of Historic Places (SIHP) site designation system: all five-digit site numbers prefixed by 50-10-27 or -28 (50=State of Hawaii, 10=Island of Hawaii, 25 or 27=USGS 7.5' series quad map ["Kailua" or "Keahole, Hawaii"]).

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# INTRODUCTION

## BACKGROUND

This report presents the results of a surface and limited subsurface archaeological inventory survey conducted at the proposed Queen Liliuokalani Trust Property project area, located in the Land of Keahuolu, North Kona District, Island of Hawaii (TMK:3-7-4-8:Por.2,12). The survey was conducted by Paul H. Rosendahl, Ph.D., Inc (PHRI), at the request of Mr. Lee Sichter of Belt, Collins & Associates, on behalf of their client, the Queen Liliuokalani Trust. The overall purpose of the survey was to provide information appropriate to and sufficient for the preparation of an Environmental Impact Statement (EIS) that could be submitted in conjunction with a Land Use Boundary Ammendment petition to the Land Use Commission.

The survey field work was conducted July 10-September 27, 1989, and January 22-29, 1990. The field crew consisted of three to eight persons under the direction of Supervisory Archaeologist Theresa K. Donham, M.A., with field supervision by Supervisory Field Archaeologist Amy Dunn and Field Archaeologist Keala Kauhi. The project was conducted under the overall direction of Principal Archaeologist Dr. Paul H. Rosendahl. Approximately 3,177 man-hours of labor were expended on the field work portion of the project.

An interim report of findings and general significance assessments was prepared for this project in February 1990 (Donham 1990a). This report is the final report for the project.

## SCOPE OF WORK

The basic purpose of an archaeological **inventory survey** is to identify—to discover and locate on available maps—all sites and features of potential archaeological significance present within a specified project area. An inventory survey constitutes an initial level of archaeological investigation. It is extensive rather than intensive in scope, and is conducted primarily to determine the presence or absence of archaeological resources. This level of survey indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. It permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for any subsequent **mitigation** work as might be necessary or appropriate. Such mitigative work could include further data collection involving

detailed recording of sites and features, and limited test excavations; in addition, mitigation could also include more extensive and intensive data recovery excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

In consideration of the above, the basic objectives of the present inventory survey were fourfold: (a) to identify (find and locate) all sites and site complexes present within the area of potential effect; (b) to evaluate the potential general significance of all identified archaeological remains; (c) to determine the possible impacts of proposed future developments upon the identified remains; and (d) to define the general scope of any subsequent intensive data collection and/or other mitigation work that might be necessary or appropriate.

Prior to carrying out the field work, a general scope of work and specific field tasks for the project were discussed with Dr. Ross H. Cordy, chief archaeologist in the Department of Land and Natural Resources-Historic Sites Section/State Historic Preservation Office (DLNR-HSS/SHPO). Based on a preliminary review of available background literature and records, and based on discussions with Mr. Sichter of BCA and appropriate DLNR-HSS/SHPO personnel, the following specific tasks were determined to constitute an adequate scope of work for the inventory survey of the proposed Kealakehe Planned Community project area:

1. Conduct archaeological background and historical documentary research involving review and evaluation of readily available archaeological and historical literature, historic documents and records, and cartographic sources relevant to the immediate project area;
2. Conduct a 100%-coverage, low-level (30-50 ft altitude) aerial survey (helicopter) of the entire project area, with special emphasis on (a) following out any foot trails present and plotting them on aerial photographs and/or maps, (b) identifying all sites observed, and (c) identifying areas devoid of sites (e.g., relatively recent lava flows and mechanically altered lands);
3. Conduct variable-coverage (partial to 100%), variable-intensity (30-90 ft intervals) ground survey of the project area, with the actual extent and

intensity of coverage determined on the basis of the aerial survey;

4. Conduct limited subsurface reconnaissance testing of selected sites and features identified within the project area (a) to determine the presence or absence of potentially significant buried cultural features or deposits, and (b) to obtain suitable samples for age determination analyses; and
5. Analyze background research data and field data, and prepare appropriate reports.

The significance of all archaeological remains identified within the project area was to be assessed in terms of the National Register criteria contained in the Code of Federal Regulations (36CFR Part 60) and criteria for evaluation of traditional cultural values prepared by the national Advisory Council on Historic Preservation. These criteria are used by the DLNR-HHS/SHPO for the evaluation of cultural resources. Specific concerns to be addressed in site assessments were the potential for significant information content, the potential for providing a unique interpretive example of a past architectural or landscape form, and the potential for preserving or promoting cultural identity and values.

## PROJECT AREA DESCRIPTION

The proposed Queen Liliuokalani Trust Property project area consists of six adjoining development parcels which together comprise approximately 1,100 acres (Parcels C, E, F1, F2, F3, and J1). Parcel C consists of approximately 200 acres and is located between Queen Kaahumanu Highway and the old Kona Airport State Park. The remaining parcels are on the east side of Queen Kaahumanu Highway, and include all lands between Palani Road to the south and the Keahuolu/Kealakehe boundary to the north. The eastern boundary of the project area is along the western boundary of the proposed Kealakehe Planned Community project area (Keahuolu parcel).

Keahuolu *ahupua'a*, in which the project area is situated, lies along the western slope of Hualalai volcano, where Pleistocene to recent Hualalai Series flows form the surface mantle. These flows are comprised primarily of alkalic olivine basalt, and are both aa and pahoehoe types (Macdonald, Abbott, and Peterson 1983:366). Specifically, the flows consist of pahoehoe flats, fissures, upthrusts, and collapsed blisters and tubes interspersed with fingers of aa that are generally oriented east-west. Although the topography of the flows is relatively rough in places, their overall aspect is a gradual slope from east to west. Elevation in the area is

nine to 650 ft AMSL (above mean sea level). The lower portion of the area (Parcel C) exhibits a slope grade of less than 5%; the remaining areas exhibit slope grades of 5-10%. In Parcel C, the project area is within 105.0 m of Pawai Bay. The upper boundary of the project area is 3.6 km from the shoreline.

Annual median rainfall within the project area ranges from approximately 500 mm (20 inches) in the lower elevations to 1,000 mm (40 inches) in the upper elevations. In general, the density of vegetation within the project area increases with increasing elevation and rainfall. Vegetation is extremely sparse in Parcel C, and extremely dense in areas above 500 ft AMSL. There is little to no surface visibility in much of the upper portions of the project area, particularly in the southern half.

Predominant tree species within the project area are *kiawe* (*Prosopis pallida* [Humb. and Bonp. ex Willd.] HBK), *koa-haole* (*Leucaena leucocephala* [Lam.] de Wit), *alaha'e* (*Canthium odoratum*), and Christmas-berry (*Schinus terebinthifolius* Raddi). Understory plants consist predominantly of lantana (*Lantana camara* L.), *kolu* (*Acacia farnesiana* [L.] Willd.), *ilima* (*Sida cordifolia* L.), fountain grass (*Pennisetum setaceum* [Forsk.] Chiov.), California grass, (*Brachiaria mutica* [Forsk.] Stapf, Jamaica vervain (*Stachytarpheta jamaicensis* [L.] Vahl), and airplant (*Bryophyllum pinnatum* [Lam.] Kurz).

In addition to the species listed above, several species are represented by scattered individual plants or small clusters of plants. These include *kukui* (*Aleurites moluccana*), *ti* (*Cordyline terminalis*), guava (*Psidium guajava*), mango (*Mangifera indica*), day flower (*Commelina diffusa* Burm.f.), sword fern (*Nephrolepis* spp.), and sisal (*Agave sisalina*).

Bulldozer grubbing has taken place in two major zones within the project area. The first grubbed zone is a c. 335.0 m wide area along the west side of Queen Kaahumanu Highway, in Parcel C. The second disturbed zone is an abandoned quarry site, located near the center of the upper project area parcels, between 250 and 300 ft AMSL. This area is approximately 460.00 m N-S by 310.00 m E-W. If surface features once existed in the grubbed areas, they have been destroyed.

Ornamentals and herbaceous plants are being cultivated in isolated pockets in the upper portions of the project area and along the lower project area boundary, adjacent to State Park lands. Surface features in current use for cultivation include enclosures, modified outcrops, pahoehoe excavations, low curvilinear walls, and cleared areas with associated



rock mounds. During the survey, these features were designated as recent agricultural features when plants or sufficient amounts of modern gardening tools, and materials such as potting soil ags, etc. were present. It should be noted that some of the features in current use are formally indistinguishable from the numerous agricultural features assumed to be pre-contact or early historic. It is possible that the features are pre-contact or early historic features that have, with minimal modification, been reused. It is also likely that some abandoned features of modern construction were not identified as such, due to a lack of diagnostic artifacts and construction style.

A number of cave sites which exhibit evidence of current habitation were located during the survey. These sites contained quantities of recent refuse, modern furnishings, and sleeping areas that were obviously currently used at the time of survey. These sites were recorded only if non-modern refuse, such as shell midden, or indigenous artifacts were observed. Some of the current habitation caves exhibit extensive modifications and alteration of prehistoric period deposits.

Surface features within the project area are in generally very good condition and do not appear to have been disturbed by livestock or grubbing to the extent observed in Kealakehe to the north.

### HISTORIC BACKGROUND AND SUMMARY OF HISTORICAL DOCUMENTARY RESEARCH

The area of North Kona between Kailua Bay and Keauhou Bay to the south is generally recognized as the population core and fertile agricultural district of North Kona (Kirch 1985:166; Kelly 1983). To the north of Kailua Bay, beginning at Honokohau, is the relatively dry Kekaha district of North Kona, with its barren lava inlands and coastal fishponds (Springer 1986:121). Keahuolu is situated in the transition zone between these two contrasting environmental districts, and is immediately north of Kailua Bay, a center of both political and economic activities since before Western contact.

The southern boundary of Keahuolu, at the shoreline, is located at Mahaihale, approximately 1.8 km north of Kukailimoku Point, named after the deity of victory in battle. Between Kukailimoku Point and the Keahuolu boundary is a narrow strip of coastal land that is within Lanihau Ahupua'a (where much of the old Kona Airport is located). Consequently, the shoreline of Keahuolu is

considerably narrower than expected, given the width of the ahupua'a less than 1.00 km inland of the coast, and about 2.0 km of Keahuolu lands (N-S) are fronted by Lanihau along the shoreline.

Kukailimoku Point and the coastal sand dunes to the north and south were apparently repeatedly used during the prehistoric and early historic periods as burial grounds. Jackson's 1883 survey map locates graves at Kukailimoku and a relatively large burial ground at Kaliliki Point to the south. Jackson referred to one massive masonry tomb as "Kamehameha's Tomb" (Neller 1980:5). Reinecke located additional graves in Lanihau and Keahuolu in 1930, and more recently Neller reported on exposed human remains at nine different locations along the coast, five in Lanihau and four at the Lanihau/Keahuolu boundary (Neller 1980:11-13). Historic period burials were also recently identified at Pawai Bay by Neighbor Island Consultants (1973).

At least two coastal heiau have been identified within Keahuolu. One of these is a small fishing heiau, referred to by Stokes as the Ko'a of Halepau. The Heiau of Kawaluna is described by Stokes (1919) as being at Pawai Bay. This latter site (SIHP 3843) was not relocated by Reinecke in 1930, nor was it field-verified by Emory in 1970 during his inventory of Big Island sites. The Neighbor Island Consultants survey (1973) of the Pawai Bay shoreline area did not identify this heiau, which Stokes describes as a loosely constructed enclosure with no opening (1919).

A third heiau, the Heiau of Paliholo, was first described by Stokes as being at or near the Keahuolu/Lanihau boundary. This site was not identified by Reinecke in 1930; it was, however, tentatively identified by Newman in 1970, and recorded as SIHP Site 2002. Newman identified burials at this site and located it in Lanihau, several hundred meters south of the Keahuolu boundary.

Twentieth century archaeological surveys (discussed below) and recent historical documentary research by Wong-Smith (Appendix B) indicates that, formerly, the immediate coastal area of Keahuolu consisted of coconut groves with houselots, graves, and shrines, and salt production areas. Gardens were undoubtedly present along the coastline as well. Ellis, during his 1822 tour of Hawaii Island, described an area he referred to as the "suburbs of Kailua," which probably included lower Keahuolu. According to Ellis:

The environs were cultivated to a considerable extent; small gardens were seen among the barren rocks on which the houses are built, wherever soil

could be found sufficient to nourish the sweet potatoe, the watermelon, or even a few plants of tobacco, and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around their roots (Ellis 1963:31).

In a letter dated July 8, 1869, David K. Kalakaua describes Keahuolu to his sister, Liliuokalani. The coastal area is summarized as follows:

The fishery is very extensive and a fine grove of cocoanut trees of about 200 to 300 grows on the beach. The flat land near the sea beach is composed chiefly of lava, but herbs and shrubbery grows on it and [it is] suitable for feed of sheep and goats.

At least one kuleana land grant was awarded in coastal Keahuolu (LCA 10303 to Maa). This grant consisted of 2.25 acres and included a coconut grove, seven fan palm trees, 11 taro kihapais, 10 potato kihapais, and salt land. According to the testimony of Mahu, the salt land was productive at the time of the legal conveyance of the grant. According to the Native Testimony records, coconuts obtained from the grove in Maa's kuleana were the property of Keohokalole.

The ahupua'a of Keahuolu was awarded to Ane Keohokalole during the Mahele of 1848. According to testimony documented during the Mahele, two walled houselots in Keahuolu had been held by Keohokalole's ancestors "from very ancient times" (Foreign Testimony 3:573). At least one of these lots was located along the shoreline. Keohokalole sold portions of her 15,000-20,000 acre grant to the government and other parties, with the balance being transferred to her heir, Liliuokalani.

There is little historic information concerning traditional Hawaiian land use for the inland portion of the project area in Keahuolu, and no kuleana grants were awarded there. Nineteenth century descriptions of inland Keahuolu by government surveyors reflect the same general environmental conditions present in the barren lava lands of Kekaha to the north. Emerson surveyed the area in the 1880s, and his map (Reg. Map 1280) denotes "rough pahoehoe, little vegetation" in the Keahuolu ahupua'a. David Kalakaua (1869) described the lower inland portions of Keahuolu as being suitable for livestock grazing (Appendix B), an assessment found in numerous nineteenth century descriptions of North Kona kula lands.

No historic references specifically describing traditional agricultural activities in inland Keahuolu or adjacent ahupua'a

to the north or south have been located. It is apparent from the archaeological record observed at Keahuolu, Kealakehe, and Honokohau 2nd, that agricultural activities (apparently prehistoric) were relatively intensive in the area designated historically as grazing land.

Comparisons by Kelly (1983) between the kuleana lands claimed and lands actually awarded in North Kona indicates to her that dryland agriculture was being conducted historically until the time of the Mahele, when vast expanses of kula lands were granted to konohiki, who utilized it as livestock grazing land (Kelly 1983:67). Kelly found that garden land claims located in the kula zone were generally not awarded to the claimants.

The forested upland area of Keahuolu was historically the primary agricultural zone and the location of kuleana grants. According to Kalakaua, "[t]he upper land or inland is arable, and suitable for growing coffee, oranges, taro, potatoes, bananas &c. Breadfruit trees grow wild as well as the Koli oil seed" (1869).

Wong-Smith reports (Appendix B) that five kuleana awards were granted in upland Keahuolu. These five grants comprise a total of 7.9 acres and range in size from 2.9 to 0.6 acres. The most common cultigen mentioned in descriptions of the claims is taro (three of three claims which name cultigens). Potatoes are mentioned in one claim, and a single coffee patch is mentioned in one claim.

During Emerson's 1880 Government Survey of North Kona, he identified the lower (makai [seaward]) edge of a forest zone, which he described as "lava covered with scattering forest and dense masses of ki root" (Kelly 1983:58). The land below this forest edge was described as "rocks covered with long grass" (Kelly 1983:58). According to Kelly's estimations, the forest edge occurred at an average elevation of 550 to 650 ft around Kailua and to the south (1983:58). However, it appears that the forest edge was somewhere between 750 and 800 ft elevation in Keahuolu (see reproduction of Emerson's map in Kelly 1983:59). This approximation places the nineteenth century forest edge very close to the eastern (mauka) boundary of the project area. According to Emerson's documentation of nineteenth century vegetation, the project area would be within the kula zone.

It was shortly after the systematic delineation of kula lands as grazing land that the Kuakini Wall was constructed. This wall extends from Kahaluu Bay to the southern portion of Keahuolu, at an average distance of 1.6 km from the coastline. At the northern end in Keahuolu, the wall is at an

elevation of 220 ft; further to the south, its average elevation is 160 ft. The purpose of the wall, as proposed by Kelly (1983:75), was to keep the free-ranging livestock contained within the kula zone, and out of the coastal settlements and gardens. The Kuakini Wall does not cross Keahuolu, but extends 183.00 m north of Palani Road, at which point it may turn west (or a later western extension was added) for a distance of approximately 380.00 m. To date, no historical information has been located that would aid in determining the reason why the wall ends where it does, rather than at an ahupua'a boundary, trail or some type of land division feature. There is a definite concentration of habitation and agricultural features at the end of the wall, to the south of the western extension.

Sometime during the late 1890s, a sisal mill was established in Keahuolu along the south side of the old Palani Road corridor. This mill location is shown on a 1924 USGS topographic map, at 428 ft AMSL (Appendix B: Figure B-1). Kelly reports that a 500-acre tract of land was cultivated in sisal, and was known as the McWayne sisal tract (Kelly 1983:89). Recent informant interviews conducted by Wong-Smith indicate that as much as 1,000 acres may have been in sisal cultivation in Keahuolu and Kealakehe. According to informant Mr. Minoru Inaba, the mill was surrounded by sisal fields (Appendix B) and was in operation until 1924.

The location of the sisal tract is yet to be determined; if, however, it surrounded the mill, as indicated by Mr. Inaba, it would have been within the current project area. There are scattered clumps of sisal within the project area, and a very concentrated growth along a section of the old Palani Roadbed, at 600 ft AMSL. In the area of the concentrated sisal are a series of walled enclosures and ramps which abut the old roadbed (SIHP Site 13435). This site is apparently at too high an elevation to correlate with the mill; it may, however, be associated with the sisal transport operations.

In comparing Keahuolu land use with Kealakehe to the north, it appears that Keahuolu was exposed to far less livestock grazing than Kealakehe. Lands in Kealakehe between 200 and 600 ft AMSL are currently used for livestock, and appear to have been used in this manner for about a century. The absence of ranching features and the relatively good preservation of most surface features in Keahuolu attests to a more limited use of the area for cattle.

## PREVIOUS ARCHAEOLOGICAL WORK

### Coastal Keahuolu

The earliest archaeological field investigations in Keahuolu focused on the major sites located along the

coastline. In his study of Hawaiian heiau, Stokes (1919) described two coastal heiau sites in Keahuolu (Halepau and Kawaluna), and a third heiau (Palihio) at or very near the Keahuolu/Lanihau boundary. The Halepau site was described by Stokes as a ko'a, or shrine for fishermen, located 100 ft from the shore in a coconut grove. The walls were up to four feet high and in good preservation at the time of his survey (1919). During his coastal survey in 1930, Reinecke located structural remains at Halepau (Site 15, house site of coral and remains of a pen around it), but he did not identify the ko'a. A short distance to the north, Reinecke identified an enclosure, with 4 ft high walls, paved with coral. This enclosure (Site 17) was in a setting described by Reinecke as "[a] regular oasis of pools, kiawe and luxuriant grass" (1930:6), and may actually correlate with the Ko'a of Halepau. According to Neller (1980), the shrine is registered as SIHP Site 2139.

The Heiau of Kawaluna is described by Stokes as a rebuilt enclosure located on the beach at Pawai Bay (see Appendix B for Stokes' narrative descriptions of the heiau). In 1930, Reinecke identified four house platforms, enclosure remains, and an unidentifiable ruin at Pawai Bay, (Sites 23 and 24), but he did not identify a heiau site. The site was registered as SIHP 3843 in 1970, but was not field verified by Emory during his inventory survey. A later survey of the Pawai Bay area by Neighbor Island Consultants (1973) did not identify the Kawaluna Heiau, although an enclosure with historic period burials was located.

The Heiau of Palihio was first described by Stokes as being at or near the Keahuolu/Lanihau boundary. It consisted of an enclosure with coral paving. According to Stokes' informants, this heiau was used for human sacrifice, and Kalakaua had it rebuilt prior to his departure from Hawaii. The site was not identified by Reinecke, although he did identify an enclosure associated with house platforms in the vicinity (Site 9). Newman tentatively identified the heiau in 1970 (SIHP 2002), and located it in Lanihau, not far from the Ko'a of Makaao.

During his survey of coastal North Kona, Reinecke identified and located 12 sites in Keahuolu and eight sites in Lanihau (Reinecke 1930:4-8). The Keahuolu sites consisted primarily of habitation platforms and enclosed yards. Reinecke enumerated 41 platforms, nearly all of which were interpreted as house sites, and seven enclosures at the 12 sites. The greatest concentration of house platforms was at Site 20, where 12 were counted. This complex is located on a flat north of Keahuolu Point. Another concentration (seven houses) was identified at the Keahuolu/Lanihau boundary (Site 12), which Reinecke associated with the Makeo complex. In addition to houses, Reinecke identified petroglyphs

(Site 20), modified pools (Sites 12 and 17), burials (Sites 12, 13, and 19), and a canoe landing (Site 14). None of Reinecke's sites are located within the current project area.

Among the identified Lanihau features, Reinecke enumerated 15 platforms, nine of which were interpreted as house sites. Eight of these house platforms were concentrated in the Makeo complex (Site 9), which also included a modified fishpond and several modified anchiline pools. Other features identified at Lanihau included petroglyphs (Sites 5, 6, 8, and 11), enclosures (Sites 7 and 9), and burials (Sites 4 and 6).

In 1970, Emory mentioned the two Keahuolu heiau sites in his inventory of known sites for selected areas of Hawaii (Emory 1970). That same year, Newman conducted an inspection of the old Kona Airport grounds, prior to its development as a State Park (Newman 1970). Newman described three Lanihau sites (SIHP 2000-2002), and one Keahuolu site (not designated) consisting of historic period burials and a cluster of ground "bait cups" (Newman 1970).

Coastal reconnaissance in Keahuolu was conducted by Bevacqua in 1972. Bevacqua's survey area was located in the immediate coastal zone, to the north of the present project area. During this survey, nine sites were identified (Bevacqua 1972). Some of these sites were later relocated by Ching, who assigned new numbers to them, due to "...vague locations...and the change in site conditions" (Ching 1978:1).

In 1975, Sinoto surveyed a road corridor through coastal Keahuolu, wherein seven sites were identified (Sinoto 1975:1). All sites were described as being "small, semi-permanent or temporary structures associated with coastal, probably marine activities" (Sinoto 1975:3). It is difficult to determine where Sinoto's survey area was located based on the report. It appears to have been to the north of the current survey area.

A series of reconnaissance survey reports were completed between 1973 and 1980 in conjunction with development of the old Kona Airport State Park along the shoreline in Keahuolu and Lanihau (Neighbor Island Consultants 1973, Fuke and Goldstein 1978, Estioko-Griffin and Lovelace 1980, and Neller 1980). Estioko-Griffin and Lovelace's survey relocated sites previously identified within the 89.7 acre parcel, and located additional sites, for a total of 35 sites. The majority of identified sites (28) were concentrated in an area just north of the old runway, along the shoreline at Pawai Bay. The most frequently identified site types included caves (11), petroglyphs (7), burials (5) and house sites (3) (Estioko-Griffin and Lovelace 1980:iii).

In 1978, Ching conducted a reconnaissance survey of all Keahuolu lands between the shoreline and Queen Kaahumanu Highway (987 acres). Ching's survey identified 59 sites with 140 component features, including sites previously identified by Bevacqua and Sinoto. The most frequently occurring features were reported to be salt pans (29), cave shelters (25), pavings (21), and cairns (21) (Ching 1978:32).

Nine of the 59 sites identified by Ching are within the boundaries of the current project area. Ching's descriptions of these sites are summarized below:

- 6537 - U-shaped boulder alignment
- 6538 - Well inside a modified cave, small platform present
- 6539 - Walled pahoehoe depression; planting or storage area
- 6540 - Habitation complex 150.00 by 300.00 m; several platforms, pavements, alignments, large habitation cave with midden and modern car parts
- 6541 - Circular alignment
- 6542 - Enclosure, constructed with aa, 4.50 by 4.00 m
- 6543 - Habitation complex; enclosure, platform, three paved areas
- 6544 - Walled cave shelter
- 6548 - Two cairns

During the current survey, difficulties were encountered in establishing reliable correlations between most of Ching's sites and features identified in the field. The only available map of Ching's sites was too generalized to accurately determine locations. In addition, many of Ching's descriptions do not provide dimensions or are too generalized to be reidentified. For most of his single features, there were several similar types in the general vicinity of his mapped locations. The tentative correlations with PHRI temporary site numbers, and problems with the correlations are summarized below (see Table 1 for correlation of temporary numbers with permanent SIHP numbers):

6537 - Similar alignments were identified at Sites T-42 and T-31, both in the vicinity of the mapped location of this site.

6538 - A water cave was identified at Site T-128 (Feature B). The location is close, but this pool does not have a small platform, and the entrance is not lined with boulders, although a few are present.

6539 - There are literally dozens of features that fit this description in the general vicinity of this site. They occur at Sites T-30, -32, -50, -51, and -52.

6540 - The only feature resembling Ching's description that was located is the cave with car parts (T-36). No platforms, pavements or trail was located. The area around the cave has been affected by road grubbing, and some of these features may have been disturbed since Ching's survey.

6541 - There are dozens of these features in the vicinity of Ching's mapped location for this sites. They occur at Sites T-19, T-21, and T-26.

6542 - An enclosure of similar dimensions (Site T-8) was identified in the vicinity of the mapped location of this site; however, it is constructed with pahoehoe slabs, not with aa.

6543 - A complex was located (Site T-15) which nearly fits this site description and its location. However, the enclosure is larger (by 7.5 sq m) than the dimensions given by Ching, and a terrace, rather than a platform, is associated.

6544 - It is uncertain whether this site is actually within the project area. There are two caves (T-10 and T-13) in the vicinity that may correlate; the dimensions, however, of neither site fit those given by Ching.

6548 - These two cairns were not relocated; they appear to have been located in the area that is currently bulldozed.

Because of the uncertainty in correlating Ching's complexes and single features, it was decided that his SIHP numbers would not be reused for this survey. It is very likely that, with the exception of disturbed features, all of the features he identified within the project area have been relocated. The problem is determining which features in the current inventory are the ones Ching identified.

A reconnaissance and testing survey was conducted in selected coastal Keahuolu parcels by Folk in 1980 (Folk 1980). Folk conducted a reconnaissance survey of a c. 20-acre proposed building site (current location of the Queen Liliuokalani Children's Education Center), wherein no sites were identified. He also conducted intensive-level mapping and recording of 21 sites in three kipuka, located near the shoreline, north of the old Kona Airport, and north of the

current project area. Test excavations were also conducted in the center of the kipuka in order to determine if buried cultural deposits were present.

During his study, Folk documented seven pavements, three caves, two platforms, four historic/recent campsites, a burial or shrine, a historic period animal enclosure, and three habitation areas (Folk 1980:21-22).

### Inland Keahuolu

In 1983, Soehren conducted a reconnaissance survey of a 10-acre parcel in upper Keahuolu, adjacent to the eastern edge of the existing Queen Liliuokalani Village subdivision. The parcel is located between 800 and 1000 ft AMSL (Soehren 1983). Soehren located no sites or cultural features within the parcel, and he describes the area as follows:

...such land appears suited only for aboreal crops, such as paper mulberry, if any. No evidence was found of traditional agricultural structures such as kuaiwi, clearing mounds or terraces, nor were there any other features attributed to prehistoric Hawaiian culture seen on the parcel (Soehren 1983).

Reconnaissance surveys conducted in inland portions of Keahuolu include two studies conducted by PHRI between 1983 and the present. In 1983, Rosendahl surveyed three separate parcels, including 100 acres west of Queen Kaahumanu Highway, along the southern boundary of Keahuolu (Area 1), 100 acres east of the highway and along the south side of Palani Road (Area 2), and 12 acres along the southern edge of Keahuolu and the northern side of Palani Road (Area 3) (Rosendahl 1983). Area 2 is within the boundaries of the current project area. Rosendahl located five sites in Area 1, two large complexes and five additional sites in Area 2, and a large complex in Area 3. The Area 3 complex was interpreted as a probable continuation of the Area 2 complex. No SIHP numbers were assigned during this survey.

The seven sites/site complexes identified by Rosendahl Within Area 2 are summarized below:

- D A complex consisting of a large low platform, mounds, alignments, modified outcrops, and cleared areas.
- E A complex consisting of numerous walls, platforms, enclosures, caves, pavements and alignments; 260.00 by 350.00 m area.

Table 1.

## CORRELATION OF SITE NUMBERS

SIHP Site No.	PHRI Temp. Site No.	SIHP Site No.	PHRI Temp. Site No.
13255	T- 1	13297	T- 47
13256	T- 3	13298	T- 48
13257	T- 4	13299	T- 49
13258	T- 5	13300	T- 50
13259	T- 6	13301	T- 51
13260	T- 7	13302	T- 52
13261	T- 8	13303	T- 53
13262	T- 9	13304	T- 54
13263	T-10	13305	T- 55
13264	T-11	13306	T- 57
13265	T-12	13307	T- 58
13266	T-13	13308	T- 60
13267	T-14	13309	T- 61
13268	T-15	13310	T- 62
13269	T-16	13311	T- 63
13270	T-17	13312	T- 64
13271	T-18	13481	T- 65
13272	T-19	13313	T- 66
13273	T-20	13314	T- 67
13274	T-21	13315	T- 68
13275	T-22	13316	T- 69
13276	T-23	13317	T- 70
13277	T-24	13318	T- 71
13278	T-25	13319	T- 72
13279	T-26	13320	T- 73
13280	T-27	13321	T- 74
13281	T-28	13322	T- 75
13282	T-29	13323	T- 76
13386	T-30	13324	T- 80
13283	T-31	13325	T- 83
13284	T-32	13326	T- 85
13285	T-33	13482	T- 87
13286	T-34	13327	T- 88
13480	T-35	13328	T- 89
13287	T-36	13483	T- 92
13288	T-37	13329	T- 93
13289	T-38	13330	T- 94
13290	T-39	13331	T- 95
13291	T-40	13332	T- 96
13292	T-41	13333	T- 97
13293	T-42	13334	T-100
13294	T-43	13335	T-101
13295	T-44	13336	T-102
13296	T-45	13337	T-104
13484	T-108	13378	T-161

Table 1. (cont.)

SIHP Site No.	PHRI Temp. Site No.	SIHP Site No.	PHRI Temp. Site No.
13338	T-109	13379	T-162
13485	T-110	13380	T-163
13486	T-111	13381	T-164
13339	T-112	13382	T-165
13340	T-113	13383	T-166
13341	T-114	13384	T-167
13342	T-116	13385	T-168
13343	T-117	13387	T-170
13344	T-118	13388	T-171
13345	T-119	13389	T-172
13346	T-120	13390	T-173
13347	T-121	13391	T-174
13348	T-122	13392	T-175
13349	T-123	13393	T-176
13350	T-124	13394	T-177
13487	T-125	13395	T-178
13351	T-126	13396	T-179
13352	T-127	13397	T-180
13353	T-128	13398	T-181
13354	T-129	13399	T-182
13355	T-130	13400	T-183
13488	T-131	13401	T-184
13356	T-132	13402	T-185
13357	T-133	13403	T-186
13358	T-134	13404	T-187
13359	T-137	13405	T-188
13360	T-138	13406	T-189
13361	T-139	13407	T-190
13362	T-140	13408	T-191
13363	T-143	13409	T-192
13364	T-144	13410	T-193
13489	T-145	13411	T-194
13490	T-146	13412	T-195
13491	T-147	13413	T-196
13365	T-148	13414	T-197
13366	T-149	13415	T-198
13367	T-150	13416	T-199
13368	T-151	13417	T-200
13369	T-152	13418	T-201
13370	T-153	13419	T-202
13371	T-154	13420	T-203
13372	T-155	13421	T-204
13373	T-156	13422	T-205
13374	T-157	13423	T-206
13375	T-158	13424	T-207
13376	T-159	13425	T-208
13377	T-160	13426	T-209

Table 1. (cont.)

SIHP Site No.	PHRI Temp. Site No.	SIHP Site No.	PHRI Temp. Site No.
13427	T-210	13454	T-237
13428	T-211	13455	T-238
13429	T-212	13456	T-239
13430	T-213	13457	T-240
13431	T-214	13458	T-241
13432	T-215	13459	T-242
13433	T-216	13460	T-243
13434	T-217	13461	T-244
13435	T-218	13462	T-245
13436	T-219	13463	T-246
13437	T-220	13464	T-247
13438	T-221	13465	T-248
13439	T-222	13466	T-249
13440	T-223	13467	T-250
13441	T-224	13468	T-251
13442	T-225	13469	T-252
13443	T-226	13470	T-253
13444	T-227	13471	T-254
13445	T-228	13472	T-255
13446	T-229	13473	T-256
13447	T-230	13474	T-257
13448	T-231	13475	T-258
13449	T-232	13476	T-259
13450	T-233	13477	T-260
13451	T-234	13478	T-261
13452	T-235	13479	T-262
13453	T-236		

F Modified sinkhole with several chambers and internal structures such as enclosures and platforms; artifacts and midden present.

G Papamu and other petroglyphs.

H Modified sinkhole with several lava tube caves and internal structures.

L Kuakini Wall.

M Wall attached to north end of Kuakini Wall.

Rosendahl's Complexes D and E correlate with a several sites that were identified during the current project within

the preserve area. These include Sites 13370-13376, 13381, and 13382. Kuakini Wall (L) had previously been assigned an SIHP number (07276). The remaining sites identified by Rosendahl were relocated and assigned SIHP numbers during this survey. The correlations are as follows: F (13350), G (13348, Fea. C), H (13387), and M (13349).

Rosendahl recommended intensive survey of all three of the areas he examined, as well as preservation of Kuakini Wall and portions of Complex E (Rosendahl 1983:13). The latter area was subsequently set aside as an archaeological preserve by QLT. An inventory of features within the area was conducted during this survey; however, specific feature descriptions and measurements were not completed.



In 1989, PHRI conducted an inventory survey of the proposed Kealakehe Planned development, which included a 150-acre parcel in Keahuolu immediately east of the current project area and northwest of Palani Road (Donham 1990b). During the survey, 53 sites were identified, most of which were interpreted as agricultural features or complexes. Eighteen agricultural complexes with three to 120 features were identified (Donham 1990b:19). Predominant feature types identified included rock mounds (278) and pahoehoe excavations (173). Only a single platform and six terraces were identified in the Keahuolu parcel. Ideally, the feature patterns of this parcel should be considered in conjunction with the current survey area for a more complete representation of the overall settlement pattern of Keahuolu.

Keahuolu was included in a regional historic overview compiled by Kelly (1983), in conjunction with the Kuakini Highway realignment corridor mitigation study. This overview included approximately 30 ahupua'a between Keahuolu and Keokea to the south. Kelly summarizes early historic and traditional Hawaiian agriculture as it was practiced in the dry mid-slope inland areas (kula) of Kona (Kelly 1983:55-75). She also provides background for the historic processes that led to abandonment of kula farming by Hawaiians during the nineteenth century.

Archaeological field work along Kuakini Highway Realignment Corridor was conducted from 1980-83 by B.P. Bishop Museum (Schilt 1984). The corridor crossed 24 ahupua'a located between Palani Road and Kilohana Subdivision to the south. The northern end of the 4.96 km long corridor was in Keahuolu. A total of 134 sites (455 features) were identified along the corridor; two sites were located in Keahuolu. These included a cairn and a modified outcrop. Twenty-two radiocarbon dates were determined from samples collected during the project (Schilt 1984:262). On the basis of the dated samples, their contexts, and other information, Schilt postulates that agricultural use of the kula was probably not intensive until after AD 1400-1500. Schilt suggests that erosional deposition of soil from agricultural areas located upslope was probably a major factor in permitting such use of the kula (Schilt 1984:274). She also suggests that due to differences in rainfall patterns, initial exploitation of the kula zone at the north end of the highway construction project area (Keahuolu) occurred later (c. AD 1550-1650) than use of this zone at the southern end (c. AD 1400-1650; 1983:274).

## RESEARCH PROBLEMS AND APPROACH

Selected research issues of importance to further archaeological investigations in Keahuolu are presented

here in order to provide an explicit context for the assessment of research significance of sites identified within the project area. These issues fall under three general approaches to archaeological interpretation—culture history, settlement pattern analysis, and human ecology.

Culture history has as its primary concern the formulation and testing of temporal models. Of major importance is the documentation of earliest human presence in a given area, and the chronological placement of significant cultural changes, events, or individuals. The development of a local cultural history, or chronology, is often viewed as a necessary first step in the pursuit of other archaeological problems, because in the absence of temporal control, synchronic patterns cannot be distinguished from diachronic patterns.

On the basis of prior analyses of archaeological data and age determinations of charcoal samples recovered from areas near the project area, it is reasonable to expect that most of the identified habitation and agricultural features in the upper portions of the project area should post-date AD 1300-1400. This hypothesis is based on dates assayed from features in Kealakehe and Honokohau, as well as the dates assayed from sites within the Kuakini Highway corridor (Schilt 1984). During a testing program in upper Kealakehe at c. 800-1000 ft AMSL, Hammatt, Shideler, and Borthwick recovered a dating sample from a hearth feature at Site 11. The sample was determined to have a calendric range of AD 1645-1950 (Hammatt et al. 1987:60).

A second date was determined from a charcoal sample collected at SIHP Site 13188 (a cave), located at 375 ft AMSL in Kealakehe (Donham 1990b:22). In Honokohau 2nd, five age determinations were derived from three sites (SIHP 12981, 12994, and 13019) (Donham 1990c:19). Four of the five determinations yielded calendric ranges between AD 1610-1955. One sample exhibited a calendric range of AD 980-1650, and is considered to have limited interpretive value due to the large standard error of the sample.

On the basis of findings along the Kuakini highway corridor, Schilt postulated that exploitation of the kula zone north of Kailua would have occurred about 100 years later (AD 1550-1650) than the spread of agriculture into the kula zone further south. This temporal difference is attributed by Schilt to the differences in rainfall patterns between the two areas (Schilt 1984:7). If there is a south-to-north gradient in the beginning of agricultural use of the kula, it should also be apparent to some degree between the southern portion of Keahuolu, which exhibits distinctively more lush vegetation, and the ahupua'a of Honokohau 2nd, which is located within the environmental district of Kekaha. We should

therefore expect to find inland cultural deposits in southern Keahuolu which predate the earliest Honokohau 2nd deposits.

To date, no age determinations have been obtained from coastal Keahuolu sites. Deposits identified as being derived from permanent habitation sites by Cordy were apparently present at Koloko by around AD 1050-1100 (Cordy 1981:180). Given the proximity of Keahuolu to Kailua Bay, and its situation between Kailua and Koloko, it is reasonable to expect that permanent coastal habitation was occurring here prior to or around AD 1100. The area of permanent coastal habitation (and household garden plots) in Keahuolu is makai of the current project area. Much of the activity reflected in lower Keahuolu appears to be agricultural, yet this area is the driest of all the kula lands in Keahuolu.

If the rainfall gradient model is to be used for predicting agricultural use on a north-south axis, then it should also be applicable on an elevational axis. Since rainfall is significantly lower in the lower elevations, then agricultural exploitation of these areas should not precede exploitation of areas with greater rainfall. However, if coastal residents were commuting to upland or inland agricultural plots, or were trading with upland agriculturalists, then deposits in temporary habitation sites should date to the period of trade or commutation. On the basis of the above hypotheses concerning the use of the kula zone by agriculturalists, we should expect that inland sites at elevations between c. 10 and 400 ft AMSL will not predate sites located above 400 ft AMSL.

One of the goals of field reconnaissance during this survey was to locate deposits in caves or other features that had potential for containing carbonized material for dating, and to collect dating samples. A wide range of formal feature types was tested, not only to aid in determining function, but to determine if carbonized remains could be expected to occur in certain types of agricultural features.

Settlement pattern analysis is an integral component of archaeological studies due to its utility in summarizing locational strategies and changes in land utilization through time. Settlement pattern analysis requires the development and application of an accurate functional typology for sites and component features, and reliable temporal control. When land use models developed through settlement pattern analysis attempt to account for or explain interrelationships between human populations and their environment, elements of the human ecology approach are being manifest. This approach adds another dimension to a local cultural history and settlement pattern by attempting to provide insight into the dynamics of group survival, as reflected in ecofactual

remains left at sites or in the relationship between specific functional feature types and aspects of the reconstructed environment.

On the basis of previous findings in inland Honokohau 2nd, Kealakehe, and Keahuolu, it was expected that the predominant material remains within the project area would be agricultural features that normally contain little to no foodstuff remains and a relatively limited range of ecofactual information. The formal variation exhibited within this general functional category has not been specifically examined for the area of North Kona located at the transition between the Kailua agricultural zone and the barren rocklands of Kekaha. Of particular interest in the study of these features is to determine, to the extent possible, what cultigents might be associated with specific feature types. If more specific functional categories can be assigned to formal types, then a considerably more accurate model of agricultural land use for North Kona will be possible. One of the more refined models proposed to date is based on environmental variants and traditional Hawaiian vegetation zones which followed the elevational gradient.

Kelly (1983) and Schilt (1984) outline four subzones along the ecological gradient which correlate with traditional Hawaiian cultivation zones, as identified in historic sources and in kuleana land claim descriptions (Kelly 1983:47-64, Schilt 1984:3-11). The four subzones and their estimated elevational ranges are: (a) the kula, from 0 to c. 500 ft AMSL; (b) the kaluulu, or breadfruit zone, from c. 500 to 1,000 ft AMSL; (c) the apaa, from c. 1,000 to 2,500 ft AMSL; and (d) the amau, or upland jungle, from c. 2,500 to 4,000 ft AMSL (Schilt:1984:6). According to this model, the project area encompasses portions of the kula subzone.

As indicated by Schilt, the elevational ranges of specific subzones appear to vary on a north to south gradient, along with variation in rainfall patterns. The upper extent of the kula zone should therefore be at a higher elevation in the northern reaches of the agricultural district, where rainfall isohyets swing inland, away from the coast. A higher elevation for the kula/kaluulu transition in Keahuolu is also supported by cartographic data from two primary sources. Emerson's survey map (discussed above), places the forest edge at approximately 750-800 ft in Keahuolu.

Given the expansiveness of the kula subzone in Keahuolu, it is desirable to obtain a more refined interpretation of elevational variation within this subzone. It might be noted that rainfall, on an elevational axis, varies by as much as 20 inches per annum within this subzone. If the patterning and relative densities of various formal or preferably, functional

types of agricultural features can be shown to be dependent on elevation, then hypothetically, it can be argued that the kula subzone as identified by Schilt and others was in fact subdivided into smaller cultivation zones by the Hawaiian agriculturalists. Such a pattern may be unique to the ahupua'a situated at the Kailua/Kekaha transition, or it may be replicated in the drier lands to the north.

In order to address this problem, much of the synthetic analysis of the survey findings is aimed at examining feature patterning and occurrence by elevation. Variables such as overall surface area of the features, associations, and degree of aggregation are examined for the various formal types, in addition to spatial patterning.

## FIELD PROCEDURES

Aerial reconnaissance of the project area was conducted July 13, 1989, via helicopter, by Supervisory Archaeologist Theresa K. Donham, Supervisory Field Archaeologist Amy Dunn, and Field Archaeologist Keala Kauhi. The survey was conducted at the lowest elevation permissible, in overlapping sweeps oriented north-south across the project area. Visibility of the surface from the air was somewhat limited by vegetation. The survey indicated that cultural features occurred on all undisturbed lava types present within the project area. Sites located from the air included the larger platforms, several caves, numerous rock piles, and major walls. The visibility conditions and general patterning of sites identified by air indicated that the pedestrian survey could not be effectively conducted using variable-intensity pedestrian sweeps. All pedestrian sweep corridors would therefore be maintained at the 10.0 m interval or less.

The pedestrian survey was conducted July 10-August 14, 1989, by a crew of five to six persons. The survey was begun in Parcel C, where sweeps were oriented E-W, beginning at the southern boundary of the parcel. Crew members involved in the pedestrian survey included Amy Dunn and Field Archaeologists Dave Dillon, Ranae Ganske, Jack Harris, Nick Kailipaka, Keala Kauhi, and Eric Pearthree. After completion of the Parcel C sweeps, a recording crew began recording located sites while the sweep crew continued to the upper project area parcels. Sweeps in the upper area were oriented N-S, beginning along the east side of Queen Kaahumanu Highway. After completion of the pedestrian survey, recording and testing continued through September 27. Additional crew members involved in the recording included Charlane Gross, Steve Ervin, Ellen Glassmeyer, Jenny O'Claray, John Risedorf, Richard Sullivan, and Debra Soper. Subsequently, additional subsurface testing

was conducted January 22-29, 1990 by a crew of three persons—Supervisory Archaeologists Theresa Donham and Bea Burgett, and Field Archaeologist Ranae Ganske.

During the pedestrian survey, survey transects were flagged in order to insure complete coverage, and all identified features were flagged, were assigned PHRI temporary site numbers, and were plotted onto a 1":200 ft scale aerial photograph. A total of 262 temporary site numbers were assigned during the pedestrian sweeps.

During the recording phase, sites were cleared of vegetation. If the sites were determined to be cultural, they were tagged with metal site tags, were photographed, were measured and described, and in certain cases, were mapped. An attempt was made to define as accurately as possible the boundaries of the site. The overall site area was measured along two perpendicular axes. In some areas, very poor surface visibility affected the accuracy of site boundary definition. Further field work, particularly vegetation clearing in some areas, may indicate that some sites are parts of the same continuous complex. It was not possible to measure and describe every observed feature within the large agricultural complexes. At these complexes, an attempt was made to obtain an accurate count of the various agricultural feature types within a specific measured area of the sites so that feature density could be estimated. Features counted, but not individually recorded in all cases, include rock mounds, pahoehoe excavations, and modified outcrops.

In general, surface visibility was such that all or nearly all surface features could be located with persons spaced c. 10.0 m apart. However, it is likely that there are additional rock mounds, pahoehoe excavations, and other minor agricultural features that were not observed during the sweeping or recording phases of field work.

Of the 262 temporary site numbers assigned, 25 were either combined with other temporary sites during the recording phase, or were deleted upon vegetation clearing and determination that the feature was noncultural (Table 1). Two sites (Mamalaho Trail and Kuakini Wall) were not given temporary site numbers during sweeps, since these sites had been previously registered on the SIHP and their locations were well documented and unmistakable.

Subsurface testing was conducted at 33 features (24 sites). Four of the features are caves with habitation midden deposits (Sites 13287, Feature A; 13302, Feature C; 13350; and 13441, Feature P). The remaining tested features include faced mounds, terraces, platforms, pahoehoe excavations, and filled crevices. A total of 29 test units (28.48 sq m) was

excavated to depths ranging from 0.03 to 1.48 m below surface. Among the excavation units, 19 were 1.00 sq m or larger. Midden was collected from the screened soil of five test units. Soil in quantities sufficient for sampling was observed and collected from 25 test units. Charcoal was collected from six test units. The charcoal samples of sufficient size for age determination analysis were transported to the Hilo laboratory where they were prepared and shipped to Beta Analytic, Coral Gables, Florida for radiometric age determination.

All soil screening was conducted in the field, with nested 1/8 and 1/4 inch mesh hardware cloth. In some cases, the soil was too damp for dry screening, so water was used with the screens. Several features contained insufficient

amounts of soil for both screening and soil sample collection. In these cases, the soil was collected for further examination. All lithic, botanical, and faunal materials collected from the 1/4" mesh samples were sorted and weighed at the Hilo laboratory. Materials recovered from the 1/8" mesh were examined for artifacts, fish and mammal remains, and shellfish species not represented in the 1/4" collections. Recovered artifacts were catalogued, drawn, measured, and described prior to curation.

Soil samples were examined closely for various inclusions (gravels, rootlets, landsnails, ecofacts, etc.) and were described using standard USDA/SCS categories and Munsell color charts.

## FINDINGS

### SURFACE FINDINGS

During the present survey, 239 sites consisting of 1,810+ component features were identified within the project area. The sites are summarized in Appendix C, and their approximate locations are shown in Figure 1.

Within the project area are four relatively distinct clusters of sites. These occur at the northwestern end of the project area, between nine and 20 ft AMSL; along the east side of Queen Kaahumanu Highway, between 50 and 150 ft AMSL; along the north side of Palani Road, between 200 and 400 ft AMSL; and at the eastern end of the project area, between 450 and 600 ft AMSL. The patterning of these clusters is such that they are in non-overlapping elevation ranges which encompass the overall elevation range of the project area.

The distribution of sites in general shows no marked tendency toward higher densities at specific elevations. If the project area is stratified in 100 ft intervals, the greatest number (70) of sites is in the 0-100 ft interval; however, this interval also covers the greatest surface area. The four intervals between 100 ft and 500 ft have similar surface areas, and three of the intervals have nearly identical site counts that range between 31 and 35 sites. The exception is the 200-300 ft interval, which contains 50 sites, most of which are clustered at the south end of the project area. When patterning of features is examined, however, there is less regularity in the distribution.

In order to examine the patterning of features by elevation, three general intervals were selected—less than 200 ft (101 sites, c. 580 acres, 53% of total surface area); 200-399 ft (117 sites, c. 380 acres, 34% of total surface area); and 400 ft or greater (51 sites, c. 140 acres, 13% of total surface area). These elevation intervals approximate three rainfall zones of 20-30 inches, 30-40 inches, and 40-50 inches per annum. It should be noted that the 30 and 40 inch isohyets swing upland approximately in the center of Keahuolu. The 30 inch isohyet, for example, is slightly below 200 ft AMSL in the southern portion of the project area, yet is at c. 350 ft in the northern portion.

A breakdown of formal feature types by elevation interval (Table 2) indicates that, overall, feature density is greater in the upper interval (400 ft or greater). In this interval, 26.4% of all features occur in 13% of the total surface area. The occurrence rate for features here is

approximately 3.4 features per acre. In the lower elevation interval (less than 200 ft), the feature occurrence rate is approximately 1.3 features per acre, and in the 200-399 interval, there are approximately 1.5 features per acre. It is likely that additional features (not located during this survey) are present in the upper elevation interval, where visibility was extremely limited.

As indicated in the following discussion, the distribution pattern for specific formal feature types does not conform to the overall feature occurrence pattern. The various formal categories are summarized below.

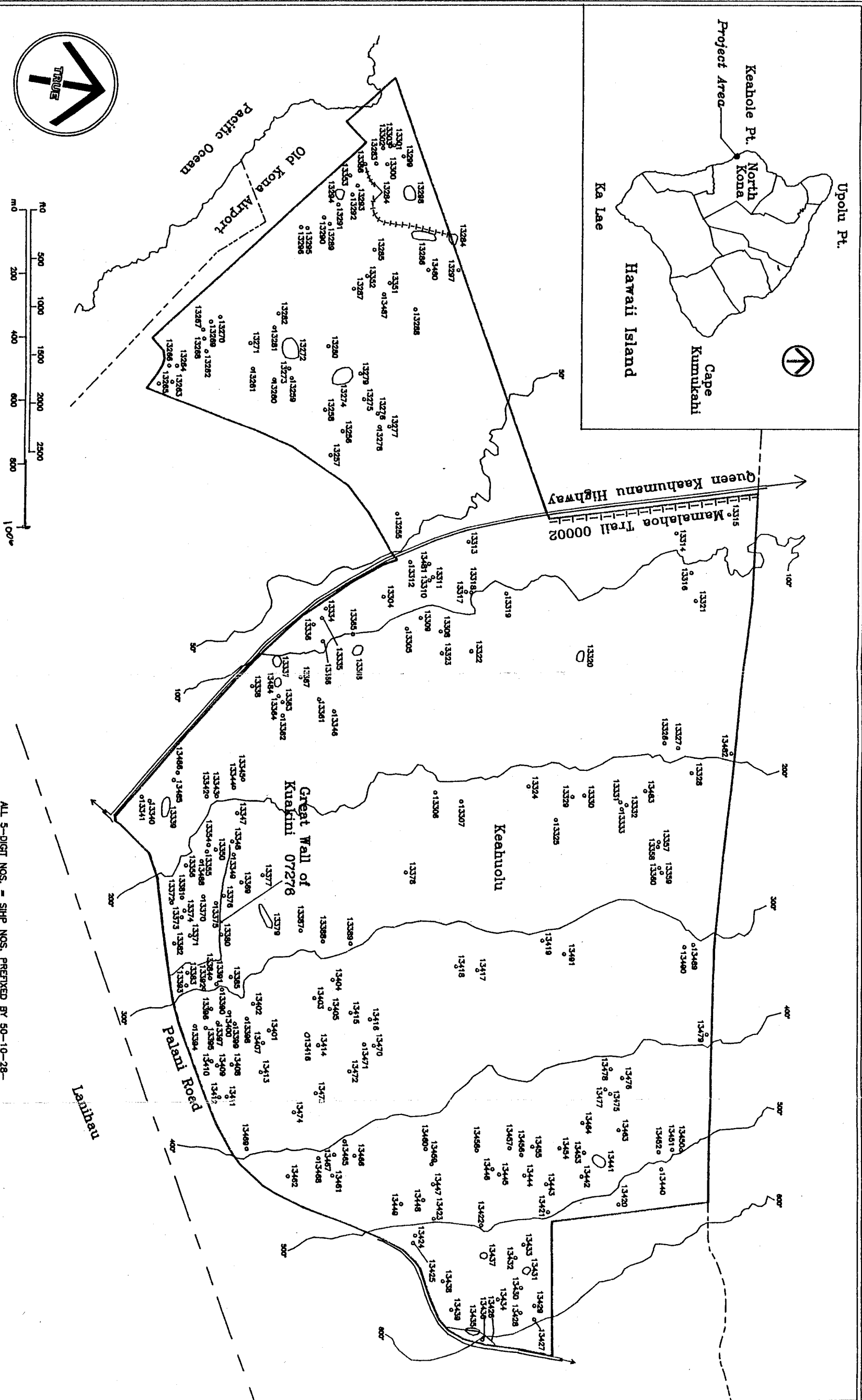
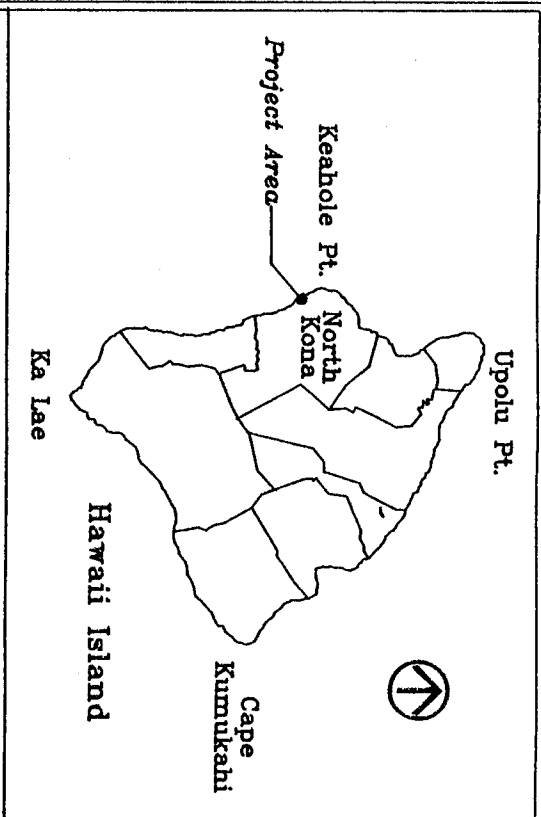
Twenty-six formal types are represented among the identified features. These include the types listed in Table 2 as well as five types with less than three occurrences each that were combined in the "other" category. These include two roadbed sections, a cupboard, a loading ramp, two modified pools, and two uprights. Predominant among the formal types are pahoehoe excavations (892, 49.3% of all features), three varieties of rock mounds (236, 13.1%), and modified blisters and outcrops (246, 13.6%). The clear majority of these features, which together comprise 76% of all features (1,374), reflect agricultural activities. Agricultural activities are also represented by enclosures, terraces, rubble walls, and low platforms. Overall, approximately 90.0% of all features are associated with agricultural functions.

Formal feature types representing temporary habitation include caves (44 of 50, 2.4%), overhangs (10, 0.6%) and possibly one or two of the five identified C-shapes. Permanent habitation is suggested, but not yet demonstrated, for 22 medium to large platforms. These features occur in complexes that contain additional agricultural features. Other functions represented by a few features each include transportation, rock art/recreation, possible aquaculture (limited to small pools), markers, burial, and ceremonial.

Ten of the formal feature types are represented by more than 2.0% of the total feature inventory. These types are individually discussed below.

### Caves

Fifty caves with evidence of prehistoric occupation or utilization were identified. These features are most common in the 200-399 elevation interval, where nearly half (48%) occur. This is also the area where most of the currently occupied caves are located. The frequency of caves in



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FIGURE 1.  
 Project Area and  
 Site Location Map

Table 2.

## FEATURE COUNTS BY FORMAL TYPE AND ELEVATION INTERVAL

Formal Type	<200ft		200-399ft		400 ft +		Total	Percent
	N	%	N	%	N	%		
Alignment	16	51.6	8	25.8	7	22.6	31	1.7
Cairn	10	25.0	13	32.5	17	42.5	40	2.2
Cave	9	18.0	24	48.0	17	34.0	50	2.8
C-Shape	2	40.0	1	20.0	2	40.0	5	0.3
Enclosure	8	18.6	17	39.5	18	41.9	43	2.3
Faced mound	-	-	2	15.4	11	84.6	13	0.7
Filled crevice	4	80.0	-	-	1	20.0	5	0.3
Linear mound	4	22.2	13	72.2	1	5.6	18	1.0
Midden scatter	3	100.0	-	-	-	-	3	0.2
Modified blister	12	19.0	17	27.0	34	54.0	63	3.5
Modified outcrop	136	74.3	20	10.9	27	14.8	183	10.1
Mound	46	22.4	20	9.7	139	67.8	205	11.3
Overhang	9	90.0	-	-	1	10.0	10	0.6
Phh. excavation	392	43.9	368	41.3	132	14.8	892	49.3
Pavement	5	31.3	2	12.5	9	56.2	16	0.8
Petroglyph	13	72.2	2	11.1	3	16.7	18	1.0
Platform	8	18.2	22	50.0	14	31.8	44	2.4
Rock concentration	17	100.0	-	-	-	-	17	0.9
Terrace	27	32.5	27	32.5	29	34.9	83	4.6
Trail	7	53.8	-	-	6	46.2	13	0.7
Wall (bifaced)	1	12.5	6	75.0	1	12.5	8	0.4
Wall	11	26.8	23	56.1	7	17.1	41	2.3
Other	5	55.6	2	22.2	2	22.2	9	0.5
<b>Total:</b>	<b>745</b>	<b>41.2</b>	<b>587</b>	<b>32.4</b>	<b>478</b>	<b>26.4</b>	<b>1,810</b>	<b>99.9</b>

Keahuolu contrasts markedly with Kealakehe to the north, where only a single habitation cave was located (Donham 1990b:13). The Keahuolu cave features generally reflect very little or limited evidence of habitation. Three caves with the thickest identified cultural deposits were tested during this survey (Sites 13287, 13350, and 13441). These features are located in the lower, middle, and upper elevation intervals, respectively. The deepest cultural deposit located within the project area (0.14 m) is at Site 13287, where a number of portable artifacts, such as coral abraders and hammerstones, were also found. A dating sample collected at this cave yielded a calendric range of AD 1430-1650 (BETA-35482).

The Site 13350 cave complex is the most extensive cave shelter within the project area. This site consists of

four major lava tubes, joined at a central collapsed blister. The interior area is extensively modified and includes enclosures, terraces, pavements, and walls. A human burial is also present. Although the midden/soil deposit is quite thin (generally less than 0.02 m), numerous portable remains and artifacts are present. Artifacts include abraders, adzes, hammerstones, bone picks, and shell scrapers. This feature may have functioned as a short-term refuge cave. Four dating samples were collected from various chambers and internal features at this cave. Two of the samples returned calendric ranges that extended into the modern era and two samples returned dates with calendric ranges between AD 1305-1650 (the dates are discussed in further detail below).

The cave tested at Site 13441 is spatially associated with a number of platforms, terraces, and modified outcrops.

It is likely that at least two of the platforms in this complex were permanent habitation features. The cultural deposit in this cave has a maximum thickness of 0.05 m. Fewer artifacts and portable remains are present here, in comparison with the preceding caves, and they are not in close association with other habitation features. A dating sample recovered from this feature has two alternative calendric ranges, AD 1523-1568 or AD 1633-1955. A prehistoric component is indicated for the site, based on portable remains. Therefore, given these alternative ranges, the occupation is likely to have occurred sometime after AD 1523.

Among the cave sites not tested, the majority exhibited modifications, such as walled entrances or cleared floors, but contained no portable remains (57%). Scattered marine shell fragments (mostly Cypraeidae and *Cellana*) were observed in 23% of the 47 caves not tested. Additional portable remains were observed in six of these caves, and consist primarily of kukui nut shell (which may not be culturally introduced), charcoal flecks (three caves), and fishbone (one cave). Coconut husks, bamboo, and hearth features were observed at one cave (Site 13458). Early twentieth century artifacts (bottle glass) were observed in two caves (13377 and 13445), and modern artifacts were observed in three caves. As noted above, modern habitation caves with no evidence of prehistoric habitation were not recorded.

In addition to the Site 13350 feature, five caves contained human interments. These caves exhibited no evidence of habitation, and minimal modifications are present in most cases.

The caves with midden remains are relatively evenly distributed across the three elevation intervals. Among the ten caves with midden deposits (not necessarily with soil), three are in the lower interval (less than 200 ft), three are in the middle interval (200-399 ft), and four are in the upper interval (400 ft and above). The burial caves are present in middle (4) or upper (2) elevations only.

## Enclosures

Most of the enclosures identified within the project area are generally small, loosely constructed features with low walls, and they appear to be associated primarily with agriculture. There are a few enclosures that are relatively unique in size and/or construction. The largest and most unique enclosure within the project area has an interior area of approximately 10,340 sq m; it surrounds the Site 13441 complex. The second-largest enclosure is square, with an interior area of 1,024 sq m. It is one of very few enclosures

recorded to date with core-filled, bifaced walls. This feature (Site 13462) is located in the preserve area. The only features observed inside the enclosure were pahoehoe excavations.

A group of seven enclosures at Site 13435 may have been constructed during the historic period. These features abut an abandoned section of Palani Road, and appear to have been built after the roadbed was in place. They range in size from 18.20 to 118.80 sq m; some sections of the feature walls are bifaced, others are stacked. The nearness of these features to the roadbed, and the presence of ramp-like filled areas from the road to the enclosures, suggest that they were utilized in the sisal mill operations that took place in the area (see Appendix B); probably the enclosures functioned in the transporting process.

Four enclosures are located inside a cave shelter (Site 13350). These features range in area from 1.7 to 13.5 sq m.

Among the larger enclosures is a circular feature at Site 13404 that has an interior area of 207.0 sq m. A portion of this enclosure wall forms a terrace, and the entire feature is very likely agricultural. Among the remaining enclosures for which measurements are available (20), three have interior areas greater than 50.00 sq m. Areas range from 3.4 to 120.0 sq m. None of the enclosures identified appear to be associated with ranching. Data is presently missing for most of the enclosures located within the preserve area; these features are associated with interior structures such as platforms and terraces.

One enclosure (Site 13329) was in current use at the time of survey. The 40.00 sq m interior area was found subdivided into small planting areas for ornamentals and other plants. No mango tree enclosures, such as those found at Kealakehe (11 located), were observed during the survey, although one was located in the Keahuolu parcel east of this survey area (Donham 1990b:13).

Two enclosures (Sites 13261 and 13381), both located in the lower elevation interval, were tested in an attempt to better define the functions of the features. Both enclosures are small and low-walled, and contain single interior features that incorporate branch coral. The Site 13261 enclosure has an interior surface area of 21.5 sq m and very low walls (0.39 m maximum height). The interior area is scattered with branch and waterworn coral, and a depression near the center is filled with cobbles and boulders. Because it was thought that this feature may enclose a human interment, it was submitted to subsurface testing. No human remains were located; however, an organically rich soil deposit was



located beneath the rock fill inside the structure. No portable remains suggesting temporary habitation were present. It is therefore most likely that this is a small planting area that may have also contained a shrine.

The Site 13381 enclosure has an interior area of 12.0 sq m, and encloses a rock and coral-filled terrace. This feature was also thought to possibly contain a human interment, and was tested. The terrace was found to contain coral throughout, and no human remains. No soil was present beneath the fill, or elsewhere inside the structure. No portable remains indicative of temporary habitation were present. This feature is most likely a shrine.

### Modified Blisters and Outcrops

These two categories are combined here, because they do not appear to have been consistently distinguished in the field by the recording crew. The definition of a modified outcrop includes the group modified blisters, which theoretically is more specific. Modified outcrops consist of natural pahoehoe depressions, slopes, or flats that have been cleared of large loose rocks and filled in places with gravel and small cobbles. The larger stones are generally arranged around or near the outer perimeter of the cleared area in loose piles or alignments. In some cases, the resulting feature is somewhat terrace-like in appearance. Modified outcrops are distinguished from pahoehoe excavations in that the lava mantle is not penetrated. They may otherwise have similar morphological characteristics.

The occurrence pattern of modified outcrops and blisters indicates a very distinct concentration between 50 and 150 ft AMSL, to the east of Queen Kaahumanu Highway (Figure 2). Excepting a few features near the coast, nearly all other modified outcrops and blisters are present in the southern portion of the project area, with slightly greater density above 400 ft AMSL. As indicated below, this patterning is quite divergent from the patterning of pahoehoe excavations. It is suspected that the availability of surface soil may be a determining factor in the location of modified outcrops and blisters.

Modified outcrops tend to occur in aggregates; the 246 features enumerated occur at only 34 sites. Groups of 10-33 modified outcrops or blisters occur at nine sites.

A single modified outcrop (Site 13424) was tested, and found to contain a 0.05 m thick deposit of organic soil beneath size-sorted layers of cobble (upper) and pebble (lower) fill.

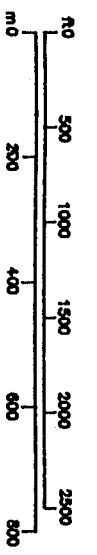
### Pahoehoe Excavations

Characteristic pahoehoe excavations consist of small lava blisters that have the surface broken away, creating a hole where the gas pocket existed between layers of lava. Depth of the hole usually ranges from 0.4 to 0.9 m. When the excavations were utilized, presumably for agriculture, the blocks and pieces of pahoehoe debris broken away were usually arranged around the perimeter of the hole in a circular alignment, or were rearranged inside the excavation, with larger stones around the perimeter. The hole is often partially filled with pieces of pahoehoe that are size-sorted (smaller pieces on the bottom, larger pieces on top). The gravel present in lower layers of these holes are often very angular and unweathered, and they appear to be artificially produced by crushing larger rocks. Soil is often mixed with the gravel, or is present as a distinct layer beneath the rock fill, not visible unless the fill is removed.

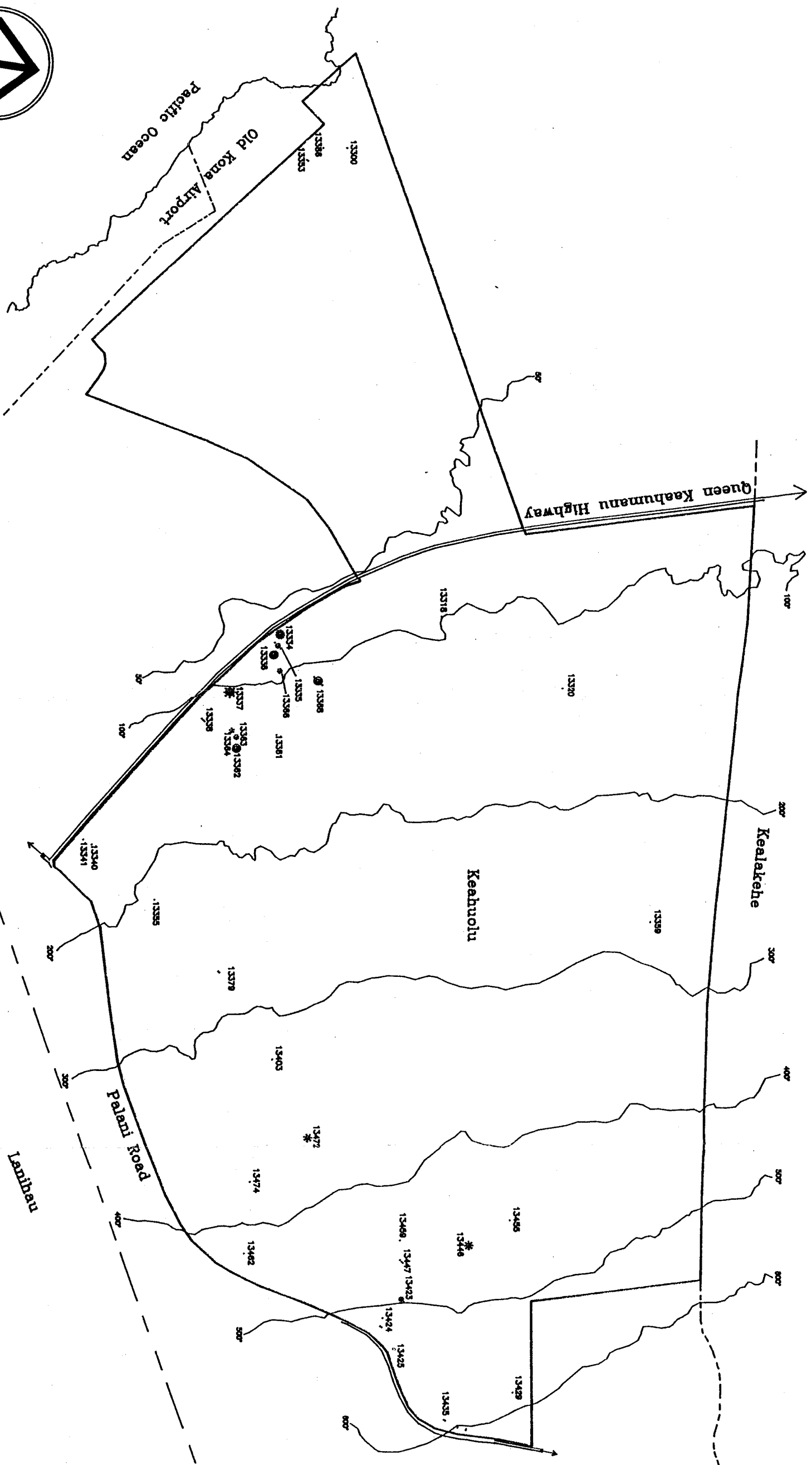
If the pahoehoe excavation is essentially a by-product of stone quarrying, there is generally no associated loose blocks in or around the hole, although smaller debris is present, and there is no evidence of modifications in or around the hole. Excavations that exhibit no internal backfilling or modifications, yet have associated piles of removed stones are problematic, since they could represent a production stage of either a stone quarry or an agricultural plot.

The required descriptive data for reliable functional interpretation of all of the identified pahoehoe excavations is currently not available, or has not been compiled and tabulated from the feature descriptions available. Such a task will require far greater time than allowed for this project. Pahoehoe excavations thought to represent quarries are indicated in Appendix C. It should be noted, however, that there has been insufficient work focused on these features to provide clear guidelines for functional interpretation. The majority of the quarry excavations appear to have been for the purpose of constructing mounds, terraces, or similar agricultural surface features. In this capacity, the quarry is associated with agriculture.

Pahoehoe excavations are widely dispersed across the project area, with one prominent cluster near the coast (Figure 3). This cluster may represent garden plots associated with coastal residences. There is essentially no surface soil in this area, and unless artificially broken, very few natural breaks in the lava mantle. Immediately to the north, however, is naturally broken, upthrust tubes and blisters,



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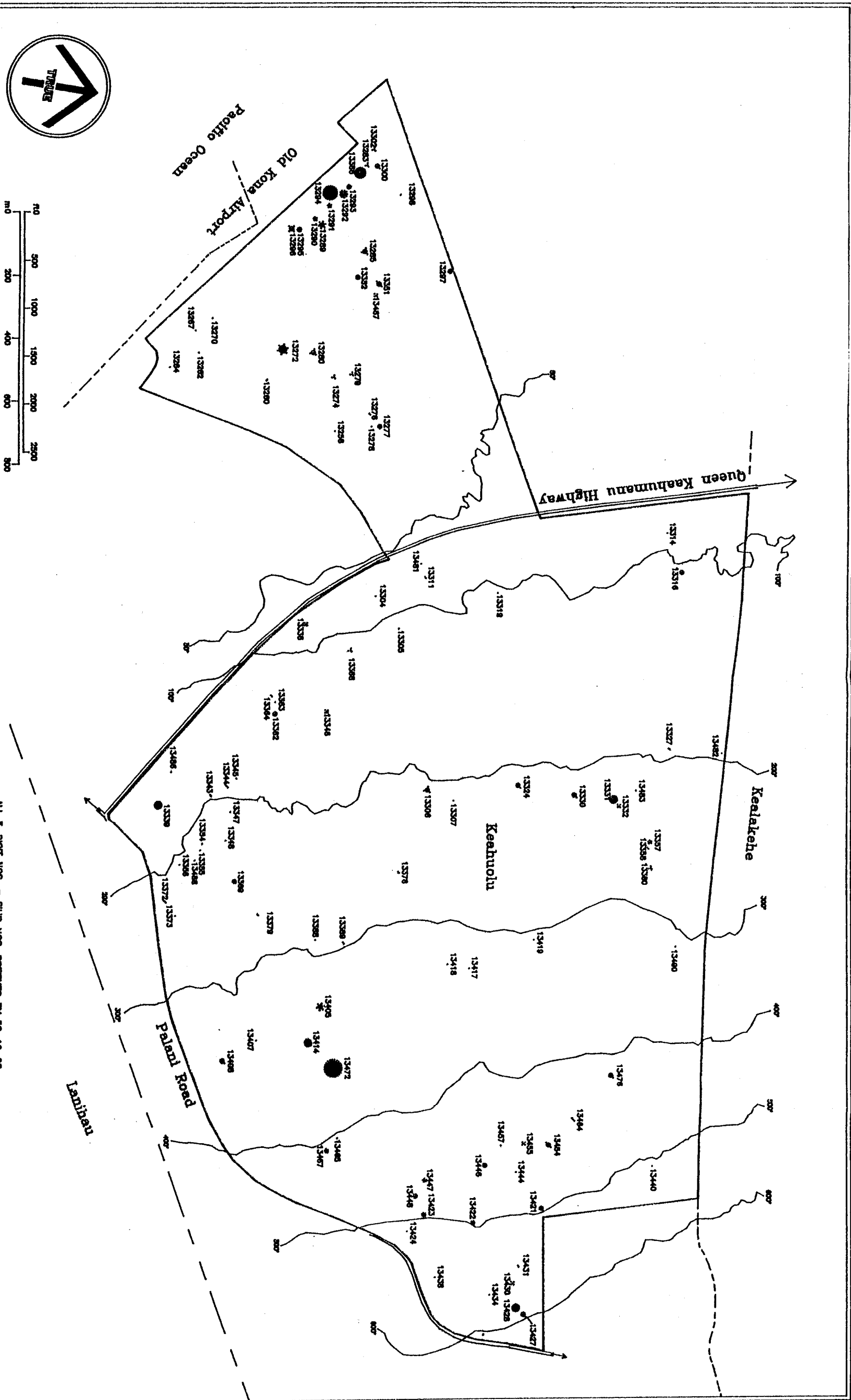
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**FIGURE 2.**  
 Occurrences of  
 Modified Outcrops and Blisters



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FIGURE 3.  
 Occurrences of  
 Pahoehoe Excavations

and several caves. It is interesting to note that the pahoehoe excavation frequency is very low in the coastal area behind the Lanihau shoreline strip (Figure 3).

Based on available data, it appears that the pahoehoe excavations along the coast are generally smaller than inland excavations. Average surface area for lower elevation excavations is 8.9 sq m, compared with 15.8 sq m in the upper elevation interval. This difference is affected to an unknown degree by the fact that a greater percentage of all excavations in the lowlands were measured, whereas the more prominent, i.e., larger features in the upper areas were measured.

The frequency of pahoehoe excavations in Keahuolu is considerably greater than that for Kealakehe, where only 85 excavations were located within an 800 acre area between 90 and 700 ft AMSL. In Keahuolu immediately upslope from the project area, 173 excavations were enumerated within a 150 acre area (Donham 1990b:14). This frequency is very similar to that for the 140 acre area above 400 ft AMSL within the project area.

## Mounds

A total of 236 rock mounds were recorded or enumerated within the project area. Thirteen of these are faced, and 18 are linear in form, as opposed to the circular to oval form of most (205) mounds. Among the circular to oval mounds, a clear majority (67%) occur in the upper elevation interval, at a rate of nearly one mound per acre of total surface area. These features are currently more frequent than pahoehoe excavations in the upper elevation interval. Only 20 circular to oval mounds were located between 200 and 399 ft AMSL, for a rate of one for every 19 acres. Mound frequency is slightly higher in the lower elevation, where one mound is present for every 13 acres. The rock concentrations observed in the lower elevations (17) are generally too small to be considered as collapsed mounds, although they could represent early construction stages of mounds.

The distribution of faced mounds shows a marked concentration in the upper elevation interval. Eleven of 13 identified faced mounds are above 400 ft AMSL; none are in the lower elevation interval. In addition, the only occurrences of noticeable aggregation of mounds at complexes is in the upper elevations (Figure 4). Mound frequency appears to increase slightly upslope from the project area, where 209 were identified in the 150 acre Keahuolu parcel previously surveyed (Donham 1990b:16).

Four faced mounds, a linear mound, and two circular to oval mounds were tested during this survey. The principal purpose of the testing was to ascertain whether they contained internal features. The faced mounds were located at Sites 13428 (2), 13434, and 13460. These structures consisted of ring-like, faced perimeters of pahoehoe slabs that were filled with smaller cobbles and pebbles. Soil was encountered beneath two of the mounds, and an unburned kukui nut (complete, but fragmented) was located near the base of one mound (Site 13428, Feature E).

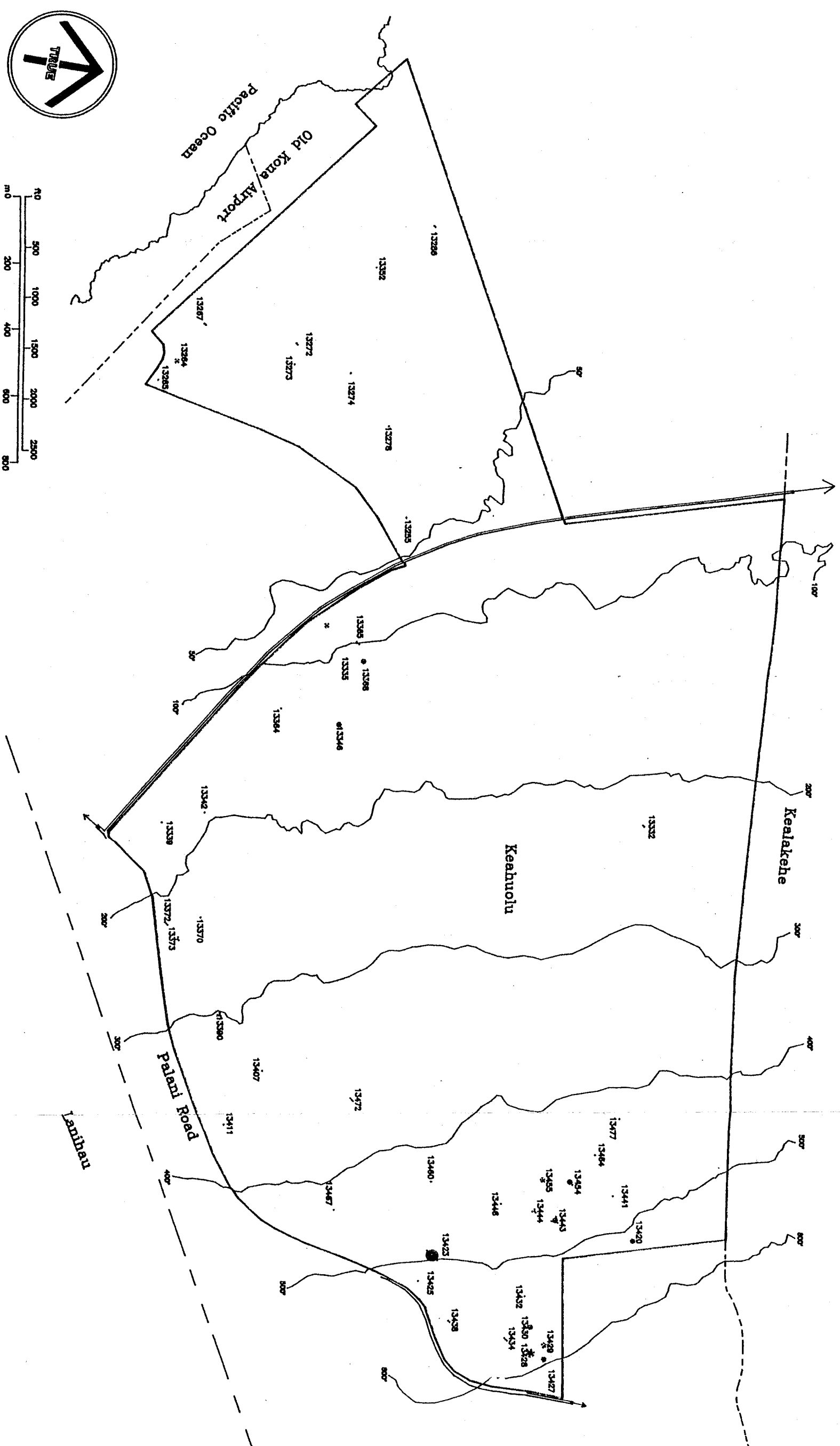
The linear mound tested (Site 13298) is one of four linear mounds in the lower elevation interval. This feature exhibited no internal differentiation of fill, and was covering a thin soil deposit. The other two mounds tested were also in the lower elevation interval (Sites 13255 and 13265). Neither of these mounds contained soil deposits. The Site 13255 mound was constructed with aa, and was mostly destroyed by grubbing. The intact portion indicated that a single layer of pahoehoe slabs had been placed on the aa prior to mound construction. Perimeter stones were slightly larger than the core filling.

## Platforms

Half of the 44 identified platforms are present in the 200-399 ft elevation interval and are mostly concentrated at the southern end of the project area, in the vicinity of Kuakini Wall. In addition, all eight of the platforms in the lower elevation interval are at 80 ft AMSL or greater; five are over 150 ft AMSL and are at the southern end of the project area. No platforms were identified makai of Queen Kaahumanu Highway.

Prior to subsurface testing, it was assumed that the faced, paved platforms with surface areas of around 17.0 sq m or greater were originally constructed as habitation features, and that some might contain human interments (cf. Cordy 1981). Eight platforms were tested during this survey; subsurface findings at these features do not readily support the hypothesis that these features were habitation structures, or that they are burial monuments. It is therefore with some uncertainty that many of the medium to large platforms are assigned habitation functions.

There appears to be some elevation difference in the patterning of platforms by size. Between 200 and 399 ft AMSL, platforms exhibit an average surface area of 42.2 sq m (maximum area is 224.0 sq m). Above 400 ft, the average platform area is 29.5 sq m (maximum area is



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**FIGURE 4.**  
 Occurrences of  
 Rock Mounds

92.4 sq m). Average platform heights for the two elevation intervals is, however, nearly identical (0.81 and 0.82 m).

Four of the tested platforms exhibit surface areas between 22.0 and 26.0 sq m. One of the larger platforms (and the highest) tested is present at Site 13365 (Feature A); it has a surface area of 22.0 sq m, with an average height of 1.2 m. The structure is vertically faced on all sides and paved on the surface. Overlying approximately half of the surface pavement is a layer (up to three stones thick) of large cobbles and small boulders that appears to have been thrown onto the platform. It appears that this layer represents backfill from a possible excavation into the platform, possibly for an interment which followed abandonment of the feature, or occurred at the time of abandonment.

Excavation indicated that the platform had not been previously disturbed; that it contained no internal features or portable remains; and that it was constructed over a prominent pahoehoe blister. The platform perimeter is essentially a faced facade around the sides of a blister. The area between the pahoehoe slope and the walls was filled with undifferentiated rock fill, and the top was leveled and covered with smaller stones. The center of this and all other platforms tested is actually the shallowest point of the fill, since it is the highest point of the underlying blister. No portable remains whatsoever were encountered in the platform fill—a situation that is highly unlikely if the feature was used for habitation.

This and other platforms tested appear to be formalized agricultural features. All of the tested platforms contained buried soil deposits up to 0.4 m thick. Soil was not observed immediately around the exterior of these features, and it is unlikely that the buried soil occurred naturally on the tops of the pahoehoe blisters. The low platforms might very well represent planting beds. The higher platforms might represent abandoned planting beds that were gradually built up as adjacent areas were cleared of loose rubble. Three of the tested platforms exhibited layers of large cobbles and boulders overlying a leveled surface of smaller stones. Such layering of fill attests to accretional buildup, rather than construction of the entire feature at one time. It is extremely difficult to properly document this process though excavation of single test units, and the presence of fill layering may have been missed in some features.

None of the platforms located in the preserve area were tested, and there is currently insufficient information concerning their construction to determine if they are habitation or agricultural features.

## Terraces

The 83 terraces identified within the project area are, in terms of numbers, evenly distributed across the three elevation intervals; the interval above 400 ft AMSL exhibits a greater count per acre. There are 29 terraces present between 400 and 600 ft AMSL. In contrast, only six terraces were enumerated in the Keahuolu parcel upslope from the project area (Donham 1990b:16).

There is little difference in the size of terraces when elevation is considered. For elevations above 400 ft AMSL, the average surface area is 34.5 sq m (19 terraces); for less than 200 ft AMSL, the average area is 36.4 sq m (20 terraces); and for the middle interval, average area is 20.35 (13 terraces).

One terrace (Site 13299) near the coast was tested in order to determine if the suspected function as a burial feature was correct. This feature contained a relatively high amount of branch coral, incorporated into the fill and placed on the surface. No internal features were observed; however, a soil deposit was encountered at the base of the rock fill.

A second terrace, located in the upper elevation interval, was also tested. This feature contained no portable remains and no soil was present beneath the fill. With the exception of terraces located inside caves, and possibly some terraces inside enclosures (preserve area), most of the terraces in the project area are probably agricultural features.

## Walls

The distribution of the 49 walls (8 bifaced) within the project area is very similar to that for platforms. The greatest proportion (in terms of numbers) occurs between 200 and 399 ft AMSL. Among the bifaced walls, 75% (6) are in the middle elevation interval, with only one each in the upper and lower intervals.

Nearly all of the unfaced walls incorporate natural rock features, which results in definition of a small space or relatively sheltered low area. Only one of the unfaced walls occurs in isolation, with no additional associated features. All other unfaced walls are in complexes with agricultural features.

### SUBSURFACE FINDINGS

Subsurface testing was conducted at 24 sites (33 features) within the project area (Table 3). Twenty-nine test units were excavated to depths ranging from 0.03 to 1.48 m below surface. Four additional subsurface samples were collected from areas each c. 0.2 m square. Five of the features tested are caves or overhangs containing habitation midden deposits. All soil excavated from units at these features was screened

through 1/4- and 1/8-in mesh, and all portable remains were collected. Eight of the remaining 29 features tested contained no soil for screening, and the deposits in the rest of the features were sterile (with one exception). Bulk samples, usually consisting of all available soil, were collected from these latter features for further examination in the laboratory.

A total of 1,451.83 g of marine invertebrate remains were collected from the 1/4-in size grade mesh at four

Table 3.

### SUMMARY OF SUBSURFACE TESTING

SIHP No.	Feature	Formal Type	Unit Size	Max. Depth	Material Recovered
13255	-	Mound	1.00 sq m	0.87 m BS	-
13257	-	Filled crev.	0.25 sq m	0.55 m BS	-
13261	-	Enclosure	1.00 sq m	0.49 m BS	Soil sample
13265	-	Mound	1.00 sq m	0.32 m BS	-
13268	F	Filled crev.	0.64 sq m	0.48 m BS	Soil sample
13272	G	Phh excav.	0.25 sq m	0.60 m BS	Soil sample
13272	L	Phh excav.	0.20 sq m	0.05 m BS	Soil sample
13281	-	Enclosure	1.60 sq m	0.70 m BS	-
13386	A	Walled overhg.	1.00 sq m	0.10 m BS	Soil samples (3)
13287	A	Cave	2.00 sq m	0.14 m BS	Soil,mid,date smpl
13298	C	Lin. mound	2.00 sq m	1.07 m BS	Soil sample
13299	-	Terrace	1.00 sq m	0.38 m BS	Soil sample
13300	D	Overhang	0.20 sq m	0.02 m BS	Soil sample
13300	A	Mod. sinkhole	0.40 sq m	0.05 m BS	Soil samples (3)
13302	C	Overhang	0.50 sq m	0.05 m BS	Shellfish remains
13325	-	Terrace	0.25 sq m	0.18 m BS	-
13326	-	Platform	1.00 sq m	0.61 m BS	Soil, midden
13335	B	Platform	2.10 sq m	0.90 m BS	Soil sample
13350	H	Cave	0.25 sq m	0.02 m BS	Dating, midden
13350	H	Cave	0.25 sq m	0.05 m BS	Soil,mid,date smpl
13350	A	Cave	0.20 sq m	0.03 m BS	Soil sample
13424	B	Mod. outcrop	0.25 sq m	0.59 m BS	Soil sample
13428	C	Faced mound	1.00 sq m	0.67 m BS	Soil sample
13428	E	Faced mound	1.00 sq m	1.05 m BS	-
13428	G	Platform	1.00 sq m	0.90 m BS	Soil sample
13434	A	Faced mound	1.00 sq m	1.48 m BS	-
13441	C	Platform	1.00 sq m	0.75 m BS	Soil sample
13441	K	Platform	0.60 sq m	0.70 m BS	Soil samples (2)
13441	O	Platform	0.25 sq m	0.63 m BS	Soil, dating
13441	P	Cave	1.25 sq m	0.05 m BS	Soil,mid,date smpl
13460	A	Faced mound	1.00 sq m	0.50 m BS	-
13471	B	Platform	1.00 sq m	0.38 m BS	Soil sample
13465	A	Platform	4.00 sq m	1.16 m BS	Soil sample

features (13287, Feature A; 13302, Feature C; 13350, Feature A; and 13441, Feature P). The majority of these remains (1426.7 g, 98%) were collected from two test units excavated at Site 13287 (Table 4).

Test Unit 1 at Site 13287 was placed over a rock-filled terrace inside the cave. The upper layer (Level 1) of the test unit consisted of rock fill that contained only scattered Isognomonidae fragments. The upper level of the soil deposit (Level 2) (0.05 m thick) contained 12 varieties of gastropods, with Cypraeidae and *Nerita picea* the predominant species. The only bivalve species present in this level was Isognomonidae. Other food remains represented in Level 2 were Echinoidea, Crustacea, bird, fish and mammal bones (Table 4).

The second level of the soil deposit (Level 3; 0.05 m thick) of TU-1 exhibited an increase in the total weight of some species, a decrease in the varieties of gastropods represented, and an increase in the varieties of bivalves. The total weight of *N. picea* and Conidae nearly doubled in Level 3, whereas the weight of Cypraeidae decreased slightly. The number of gastropod species represented decreased from 12 to 8. Five bivalve species were represented in Level 3, including a significant increase in Isognomonidae by weight. Weights for Echinoidea doubled, and weight of mammal bone increased five-fold. The differences in the proportions of shellfish species represented between Levels 2 and 3, and the fact that there was no consistent trend of increasing or decreasing frequencies in the shellfish, suggest that different occupation components are represented.

TU-2 at Site 13287 was located near the center of the cave chamber, 3.0 m east of TU-1. Two levels, each 0.05 m thick, were excavated. Due to the irregularity of the deposit, portions of the unit were excavated to bedrock within the first level, and the soil volume was considerably less for Level 2 as compared with Level 1. This difference in volume probably accounts for the consistent decrease in all remains between Levels 1 and 2. In Level 1, eight gastropod species and four bivalve species are represented. In Level 2, six gastropod species and three bivalve species are represented, all of which are present in Level 1. The predominant shellfish in Level 1 are Cypraeidae, *N. picea*, and Conidae. In Level 2, Cypraeidae and *N. picea* predominate, with Thaididae ranking third, and Conidae fourth by weight. All shellfish species present in TU-2 are present in TU-1 in greater quantities (overall, more than twice the quantity by weight). TU-2 does not exhibit sufficient variability between levels to indicate two possible components in this area of the cave.

The second highest quantity of shellfish remains recovered by weight is from Site 13350. A single 0.05 m thick level was excavated near the center of this cave, yielding 18.79 g of shellfish. A single gastropod species (Cypraeidae) and a single bivalve species (Isognomonidae) is represented, in addition to Echinoidea, and bird, fish, and mammal bone.

Midden collections from the cave feature (Feature P) at Site 13441 and the overhang feature (Feature C) at Site 13302 are very sparse (less than 5.0 g). Shellfish species recovered from Site 13441 include, primarily, trace amounts of *Cellana*, *Nerita picea*, *Drupa ricina*, and Isognomonidae. Echinoidea, bird bone, and mammal bone are also present in very small quantities.

Shellfish recovered from Site 13302 include *Nerita picea*, *Theodoxus* spp., and Cypraeidae. No Echinoidea or other faunal remains were recovered.

The overall volume of recovered midden remains, as well as the thickness of the deposits in the four tested habitation features indicates that Site 13287 was the most intensively utilized shelter identified to date within the project area. Although distinct occupational components are not discernible in stratigraphic profile, the differences in occurrences and amounts of various shellfish species between the 0.05 m thick levels indicates at least two distinct occupations.

The frequency of recovered artifacts for TU-1 and TU-2 at Site 13287 exhibits a reverse pattern when compared to midden remains. Eight of the ten indigenous artifacts collected during excavation are from TU-2. These include a bone hook fragment, an Echinoid spine abrader, three volcanic glass flakes, a perforated pig tooth, and two perforated mammal bone fragments. Two Echinoid spine abraders were recovered from TU-1, one from each level. Eight metal fragments and a glass bead were also recovered from TU-2. All artifacts from TU-2 were from Level 1 (Table 5).

The bone hook fragment recovered from TU-2 consists of a 19.6 mm long shaft section of what appears to have been a one-piece hook. The section is relatively straight, suggesting that the hook was originally somewhat large. Weight is 0.11 g.

The perforated pig tooth is broken laterally across the drilled hole, which was positioned in the center of the short axis of the tooth. Overall length of the fragment is 20.8 mm; weight is 0.49 g.



Table 4.  
SUMMARY OF MIDDEN REMAINS

CATEGORY	13287				13302		13350		13441		GRAND TOTAL
	Feature A				Feature C		Feature P		Feature P		
	I-1	I-2	I-3	Total	I-1	I-2	I-1	I-2	I-1	I-2	
MARINE INVERTEBRATES											
GASTROPODS											
<i>Cellana</i> spp.	13.33	2.24		15.57	0.65	0.15		0.80			17.72
<i>Trochus intextus</i> spp.	2.32			2.32				0.00			2.32
<i>Nerita</i> spp.	1.53			1.53	7.43			7.43			8.96
<i>N. picea</i> spp.	80.54	141.23		221.77	70.60	20.01		90.61		0.41	312.83
<i>N. polita</i> spp.	15.74	22.90		38.64	2.96			2.96			41.60
<i>Theodoxus</i> spp.	0.31			0.31				0.00			0.85
<i>Littorina pintado</i> spp.	6.62	9.17		15.79	6.30			9.56			25.35
<i>Mitrella</i> spp.	0.07			0.07				0.00			0.07
<i>Lymnaeidae</i>	156.69	149.87		306.56	94.96	37.48		132.44	18.24		458.60
<i>Cymatidae</i>	0.72			0.72				0.00			0.72
<i>Thaididae</i>	65.81	66.85		132.66	38.99	24.09		63.08			195.74
<i>Drupa ricina</i> spp.				0.00				0.00		1.64	1.64
<i>Conidae</i>	61.15	109.26		170.41	74.48	13.61		88.09	0.54		259.04
<i>Terebridae</i>				0.54				0.00			0.54
Unidentified gastropods		25.41		25.41		8.20		8.20			33.61
SUBTOTAL GASTROPODS	0.00	404.83	527.47	932.30	296.37	106.80	403.17	2.48	18.24	3.40	1359.59
BIVALVES											
<i>Brachidontes crebristriatus</i>		0.20		0.20				0.00			0.20
<i>Isognomonidae</i>	7.65	1.01	6.42	15.08	7.37	4.30		11.67	0.14	0.20	27.09
<i>Tellinidae</i>			3.76	3.76	3.22			3.22			6.98
<i>Veneridae</i>			3.15	3.15	1.92	0.79		2.71			5.86
<i>Chemacea</i>			0.48	0.48				0.00			0.48
Unidentified bivalve			0.48	0.48	2.07			2.07			2.07
SUBTOTAL BIVALVES	7.65	1.01	14.01	22.67	14.58	5.09	19.67	0.00	0.14	0.20	42.68
OTHER											
<i>Echinoidea</i>		12.96	21.95	34.91	10.90	2.33	13.23		0.41	0.29	48.84
<i>Crustacea</i>		0.72		0.72			0.00				0.72
TOTAL MARINE INVERTEBRATES	7.65	419.52	563.43	990.60	321.85	114.22	436.07	2.48	18.79	3.89	1451.83
VERTEBRATES											
Bird		1.32	2.97	4.29	2.88		2.88		0.20	0.17	7.54
Fish		0.50		0.50		0.74	0.74		0.51		1.75
Mammal		1.38	5.26	6.64	6.75		6.75		2.96	14.47	30.82
TOTAL VERTEBRATES	0.00	3.20	8.23	11.43	9.63	0.74	10.37	0.00	3.67	14.64	40.11
VEGETAL REMAINS											
Charcoal		11.31	0.01	11.32	43.62	0.03	43.65		5.40		60.37
<i>Aleurites moluccana</i>		3.33	2.19	5.52	3.31		3.31		22.79	51.33	82.95
TOTAL VEGETAL REMAINS	0.00	14.64	2.20	16.84	46.93	0.03	46.96	0.00	28.19	51.33	143.32
GRAND TOTAL	7.65	425.92	579.89	1013.46	341.11	115.70	456.81	2.48	26.13	33.17	1532.05

Table 5.

**SUMMARY OF PORTABLE ARTIFACTS, SUBSURFACE COLLECTION - SITE 13287**

Artifact Category	TU-1		TU-2	Total
	L-2	L-3	L-1	
<b>INDIGENOUS</b>				
FISHING GEAR				
Hook fragment (bone)	-	-	1	1
TOOLS				
Abrader (Echinoid)	1	1	1	3
FLAKED STONE				
Volcanic glass	-	-	3	3
ORNAMENTS				
Perforated pig tooth	-	-	1	1
OTHER				
Perf. mammal bone	-	-	2	2
<b>TOTAL INDIGENOUS:</b>	<b>1</b>	<b>1</b>	<b>8</b>	<b>10</b>
<b>NON-INDIGENOUS</b>				
ORNAMENTS				
Glass bead	-	-	1	1
OTHER				
Metal fragments	-	-	8	8
<b>TOTAL NON-INDIGENOUS:</b>	<b>0</b>	<b>0</b>	<b>9</b>	<b>9</b>
<b>TOTAL ARTIFACTS:</b>	<b>1</b>	<b>1</b>	<b>17</b>	<b>19</b>

Two very small pieces of mammal bone with small drilled holes were recovered. The original sizes or shapes of these items cannot be determined from the fragments, which weigh 0.23 and 0.65 g.

Indigenous artifacts were recovered from screened soil only at Site 13287. Historic period artifacts, consisting of glazed stoneware sherds, were collected from the surface inside Feature A at Site 13386. No artifacts or midden were recovered from the screened soil excavated at this feature.

Sixteen soil samples collected from 16 features at 12 sites were subjected to standard soil description analysis and were closely examined for inclusions (see Table 6 for summary of soil samples). All samples were collected from beneath the rock fill of platforms, terraces, mounds, modified outcrops, or filled crevices and depressions. None of the soil

deposits sampled were exposed, although some may have been on an existing surface for an indeterminate period prior to construction of the overlying feature.

Eight of the soil samples were collected from beneath platforms, three from beneath mounds (two faced), and one each from beneath a terrace, an enclosure, a filled crevice, and a modified outcrop. Five samples are from features below 200 ft AMSL; eight are from features above 400 ft AMSL, and two are from features between 200 and 399 ft AMSL. With one exception, all sampled deposits had at least 0.3 m of rock fill over them; average beginning depth of the samples is 0.59 m below the surface of the feature.

The most common texture of collected soil is silt loam (sil), present in nine samples. Gravelly silt loam (gsl) occurs in two samples collected from the base of a filled crevice

Table 6.

## SUMMARY OF SOIL SAMPLES

SIHP No.	Feature	Depth	Color	Texture	Structure	Consistence
13261	-	47-49	5YR2.5/0	sil	1fgr	dsh, mfi, wso
						Angular basalt gravel common; lichens present; high organic content, very sparse tiny rootlets
13268	F	43-48	2.5YR3/2	gsil	1fsbk	dso, mfr, wss
						Very little organic content; mostly decomposing basaltic lava; very common angular gravels
13298	C	102-107	2.5YR2.5/0	sil	1msbk	dsh, mfi, wss
						Rich, organic matrix; no gravel; few land snails; very tiny rootlets common; may have carbonized material
13299	-	35-38	5YR2.5/2	sil	0msbk	dso, mfr, wss
						Decomposing roots and land snail; gravel rare; may have carbonized material
13326	-	55-59	5YR2.5/1	sil	1fcr	dlo, mlo, wss
						Rich in organic material; numerous small pieces Echinoidea, land snails; gravel very sparse, few tiny rootlets
13335	B	44-47	2.5YR3/4	sicl	2msbk	dso, mfr, wss
						Very little organic content; no land snails, sparse rootlets; no gravel
13424	A	54-59	5YR2.5/1	gsil	2fbk	dh, mfi, wso
						Numerous tiny gravels; scattered weathered pebbles; rootlets common
13428	A	95-97	5YR3/2	sl	0vfsg	dlo, mvf, wso
						Humic, duff-like matrix; roots and rootlets common; broken land snails
13428	C	57-67	2.5YR2.5/2	sl	0vfcr	dlo, mvfr, wso
						Numerous small roots; weathered gravels; few land snails; very humic
13428	G	76-82	2.5YR2.5/2	sil	3msbk	dh, mvf, wss
						Angular gravels common; numerous rootlets, land snails; <u>koa</u> seeds
13441	C	56-66	2.5YR2.5/0	sil	3fsbk	dh, mvf, wss
						Few angular gravels; numerous rootlets, land snails, and seeds
13441	K	10-14	2.5YR2.5/0	sil	1fcr	dso, mf, wso
						Scattered weathered basalt pebbles; possible carbonized material; rootlets common; no snails

(Soil Survey Staff 1962)

Table 6. (cont.)

SIHP No.	Feature	Depth	Color	Texture	Structure	Consistence
13441	O	60-63	2.5YR2.5/0	sil	3fsbk	dh, mvf, wso
Few angular gravels; rootlets uncommon; no snails; possible carbonized material; very similar to Feature C soil						
13465	A	114-116	2.5YR3/2	sil	1vfcf	dlo, mf, wss
Duff-like matrix; numerous angular gravels; seeds; broken land snails						
13471	B	31-35	2.5YR2.5/2	sicl	2fsbk	dh, mvf, ms
Angular gravels common; scattered weathered pebbles; numerous rootlets						

(Site 13268) and from the base of a modified outcrop (Site 13424). Sandy loam occurs in two samples, both of which were collected from beneath faced mounds at Site 13428. Silty clay loam is present in two samples, collected from beneath platforms (Sites 13335 and 13471).

Samples which appeared to be essentially undisturbed duff were collected at Sites 13428 and 13465. These samples include the sandy loam located beneath two faced mounds, and a silty loam located beneath a platform. This latter sample was collected from the deepest provenience, as measured from the top of the feature.

Soil which is very black, highly organic, and somewhat greasy to the touch occurs in five samples, four of which may have decomposing carbonized material. These soils occurred under various feature types, in all three elevation intervals. Feature types include three platforms, two of which are at Site 13441, a terrace, an enclosure, and a linear mound.

Marine faunal remains were observed in one sample recovered from beneath a platform at Site 13326. Numerous tiny pieces (less than 1/8-in in diameter) of Echinoidea occur in this matrix, which consists of highly organic silty loam. No *kukui* nut remains occur in collected soil; however, *kukui* shell was observed in three features, a faced mound (Feature E) and a platform (Feature G) at Site 13428, and a platform (Feature C) at Site 13441. In all three cases, the nut remains were located near the rock fill/soil interface and appeared to represent a complete, unburned nut. The soil matrix in all of these features is humic topsoil and additional

seeds, such as *koa-haole*, are present in the matrix. It is therefore uncertain whether the nuts were purposely placed or planted in these features, or were present in the duff prior to feature construction. In no case were they buried in the soil deposit.

Distinct patterns of soil type occurrence associated with specific feature types, elevation intervals, or depth below feature surface are not readily apparent among the collected samples. It is possible that more in-depth examination of the soil through chemical and palynological analysis will provide more relevant data for the interpretation of specific feature functions. A systematic study of existing natural soil deposits would provide a baseline for comparative analyses of the soils.

## AGE DETERMINATIONS

Seven dating samples, collected from three sites, were of sufficient size for age determination analysis. The samples were processed by Beta Analytic, Inc. They were calibrated according to Stuiver and Pearson (1986), and adjusted ages were normalized to 0.25 per mil carbon 13, with the calendric range calculated at two sigmas (Table 7). All of the samples consisted of charcoal. Two samples (RC-654 and 656) were less than 1.0 g and were given extended counting time in order to reduce the statistical error.

Six of the seven assayed samples were recovered from cave features at Sites 13287, 13350, and 13441. The seventh sample was collected from the surface of a soil deposit in Feature O, a platform, at Site 13441. Both

samples from Site 13441, and a Level 1 sample from Site 13350, were determined to be influenced by bomb C-14. Two of these samples returned the nineteenth century adjusted C-14 ages. All other samples returned adjusted C-14 ages ranging from AD 1580 to 1790.

Samples collected from Level 3 at Site 13287 and from a hearth at Site 13350 returned the earliest adjusted C-14 ages—AD 1580+/-50 and 1580+/-90, respectively. These ages have identical calibrated calendric ranges of AD 1430-1650. The Site 13287 and 13350 caves are the most intensively utilized habitation caves identified to date within the project area. Site 13287 is located at 12 ft AMSL and Site 13350 is located at 217 ft AMSL.

A second sample, collected from from the cave floor at Site 13350, returned an adjusted C-14 age of AD 1510+/-90. The adjusted calendric range for this sample has two alternatives, AD 1305-1360 or AD 1380-1650. The latter alternative appears to be most compatible with the C-14 age. This date is essentially contemporaneous with the Sample 653 date from this site.

Later occupation of Site 13350 is suggested by a third dated sample collected within the cave. This sample (652) returned an adjusted C-14 age of AD 1730+/-50. Five alternative adjusted calendric ranges are given for this sample; two extend into the nineteenth century and one is modern. The median range among the five alternatives is AD 1726-1818. On the basis of this date, it appears that an early historic component is present at Site 13350.

The dated sample from Site 13287 was recovered from the base of a cultural deposit which appears to represent the earliest of at least two occupational components. Later occupation(s) of Site 13287 is indicated by changes in the midden deposit and by the presence of possibly early historic period artifacts (a glass bead and small metal fragments).

On the basis of these dates, and recovered artifacts, it appears that Sites 13287 and 13350 were being utilized during the same time period(s).

Table 7.

## SUMMARY OF RADIOCARBON AGE DETERMINATIONS

PHRI Lab.No. RC-	Lab. No. BETA-	Provenience	C-14 Age Yrs. B.P. (one sigma)	C-13/ C-12 Ratio	C-13 Adjusted C-14 Age Yrs. B.P.	*Calendric Range Yrs. AD
<i>SITE 13287</i>						
650	35482	Feature A, TU-1, Level 3, 84-89 cmbd	290±50	-20.2	370±50	1430-1650
<i>SITE 13350</i>						
651	35483	TU-1, Layer I, Level 1, 0-2 cmbs	120±70	-26.1	100±70	1650-1955#
652	35484	TU-2, Layer I, Level 1, 0-5 cmbs	150±50	-21.0	220±50	1523-1566 1629-1696 1726-1818 1859-1861 1921-1954
653	35485	TU-3, Layer I, Level 1, 0-5 cmbs	410±60	-27.5	370±60	1430-1650
654	35486	Feature C, TU-4, Level 1, Surface	460±90	-26.2	440±90	1305-1360 1380-1650
<i>SITE 13441</i>						
655	35487	Feature P, TU-1, Layer I, Level 1, 0-5 cmbs	100.3±1.0% modern	-13.7	160±80	1523-1568 1630-1955#
656	35488	Feature O, HF-1, 43-45 cmbs	60±90	-21.6	120±90	1640-1955#

\* Calibrated according to Stuiver and Pearson (1986). Range at two sigmas.

# Denotes influence of bomb C-14.

## CONCLUSION

### DISCUSSION

The principal research goals of this preliminary analysis of inventory survey data were to examine existing hypotheses concerning the chronology of settlement and agricultural expansion in Keahuolu, and to search for patterns in the spatial distribution of various features that might be used to infer specific land use patterns as practiced by traditional Hawaiian agriculturalists.

One hypothesis examined here is Schilt's suggestion that agricultural expansion into the kula zone occurred in the Kona agricultural district between AD 1400 and 1650, with a similar expansion beginning in the area north of Kailua approximately 100 years later, between AD 1550-1650 (Schilt 1984:274). Radiocarbon dates from deposits in Kealakehe have suggested that agricultural activities in the inland portion of Keahuolu should postdate AD 1400 (Donham 1990b). The only reliable dates from the current project area are from two habitation caves; one is located 0.5 km from the coast and one is located 1.6 km from the coast. The artifactual deposits and extent of structural modifications in these caves suggest that they were used more intensively than as temporary shelters for travelers. The earliest dates returned for both caves indicate possible initial use during the same time period, between AD 1430 and 1650. This period may well represent the time of initial agricultural expansion into the kula zone, which is not considerably later than Schilt's hypothesized expansion period further south, in the core area of the Kona Field System.

There is ample evidence of relatively widespread activities in Keahuolu through the early historic period. During the current project, artifacts of early historic period manufacture were recovered from surface proveniences at three sites in the lower elevation interval (below 200 ft AMSL), and early historic period rock carvings such as names and initials occur in all elevation intervals. A radiometric date was also returned from the Site 13350 cave, a date which brackets the Contact Period. The chronology for inland Keahuolu is still tentative; however, indications are that the Keahuolu kula zone was used by traditional agriculturalists for at least a 400 year period, between c. AD 1450 and 1850. The absence of evidence for intensive cattle grazing, particularly in southern Keahuolu, means a possible extension of agricultural utilization through the nineteenth and early twentieth centuries.

The technique employed in this study to examine variation in land use has been to stratify the project area into three elevation intervals, which approximate the rainfall isohyets as projected for Keahuolu (following the data provided in the EIS for this project). The lower elevation interval (less than 200 ft AMSL) encompasses approximately 52.7% of the total surface area examined during the project, and contains 41.2% of the identified features. Features reflecting agriculture, temporary habitation, transportation, aquaculture, and possibly ceremonial activities are present. This area contains a relatively high proportion of the identified petroglyphs (72.2%) and trails (53.8%). The identification of both of these formal types is greatly enhanced in the lower elevations, due to sparse vegetation cover.

The 200-399 ft elevation interval encompasses 34.5% of the total surface area and contains 32.4% of the identified sites. This area differs from the lower elevations in that no trails were located, and surface features such as midden scatters, filled crevices, overhangs, and rock concentrations were absent. The middle elevation interval contains a significantly higher proportion of bifaced walls and platforms, as compared to the other two intervals. This difference is attributable to the concentration of possible habitation and agricultural features in the vicinity of the north end of Kuakini Wall. It is uncertain at this time whether the site cluster predates or postdates the wall. The eastern extent of the site concentration extends well beyond the wall to the east, and apparently continues to the south side of Palani Highway, outside the current project area (Rosendahl 1983).

The middle elevation interval also exhibits a substantial increase in cave shelters, cave burials, enclosures, and linear mounds, as compared with the lower elevation interval. Pahoehoe excavations and terraces show no major change in general frequencies between these two intervals, although they are more dense in the middle interval when relative surface areas are considered.

The upper elevation zone exhibits a substantial increase in rock mounds, particularly faced mounds, and modified blisters. Other agricultural features such as pahoehoe excavations, enclosures, terraces and platforms exhibit a higher density here than in lower elevations, but there is no significant difference in the occurrence of these features between the upper and middle elevation intervals. Findings from a prior survey of a 150-acre parcel in Keahuolu

immediately east of this project area indicate that between 600 and 750 ft AMSL, feature density increases, and the predominance of rock mounds becomes more apparent (Donham 1990b).

Examination of variation in the size, construction, and deposits of agricultural features by elevation intervals failed to determine substantive differences that might be dependent upon the elevation gradient. There does, however, appear to be differences in the occurrence patterns of certain formal feature types. These differences undoubtedly signal functional variation in some cases, but may also signal temporal variation. For example, faced rock mounds and possibly the agricultural platforms may be later variants of these general feature types. Likewise, the higher incidence of bifaced walls in the middle elevation interval may reflect more intensive use of this area during the historic period.

In order to obtain reliable data for continued analysis of the agricultural complexes, it is recommended that a systematic sampling approach be adopted, whereby sample blocks or transects are cleared of vegetation and all features within the designated area are plotted and recorded. These sample transects or blocks should be located independently of the existing sites in order to control for those features not located between survey sweeps in areas of dense vegetation.

The use of sampling blocks will provide a reliable basis for the analyses of feature density and relative frequency of types, and will provide a more realistic framework for comparing elevation variation. A sampling scheme will also help determine the best means for identifying site boundaries (or the absence of such) in areas where this is problematic. For example, it is suspected that several of the complexes in the upper elevations are currently delineated on the basis of no visibility, rather than the absence of features. Total clearing of the entire area is not feasible; however, this would be nearly accomplished if every complex was cleared in order to determine site boundaries. A systematic sampling approach should provide sufficient data for the mitigation of adverse effects on a large proportion of the agricultural complexes recommended for further data collection.

In conjunction with a sampling approach to further data collection within the project area, a more exact and replicable feature typology should be developed. With a proper typology, the spatial patterning of various feature types can be rapidly recorded, without the timely process of drawing each feature to scale. Given the expansiveness of the project area and the extensive clearing that will have to be completed for detailed scaled mapping, this procedure will of necessity

be limited to a relatively small proportion of the area recommended for further work. Plotting features by type will provide a much larger data base for examining spatial patterns.

## GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

General significance assessments and recommended general treatments for all identified sites are summarized in Table 8. Specific field work tasks for individual sites are summarized in Appendix C. Significance categories used in the site evaluation process are based on the National Register criteria for evaluation, as outlined in the Code of Federal Regulations (36 CFR Part 60). DLNR-HSS/SHPO uses these criteria for evaluating cultural resources. Sites determined to be potentially significant for information content fall under Criterion D, which defines significant resources as ones which "...have yielded, or may be likely to yield, information important in prehistory or history." Sites potentially significant as representative examples of site types are evaluated under Criterion C, which defines significant resources as those which "...embody the distinctive characteristics of a type, period, or method of construction...or that represent a significant and distinguishable entity whose components may lack individual distinction."

Sites with potential cultural significance are evaluated under guidelines prepared by the Advisory Council on Historic Preservation (ACHP) entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (ACHP Draft Report, August 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth." The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value."

To further facilitate management decisions regarding the subsequent treatment of resources, the general significance of the archaeological resources identified during the inventory survey were also evaluated in terms of potential scientific research, interpretive, and/or cultural values (PHRI Cultural Resource Management [CRM] Value Modes; see Appendix C for individual assessments of sites). **Research value**, refers to the potential of archaeological resources for producing information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional,



Table 8.

**SUMMARY OF GENERAL SIGNIFICANCE ASSESSMENTS  
AND RECOMMENDED GENERAL TREATMENTS**

SIHP Site No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
13255	-	+	-	-	-	+	-	-
13256	-	+	-	-	-	+	-	-
13257	-	+	-	-	-	+	-	-
13259	-	+	-	-	-	+	-	-
13261	-	+	-	-	-	+	-	-
13263	-	+	-	-	-	+	-	-
13264	-	+	-	-	-	+	-	-
13265	-	+	-	-	-	+	-	-
13266	-	+	-	-	-	+	-	-
13267	-	+	-	-	-	+	-	-
13269	-	+	-	-	-	+	-	-
13270	-	+	-	-	-	+	-	-
13271	-	+	-	-	-	+	-	-
13273	-	+	-	-	-	+	-	-
13276	-	+	-	-	-	+	-	-
13278	-	+	-	-	-	+	-	-
13282	-	+	-	-	-	+	-	-
13283	-	+	-	-	-	+	-	-
13284	-	+	-	-	-	+	-	-
13285	-	+	-	-	-	+	-	-
13286	-	+	-	-	-	+	-	-
13288	-	+	-	-	-	+	-	-

**General Significance Categories:**

- A = Important for information content, further data collection necessary (PHRI=research value);
- X = Important for information content, no further data collection necessary (PHRI=research value, SHPO=not significant)
- B = Excellent example of site type at local, region, island, state, or national level (PHRI=interpretive value); and
- C = Culturally significant (PHRI=cultural value).

**Recommended General Treatments:**

- FDC = Further data collection necessary (detailed recording, surface collections, and limited excavations, and possibly subsequent data recovery/mitigation excavations);
- NFW = No further work of any kind necessary, sufficient data collected archaeological clearance recommended, no preservation potential;
- PID = Preservation with some level of interpretive development recommended (including appropriate related data recovery work); and
- PAI = Preservation "as is", with no further work (and possible inclusion into landscaping), or possibly minimal further data collection necessary

Table 8. (cont.)

SIHP Site No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
13292	-	+	-	-	-	+	-	-
13293	-	+	-	-	-	+	-	-
13296	-	+	-	-	-	+	-	-
13297	-	+	-	-	-	+	-	-
13298	-	+	-	-	-	+	-	-
13299	-	+	-	-	-	+	-	-
13301	-	+	-	-	-	+	-	-
13303	-	+	-	-	-	+	-	-
13304	-	+	-	-	-	+	-	-
13305	-	+	-	-	-	+	-	-
13307	-	+	-	-	-	+	-	-
13310	-	+	-	-	-	+	-	-
13311	-	+	-	-	-	+	-	-
13312	-	+	-	-	-	+	-	-
13313	-	+	-	-	-	+	-	-
13314	-	+	-	-	-	+	-	-
13316	-	+	-	-	-	+	-	-
13317	-	+	-	-	-	+	-	-
13318	-	+	-	-	-	+	-	-
13319	-	+	-	-	-	+	-	-
13320	-	+	-	-	-	+	-	-
13321	-	+	-	-	-	+	-	-
13325	-	+	-	-	-	+	-	-
13326	-	+	-	-	-	+	-	-
13327	-	+	-	-	-	+	-	-
13329	-	+	-	-	-	+	-	-
13338	-	+	-	-	-	+	-	-
13341	-	+	-	-	-	+	-	-
13345	-	+	-	-	-	+	-	-
13347	-	+	-	-	-	+	-	-
13354	-	+	-	-	-	+	-	-
13361	-	+	-	-	-	+	-	-
13363	-	+	-	-	-	+	-	-
13366	-	+	-	-	-	+	-	-
13367	-	+	-	-	-	+	-	-
13369	-	+	-	-	-	+	-	-
13378	-	+	-	-	-	+	-	-
13388	-	+	-	-	-	+	-	-
13389	-	+	-	-	-	+	-	-
13406	-	+	-	-	-	+	-	-
13424	-	+	-	-	-	+	-	-
13426	-	+	-	-	-	+	-	-
13432	-	+	-	-	-	+	-	-
13433	-	+	-	-	-	+	-	-
13434	-	+	-	-	-	+	-	-
13439	-	+	-	-	-	+	-	-
13442	-	+	-	-	-	+	-	-

Table 8. (cont.)

SIHP Site No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
13444	-	+	-	-	-	+	-	-
13453	-	+	-	-	-	+	-	-
13461	-	+	-	-	-	+	-	-
13469	-	+	-	-	-	+	-	-
13470	-	+	-	-	-	+	-	-
13475	-	+	-	-	-	+	-	-
13480	-	+	-	-	-	+	-	-
13481	-	+	-	-	-	+	-	-
13482	-	+	-	-	-	+	-	-
13483	-	+	-	-	-	+	-	-
13485	-	+	-	-	-	+	-	-
13486	-	+	-	-	-	+	-	-
13487	-	+	-	-	-	+	-	-
13489	-	+	-	-	-	+	-	-
13490	-	+	-	-	-	+	-	-
<b>Subtotal:</b>	<b>0</b>	<b>84</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>84</b>	<b>0</b>	<b>0</b>
13258	+	-	-	-	+	-	-	-
13260	+	-	-	-	+	-	-	-
13262	+	-	-	-	+	-	-	-
13268	+	-	-	-	+	-	-	-
13272	+	-	-	-	+	-	-	-
13274	+	-	-	-	+	-	-	-
13277	+	-	-	-	+	-	-	-
13279	+	-	-	-	+	-	-	-
13280	+	-	-	-	+	-	-	-
13287	+	-	-	-	+	-	-	-
13289	+	-	-	-	+	-	-	-
13290	+	-	-	-	+	-	-	-
13291	+	-	-	-	+	-	-	-
13294	+	-	-	-	+	-	-	-
13295	+	-	-	-	+	-	-	-
13300	+	-	-	-	+	-	-	-
13302	+	-	-	-	+	-	-	-
13306	+	-	-	-	+	-	-	-
13308	+	-	-	-	+	-	-	-
13309	+	-	-	-	+	-	-	-
13315	+	-	-	-	+	-	-	-
13322	+	-	-	-	+	-	-	-
13323	+	-	-	-	+	-	-	-
13324	+	-	-	-	+	-	-	-
13328	+	-	-	-	+	-	-	-
13330	+	-	-	-	+	-	-	-
13331	+	-	-	-	+	-	-	-
13332	+	-	-	-	+	-	-	-
13333	+	-	-	-	+	-	-	-

Table 8. (cont.)

SIHP Site No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
13334	+	-	-	-	+	-	-	-
13335	+	-	-	-	+	-	-	-
13336	+	-	-	-	+	-	-	-
13337	+	-	-	-	+	-	-	-
13339	+	-	-	-	+	-	-	-
13340	+	-	-	-	+	-	-	-
13342	+	-	-	-	+	-	-	-
13343	+	-	-	-	+	-	-	-
13344	+	-	-	-	+	-	-	-
13346	+	-	-	-	+	-	-	-
13348	+	-	-	-	+	-	-	-
13349	+	-	-	-	+	-	-	-
13351	+	-	-	-	+	-	-	-
13352	+	-	-	-	+	-	-	-
13353	+	-	-	-	+	-	-	-
13355	+	-	-	-	+	-	-	-
13356	+	-	-	-	+	-	-	-
13357	+	-	-	-	+	-	-	-
13358	+	-	-	-	+	-	-	-
13362	+	-	-	-	+	-	-	-
13364	+	-	-	-	+	-	-	-
13365	+	-	-	-	+	-	-	-
13368	+	-	-	-	+	-	-	-
13370	+	-	-	-	+	-	-	-
13374	+	-	-	-	+	-	-	-
13379	+	-	-	-	+	-	-	-
13385	+	-	-	-	+	-	-	-
13386	+	-	-	-	+	-	-	-
13387	+	-	-	-	+	-	-	-
13391	+	-	-	-	+	-	-	-
13397	+	-	-	-	+	-	-	-
13399	+	-	-	-	+	-	-	-
13401	+	-	-	-	+	-	-	-
13402	+	-	-	-	+	-	-	-
13403	+	-	-	-	+	-	-	-
13404	+	-	-	-	+	-	-	-
13405	+	-	-	-	+	-	-	-
13407	+	-	-	-	+	-	-	-
13410	+	-	-	-	+	-	-	-
13411	+	-	-	-	+	-	-	-
13412	+	-	-	-	+	-	-	-
13414	+	-	-	-	+	-	-	-
13415	+	-	-	-	+	-	-	-
13416	+	-	-	-	+	-	-	-
13417	+	-	-	-	+	-	-	-
13418	+	-	-	-	+	-	-	-
13419	+	-	-	-	+	-	-	-

Table 8. (cont.)

SIHP Site No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
13420	+	-	-	-	+	-	-	-
13421	+	-	-	-	+	-	-	-
13422	+	-	-	-	+	-	-	-
13423	+	-	-	-	+	-	-	-
13425	+	-	-	-	+	-	-	-
13427	+	-	-	-	+	-	-	-
13428	+	-	-	-	+	-	-	-
13429	+	-	-	-	+	-	-	-
13430	+	-	-	-	+	-	-	-
13431	+	-	-	-	+	-	-	-
13435	+	-	-	-	+	-	-	-
13436	+	-	-	-	+	-	-	-
13437	+	-	-	-	+	-	-	-
13438	+	-	-	-	+	-	-	-
13440	+	-	-	-	+	-	-	-
13443	+	-	-	-	+	-	-	-
13446	+	-	-	-	+	-	-	-
13447	+	-	-	-	+	-	-	-
13448	+	-	-	-	+	-	-	-
13449	+	-	-	-	+	-	-	-
13450	+	-	-	-	+	-	-	-
13451	+	-	-	-	+	-	-	-
13452	+	-	-	-	+	-	-	-
13454	+	-	-	-	+	-	-	-
13455	+	-	-	-	+	-	-	-
13456	+	-	-	-	+	-	-	-
13457	+	-	-	-	+	-	-	-
13458	+	-	-	-	+	-	-	-
13459	+	-	-	-	+	-	-	-
13460	+	-	-	-	+	-	-	-
13462	+	-	-	-	+	-	-	-
13464	+	-	-	-	+	-	-	-
13465	+	-	-	-	+	-	-	-
13466	+	-	-	-	+	-	-	-
13467	+	-	-	-	+	-	-	-
13468	+	-	-	-	+	-	-	-
13471	+	-	-	-	+	-	-	-
13472	+	-	-	-	+	-	-	-
13473	+	-	-	-	+	-	-	-
13474	+	-	-	-	+	-	-	-
13476	+	-	-	-	+	-	-	-
13477	+	-	-	-	+	-	-	-
13478	+	-	-	-	+	-	-	-
13479	+	-	-	-	+	-	-	-
13484	+	-	-	-	+	-	-	-
13488	+	-	-	-	+	-	-	-
13491	+	-	-	-	+	-	-	-
<b>Subtotal:</b>	<b>123</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>123</b>	<b>0</b>	<b>0</b>	<b>0</b>

Table 8. (cont.)

SIHP Site No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
13371	+	-	+	-	+	-	+	-
13372	+	-	+	-	+	-	+	-
13375	+	-	+	-	+	-	+	-
13380	+	-	+	-	+	-	+	-
13381	+	-	+	-	+	-	+	-
13382	+	-	+	-	+	-	+	-
13383	+	-	+	-	+	-	+	-
13384	+	-	+	-	+	-	+	-
13390	+	-	+	-	+	-	+	-
13393	+	-	+	-	+	-	+	-
13394	+	-	+	-	+	-	+	-
13396	+	-	+	-	+	-	+	-
13400	+	-	+	-	+	-	+	-
13413	+	-	+	-	+	-	+	-
13445	+	-	+	-	+	-	+	-
<b>Subtotal:</b>	<b>15</b>	<b>0</b>	<b>15</b>	<b>0</b>	<b>15</b>	<b>0</b>	<b>15</b>	<b>0</b>
13373	+	-	+	*	+	-	+	-
13408	+	-	+	*	+	-	+	-
13441	+	-	+	*	+	-	+	-
13376	+	-	+	*	+	-	+	-
13392	+	-	+	*	+	-	+	-
13395	+	-	+	*	+	-	+	-
13398	+	-	+	*	+	-	+	-
13409	+	-	+	*	+	-	+	-
<b>Subtotal:</b>	<b>8</b>	<b>0</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>0</b>	<b>8</b>	<b>0</b>
13275	+	-	-	+	+	-	-	+
13281	+	-	-	+	+	-	-	+
13350	+	-	-	+	+	-	-	+
13359	+	-	-	+	+	-	-	+
13360	+	-	-	+	+	-	-	+
13377	+	-	-	+	+	-	-	+
13463	+	-	-	+	+	-	-	+
<b>Subtotal:</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>7</b>
00002	+	-	+	+	+	-	+	-
07276	+	-	+	+	+	-	+	-
<b>Subtotal:</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>
<b>Total: 239</b>	<b>155</b>	<b>84</b>	<b>25</b>	<b>17</b>	<b>155</b>	<b>84</b>	<b>25</b>	<b>7</b>

\*Provisional assessment; definite assessment pending completion of further data collection.

and interregional levels of organization. **Interpretive value** refers to the potential of archaeological resources for public education and recreation. **Cultural value**, within the framework for significance evaluation used here, refers to the potential of archaeological resources for the preservation and promotion of cultural and ethnic identity and values. These three value modes are derived from the above state and federal evaluation criteria.

Based on the above federal criteria, 207 of the 239 sites identified during the current project (86.9%) are assessed as significant solely for information content. No further work is recommended for 84 (40.6%) of the 207 sites. These 84 sites (pahoehoe excavations, cairns, rock mounds, walls, and modified outcrops) are generally isolated agricultural features which lack cultural deposits and portable remains; they have been measured, mapped, described, photographed, plotted, and selected examples have been excavated. Data collected from them during the present survey is considered sufficient; their preservation is not essential, although they could perhaps be considered for inclusion into development landscaping. Further data collection is recommended for the remaining 123 of the 207 sites (59.4%). After further data collection is completed, if warranted, a data recovery plan should be prepared and implemented for sites not recommended for preservation or interpretation.

Twenty-three of the 239 recorded sites are assessed as significant under National Register Criteria C (GSA Category B, excellent embodiment of a distinctive type) and D (GSA Category A, information content). The majority of these sites are habitation/agriculture complexes located within a distinct concentration at the northern end of Kuakini Wall, along Palani Road. The fact that these sites are spatially concentrated within a "district-like" area greatly enhances their integrity and Criterion C significance. As a group, these sites also exhibit a high cultural value, which cannot be attributed to most of them on an individual basis. One site (13441 - complex) is not located within the preserve district ["district-like area"]. This complex includes a number of unique and exemplary agricultural and habitation features, and is contained within a relatively well-preserved enclosure. The formal attributes of the features at this site are not repetitive of the features within the preserve district, and it is likely that a different time period, social group, or agricultural pattern is represented.

Eight of the sites within the preserve district with Criterion C and D significance (GSA categories A and B) are individually assessed as having provisional cultural value, in addition to high interpretive and information values (13373, 13408, 13441, 13376, 13392, 13395, 13398,

13409). These sites include features which potentially contain human interments. Presence or absence of the burials can only be determined through subsurface testing. If, however, the features are preserved for their interpretive value within the context of the surrounding area, there would be no need to disturb the features or potential interments.

One site (13281) is assessed under National Register Criterion D (GSA Category A) and as having high cultural value (GSA Category C). This site is a shrine, and preservation "as is" is recommended.

Six of the 239 total identified sites are assessed as significant under National Register Criterion D (GSA Category A, information content) and as having high cultural value (GSA Category C), due to the presence of human remains (13275, 13350, 13359, 13360, 13377, 13463). These sites consist of cave shelters with exposed human interments that are generally in poor preservation and disturbed. It is recommended that the remains be preserved "as is" in the location of original interment, with stabilization of the disturbed burial features and documentation of the nature (i.e., disposition prior to stabilization) and the location of the remains.

If the burials are not preserved "as is," it is required that the procedures of Section 43 of Chapter 6E (Historic Preservation, Haw. Rev. Stat., as amended) be followed. DLNR-HSS/SHPO should be notified and will contact the Office of Hawaiian Affairs (OHA). A mitigation plan for burials, with osteological analyses, should be worked out with DLNR-HSS/SHPO. In addition, a search for direct lineal descendants should be undertaken, consisting minimally of publishing a public notice in a newspaper of general circulation. If direct lineal descendants are found, the osteological analyses shall be subject to their wishes. Lastly, a plan for final disposition of the remains should be developed in accordance with Section 43 of Chapter 6E. It is recommended that any remains found be reinterred within the project area. If this is not possible, they should be reinterred in a nearby cemetery. A disinterment permit may be required from the State Department of Health.

Two sites, Mamalahoa Trail (0002) and Kuakini Wall, (07276) are assessed as significant under National Register Criteria C and D (GSA Categories A and B), as well as having high cultural value (GSA Category C). Preservation with interpretive development of the portions of the sites within the project area is recommended.

As an important initial step prior to data collection, it is recommended that all identified sites recommended for

further archaeological work be accurately located and plotted by professional surveyors, with the aid of an archaeologist, on an appropriate scale topographic map of the project area. This would greatly aid development planning by allowing further archaeological work determinations (further data collection, data recovery and/or preservation) to be more accurately considered on a site-by-site basis.

The evaluations and recommendations presented within this final report have been based on a 100% aerial, variable-

coverage surface, and limited subsurface inventory survey of the project area. There is always the possibility, however remote, that potentially significant, unidentified surface and/or subsurface cultural remains will be encountered in the course of future archaeological investigations or subsequent development activities. In such situations, archaeological consultation should be sought immediately.



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## APPENDIX A

### SITE DESCRIPTIONS

**SITE NO.:** State: 50-10-27-00002  
**SITE TYPE:** Mamalahoa Trail  
**TOPOGRAPHY:** Relatively flat to undulating pahoehoe and aa flows.  
**VEGETATION:** Kiawe, koa-haole and grass  
**ELEVATION:** c. 50-93 feet  
**CONDITION:** Fair  
**INTEGRITY:** Affected by vehicular traffic  
**PROBABLE AGE:** Historic  
**FUNCTIONAL INTERPRETATION:** Transportation  
**DIMENSIONS:** 674.00 m by 4.20 m  
**DESCRIPTION:** Mamalahoa Trail is generally a graded curbstone horse trail/road that was constructed under government direction during the nineteenth century. Portions of the trail follow a prehistoric transportation route. The trail is discernible in the northern portion of the project area, 45.00 to 60.00 m east or and generally parallel with Queen Kaahumanu Highway. The trail surface has been affected by vehicular use, resulting in degradation of the kerbstone alignments along the sides.

**SITE NO.:** State: 13255 PHRI: T-1 (Figure A-1)  
**SITE TYPE:** Mound  
**TOPOGRAPHY:** Relatively flat ropy pahoehoe and aa that has been flattened by bulldozing.  
**VEGETATION:** Christmas-berry, grass, and some 'ilima  
**ELEVATION:** c. 37 feet  
**CONDITION:** Poor  
**INTEGRITY:** Original size, shape indeterminate  
**PROBABLE AGE:** Possible prehistoric  
**FUNCTIONAL INTERPRETATION:** Agriculture  
**DIMENSIONS:** 3.35 m by 3.00 m by 1.07 m  
**DESCRIPTION:** A single feature site that has been isolated in a bulldozed area. The mound is oval to oblong in plan, with a rounded top and outsloping sides. It is constructed with a perimeter of loosely piled aa boulders and cobbles, and filled with smaller pahoehoe and aa pebbles. The feature has been affected by bulldozer grubbing, and presently has a quantity of dozer-deposited aa pebbles against the western side. The only intact portion of the original feature is at the NE corner, where faced perimeter slabs are stacked c. 0.60 m high for 0.83 m along the north side.

A 0.70 m wide test trench was excavated across the center the feature, in order to determine the extent of dozer disturbance and to determine the function of the feature. All material encountered in this trench was dozer disturbed. A second unit (1.0 by 1.0 m sq) was therefore excavated into the intact portion of the mound, in order to determine if an

internal feature was present. At the base of the mound (0.77 m below existing top at this corner), a single layer of pahoehoe slabs was encountered. Below the layer of slabs was a very thin duff deposit overlying a consolidated aa surface. No midden remains, artifacts or other cultural materials were encountered.

**SITE NO.:** State: 13256 PHRI: T-3 (Figure A-2)  
**SITE TYPE:** Pahoehoe excavation  
**TOPOGRAPHY:** Flat, ropy pahoehoe in immediate area of site. Undulating aa and pahoehoe field in vicinity.  
**VEGETATION:** Sparse grasses, ferns and low lantana bushes  
**ELEVATION:** c. 23 feet  
**CONDITION:** Good  
**INTEGRITY:** Unaltered  
**PROBABLE AGE:** Prehistoric  
**FUNCTIONAL INTERPRETATION:** Agriculture  
**DIMENSIONS:** 6.00 m by 5.50 m by 0.60 m maximum depth  
**DESCRIPTION:** A single pahoehoe excavation area divided into two linear sections. Depth of the excavation averages 0.15 m around the edges, with maximum depth at the center. Excavated pahoehoe blocks have been arranged in four distinct concentrations in and around the perimeters of the feature. Two rock concentrations occur at the inside edges of one section of the excavation, and one concentration is along the center of the other section. The fourth concentration is a loose pile to the east of the excavation. The pahoehoe blocks range in size from 11x10x7 cm to 56x45x15 cm. No soil was observed in the feature, however, soil deposits may be present beneath rock fill.

**SITE NO.:** State: 13257 PHRI: T-4 (Figure A-3)  
**SITE TYPE:** Filled crevice  
**TOPOGRAPHY:** The site consists of a major upthrust of pahoehoe with a wide crevice area at the center.  
**VEGETATION:** Thick to moderate grasses, kiawe, lantana, Christmas-berry; sword fern in the crevice area.  
**ELEVATION:** c. 28 feet  
**CONDITION:** Fair-good  
**INTEGRITY:** Unaltered  
**PROBABLE AGE:** Prehistoric  
**FUNCTIONAL INTERPRETATION:** Indeterminate  
**DIMENSIONS:** 3.05 m by 1.05 m by 3.00 m maximum height  
**DESCRIPTION:** An irregular-shaped area 0.70 by 0.75 m has been cleared of natural boulders cobble fall and has been leveled with cobble-size fill. The cleared stones are

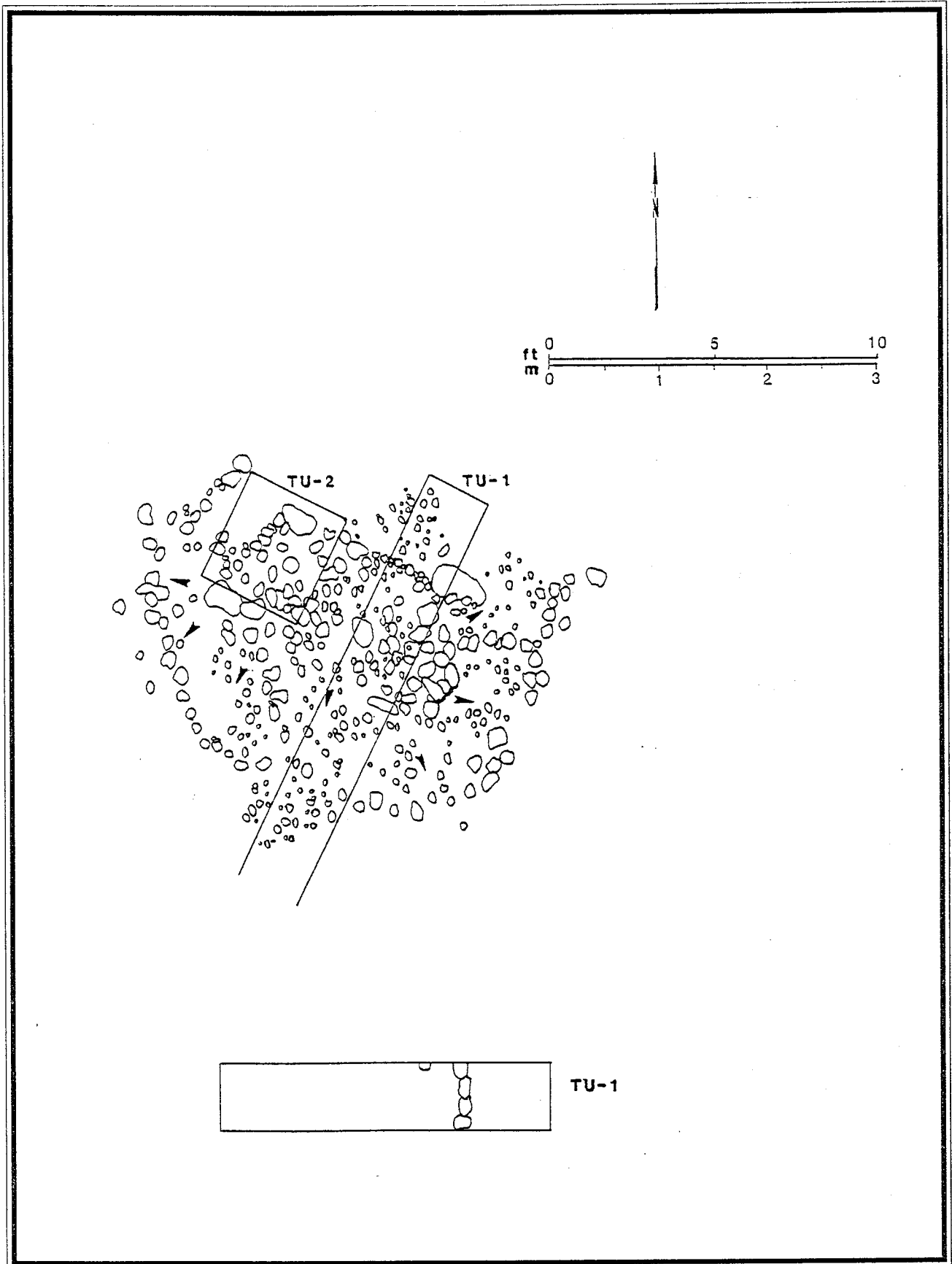


Figure A-1. SITE 13255

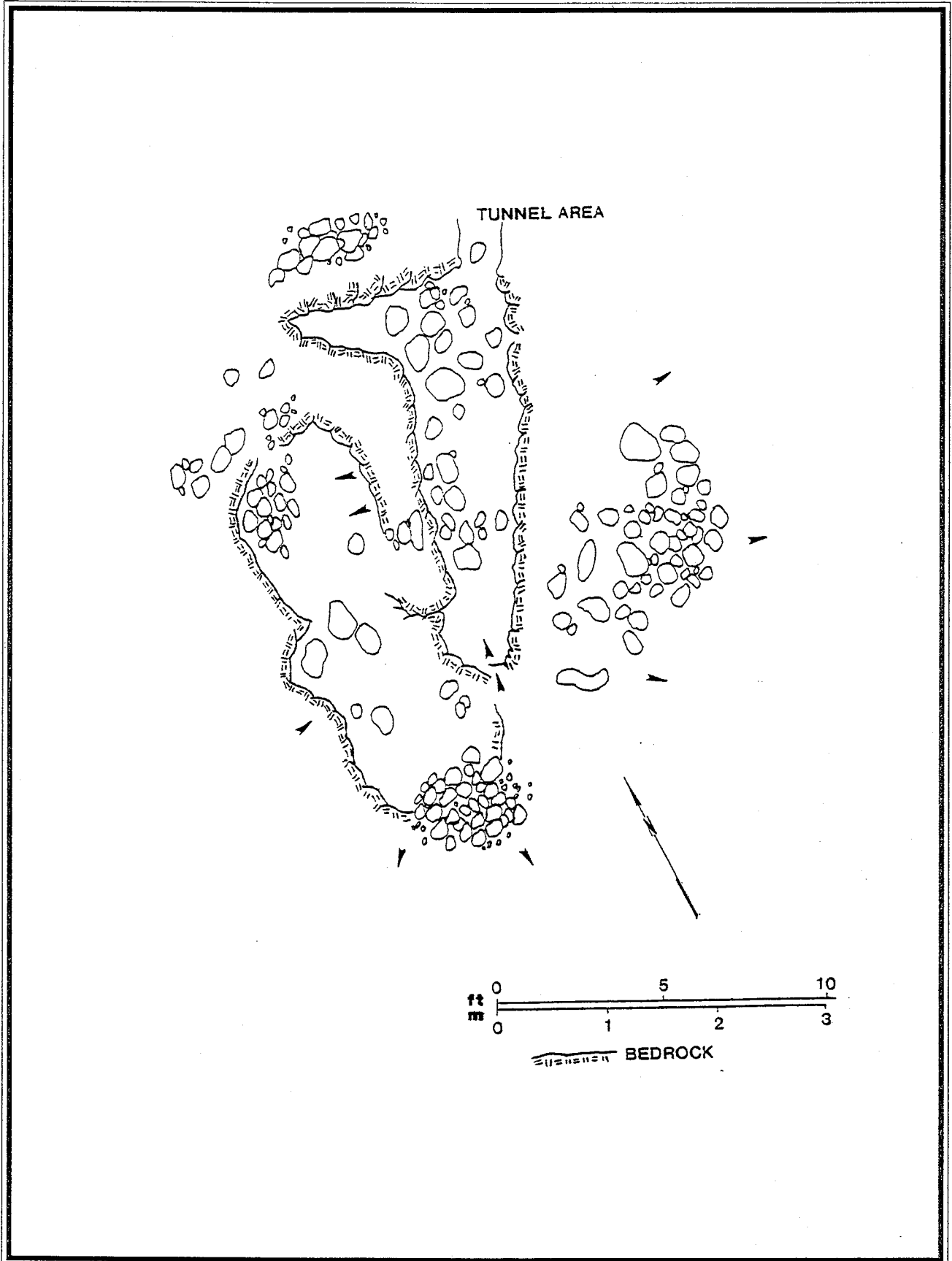


Figure A-2. SITE 13256

concentrated in the crevice to the sides of the leveled area. A small test unit was excavated into the fill, in order to determine possible function. The fill was found to be only one to two layers thick, overlying two sharp, vertical pahoehoe projections. It appears that the feature was constructed in order to permit easier access into the crevice area, which contains two natural cupboards. No soil or portable remains were located in or under the fill, or in the natural cupboards.

**SITE NO.:** State: 13258 PHRI: T-5

**SITE TYPE:** Complex (2 Features)

**TOPOGRAPHY:** Undulating terrain consisting of uneven flows of smooth and ropy pahoehoe and aa.

**VEGETATION:** Sparse grass, noni, kiawe, and Christmas-berry

**ELEVATION:** c. 26 feet

**CONDITION:** Fair-good

**INTEGRITY:** Unaltered

**PROBABLE AGE:** Prehistoric-early historic

**FUNCTIONAL INTERPRETATION:** Temporary habitation

**DESCRIPTION:** Overall complex area measures c. 24.0 m (E-W) by 5.0 m (N-S). The site consists of an overhang (Feature A) and a cupboard (Feature B). One isolated waterworn hammerstone was observed on the surface between the features.

**FEATURE A:** Overhang

**FUNCTION:** Habitation

**DIMENSIONS:** 3.75 m by 2.51 m by 0.92 m maximum ceiling height

**DESCRIPTION:** The overhang faces the northwest and utilizes natural upthrusts of pahoehoe in front and along the sides. Blocks and upright slabs of pahoehoe have been placed to form a windbreak in front of the opening. The opening of the shelter ranges c. 0.33 to 0.92 m.

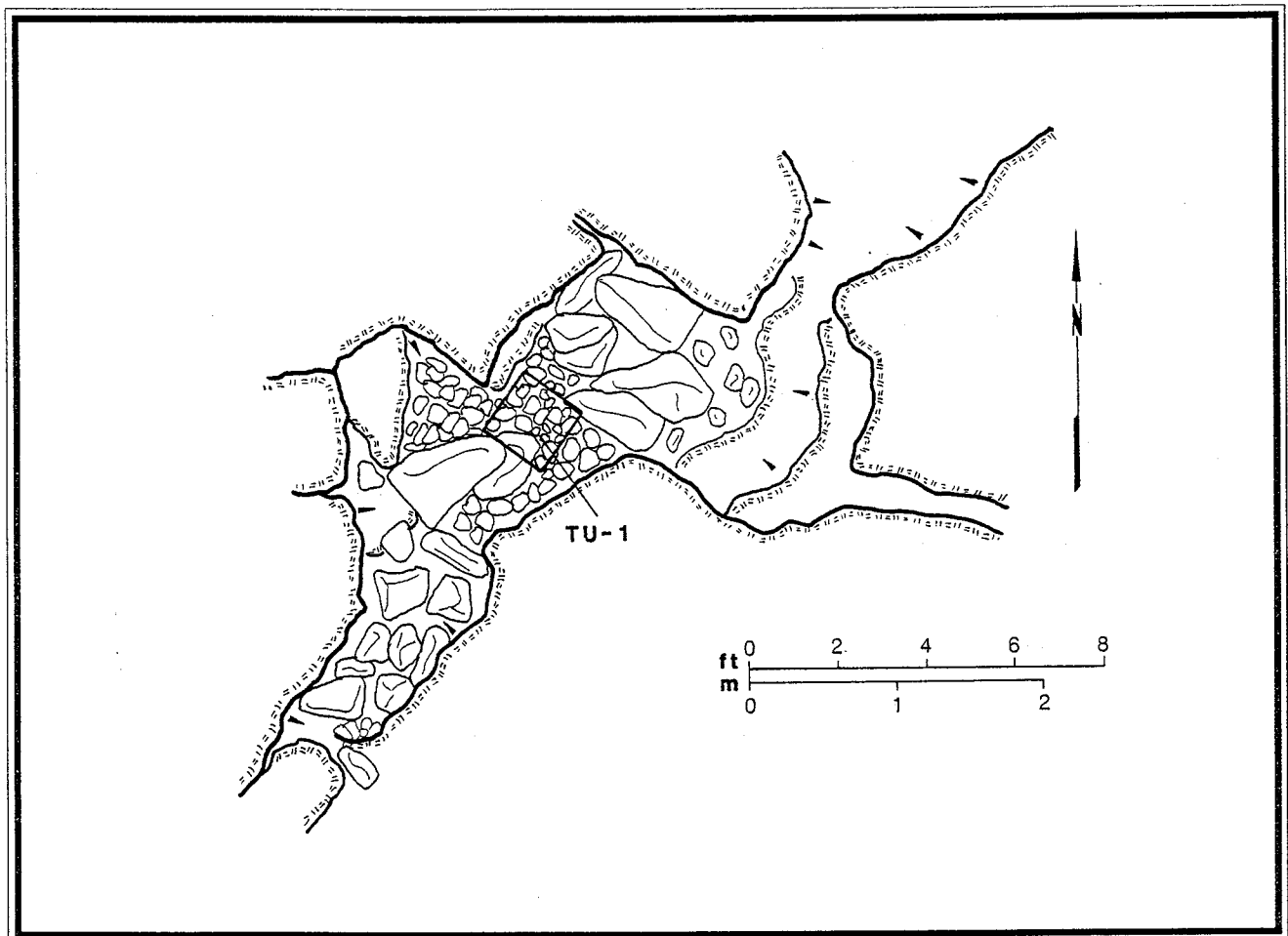


Figure A-3. SITE 13257

No cultural deposits or remains found in the shelter area. However, the rectangular area in front of the opening has been modified as an apparent windbreak. Rough dimensions of interior area in front of the rock shelter, from the opening to the alignment of slabs and blocks measures c. 2.64 (E-W) by 2.58 m (N-S).

**FEATURE B:** Cupboard**FUNCTION:** Storage**DIMENSIONS:** 0.93 m by 0.88 m by 0.67 m

**DESCRIPTION:** Roughly square shape in plan, the feature consists of an excavated hole within a low depression of aa. The cupboard is located 23.32 m from Feature A at 289 degrees Az. No portable remains or deposits were observed inside the feature.

**SITE NO.:** State: 13259 PHRI: T-6**SITE TYPE:** Rock concentration

**TOPOGRAPHY:** Smooth pahoehoe blister slightly raised from the surrounding terrain.

**VEGETATION:** Thick grass, noni, and kiawe in the surrounding area

**ELEVATION:** c. 22 feet**CONDITION:** Good**INTEGRITY:** Unaltered**PROBABLE AGE:** Indeterminate**FUNCTIONAL INTERPRETATION:** Indeterminate

**DIMENSIONS:** 4.00 m by 4.00 m by 0.32 m maximum height

**DESCRIPTION:** Approximately 11 large angular basalt blocks are situated in a random arrangement along a large crack near the summit of a low pahoehoe dome. A section of the crack is also filled with smaller angular blocks. The basalt blocks range in size from 14x10x7 cm to 38x32x27 cm.

A small excavated area is situated c. 2.3 m north of the rock scatter. The excavation is shallow, with a maximum depth of c. 5 cm, and contains one waterworn basalt hammerstone. Another small excavated area is situated c. 1.5 m northeast. Both of these excavated areas has the uppermost layer of pahoehoe bedrock removed, and exhibit no evidence of internal modification or deposits.

**SITE NO.:** State: 13260 PHRI: T-7**SITE TYPE:** Complex (6 Features)

**TOPOGRAPHY:** Undulating terrain consisting of pahoehoe and sinkholes.

**VEGETATION:** Grasses, Christmas-berry, lantana, 'ilima and noni

**ELEVATION:** c. 19 feet**CONDITION:** Good**INTEGRITY:** Unaltered**PROBABLE AGE:** Prehistoric**FUNCTIONAL INTERPRETATION:** Habitation-quarry-water catchment

**DESCRIPTION:** Overall complex area measures c. 25.0 m (N-S) by 28.0 m (E-W). The site consists of two walls, one of which is constructed across an overhang (Feature A). The second wall is associated with a sinkhole (Feature B). Also present are two pahoehoe excavations (Features C and D), a filled crevice (Feature E) and an overhang (Feature F).

**FEATURE A:** Wall**FUNCTION:** Water catchment

**DIMENSIONS:** 1.82 m by 0.36 m by 1.10 m (height from overhang floor)

**DESCRIPTION:** Feature A consists of a wall built across a V-shape overhang. This wall is constructed with large angular basalt boulders, stacked single width and faced on one side. Medium to large angular cobbles are used as fill behind the unfaced side of the wall. The filled area is up to 0.80 m wide, and is on the exterior side, with the overhang to the faced side of the wall. The floor of the overhang is fairly smooth, and possibly paved with small slabs of pahoehoe. Ceiling height of the catchment ranges from 0.41 to 0.83 m. Approximately three gourd fragments are present inside the overhang.

**FEATURE B:** Wall**FUNCTION:** Water catchment

**DIMENSIONS:** 1.75 m by 1.70 m by 0.83 m

**DESCRIPTION:** This wall is built across a sinkhole and pahoehoe crevice. It is constructed with small angular boulders, single stacked and faced on one side, with smaller cobbles as fill against the unfaced side. A small overhang is situated east of the wall. It measures c. 4.5 m (NE-SW) by 2.5 m (NW-SE), with a ceiling height of 0.40 to 0.65 m. A coconut shell fragment, gourd fragments, and 12 thin, smooth sticks (c. 15 cm in length and c. 0.8 cm in diameter) occur inside the overhang. The sticks are situated beneath the gourd and coconut fragments. A waterworn basalt hammerstone (16x13 cm) is also present.

**FEATURE C:** Pahoehoe excavation**FUNCTION:** Quarry

**DIMENSIONS:** 1.50 m by 0.35 m by 1.30 m maximum depth

**DESCRIPTION:** Large blocks of pahoehoe have been excavated along a sinkhole edge with the area immediately around and below the excavated area cleared of material. The excavated pahoehoe face is c. 25 to 30 cm thick. One waterworn basalt hammerstone (23x20x13 cm) and one Conidae shell fragment were observed.



**FEATURE D:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 1.45 m by 0.69 m by 0.20 m maximum depth**DESCRIPTION:** A small excavated area within flat to gently undulating pahoehoe flow. The excavated area is smooth and clean with no excavated material present in the immediate area except for gravel sized angular pieces against the downhill corner. It appears that all sides are excavated. Two cracks, filled with rubble, oriented c. NW-SE are situated east of the excavated area.**FEATURE E:** Filled crevice**FUNCTION:** Indeterminate**DIMENSIONS:** 6.80 m by 0.36 m by 0.70 m maximum depth from fill**DESCRIPTION:** A cobble filled crevice oriented c. E-W is situated within undulating, glassy and somewhat vesicular pahoehoe. Two small areas along the east side of the crevice show evidence of excavation. It is partially filled with angular basalt cobbles. The surface of the cobble fill is c. 0.54 to 0.70 m below the surface of the crack. The thickness of the cobble fill can not be determined, but it is at least 0.20 m. The average size of the angular cobbles used as fill measures c. 0.13 m by 0.12 m by 0.8 m. Three to ten boulders and cobbles are visible on the pahoehoe surface. Two waterworn basalt hammerstones (27x17x10 cm; 26x20x14 cm) are present on fill inside the crevice. A third hammerstone (21x13x14 cm) occurs 2.50 m to the south.**FEATURE F:** Overhang**FUNCTION:** Habitation/water catchment**DIMENSIONS:** 2.70 m by 1.60 m by 0.74 m**DESCRIPTION:** A natural overhang with a partially cleared floor. Flat slabs of pahoehoe are set back in the north corner, and could possibly function as a water catchment area. One *Cypraea* sp. fragment was present on top of the pahoehoe slabs. One waterworn basalt hammerstone was also present to the exterior of the overhang, c. 2.45 m to the WNW, on top of the pahoehoe surface.**SITE NO.:** State: 13261 PHRI: T-8 (Figure A-4)**SITE TYPE:** Enclosure**TOPOGRAPHY:** Gentle slope of pahoehoe flow.**VEGETATION:** Sparse grass, lantana, and one Christmas-berry outside of the enclosure.**ELEVATION:** c. 18 feet**CONDITION:** Fair**INTEGRITY:** Unaltered**PROBABLE AGE:** Prehistoric**FUNCTIONAL INTERPRETATION:** Possible ceremonial/indeterminate**DIMENSIONS:** 5.00 m by 4.32 m by 0.39 m maximum wall height**DESCRIPTION:** This roughly square enclosure is situated around the perimeter of a shallow pahoehoe depression. It is constructed with loosely stacked pahoehoe slabs, and exhibits no evidence of faced sides. The walls are c. 0.4-0.6 m wide and have tumbled in places, with the slabs falling to the interior of the enclosure. The lowest portion of the wall is at the southwest corner, where a possible entrance occurs. In this area, slabs were piled over a crevice and natural depression of indeterminate depth.

A 1.0 by 1.0 m test unit was excavated into the rock fill in order to determine if subsurface features occurred. The surface of the filled area varied from 0.17 to 0.32 m below the top of the wall prior to excavation. The rock fill consisted of a single layer of slabs (possibly wall fall) and two to three layers of smaller pahoehoe cobbles and pebbles. Thickness of the fill ranged from 0.16 to 0.20 m. Two small pockets of very dry soil were located in low spots of the crevice, beneath the rock fill. A sample of the soil was collected. No portable remains or other cultural material occurred in the test unit.

Three waterworn basalt cobbles and five coral fragments were observed within the enclosure.

**SITE NO.:** State: 13262 PHRI: T-9**SITE TYPE:** Complex (2 Features)**TOPOGRAPHY:** Smooth and fairly flat pahoehoe flow**VEGETATION:** Moderate amounts of lantana and grasses.**ELEVATION:** c. 14.5 feet**CONDITION:** Poor-fair**INTEGRITY:** Unaltered**PROBABLE AGE:** Prehistoric-early historic**FUNCTIONAL INTERPRETATION:** Agriculture/  
possible habitation**DESCRIPTION:** Overall complex area measures c. 13.0 m (N-S) by 14.0 m (E-W). The site consists of an L-shape wall (Feature A), and a pahoehoe excavation (Feature B).**FEATURE A:** L-shape wall**FUNCTION:** Possible temporary habitation**DIMENSIONS:** 4.00 m by 2.50 m by 0.48 m maximum wall height**DESCRIPTION:** Feature A is an L-shape, bifaced and core filled wall. The wall is built low and abuts the pahoehoe flow edge along its SE corner. The pahoehoe flow forms a natural eastern perimeter of the feature, giving it an overall U-shaped enclosure appearance. Portions of the wall are collapsed.

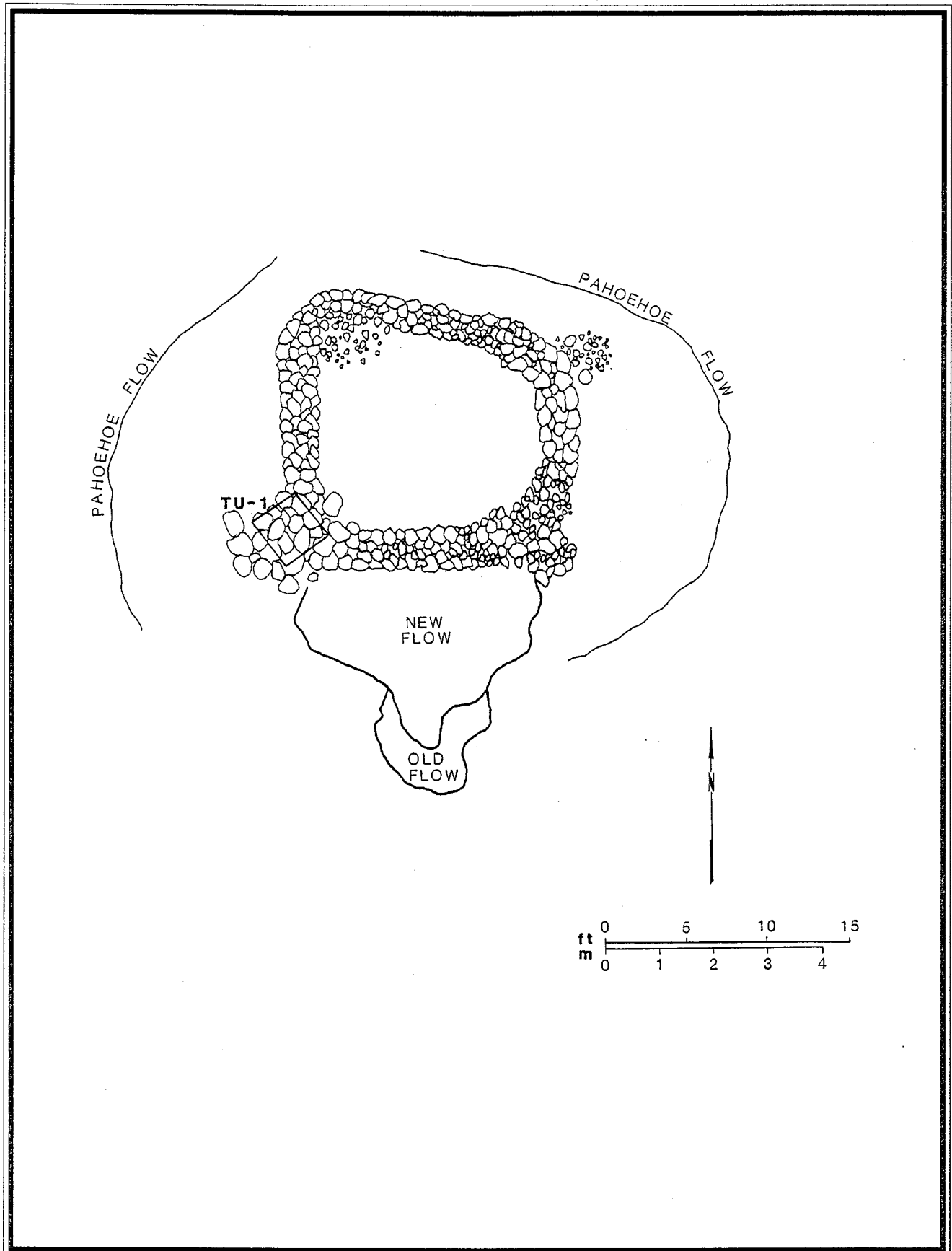


Figure A-4. SITE 13261

A deposit of dark brownish-black soil (at least 7 cm thick) is present within the enclosure interior. A possible semicircular ring of stones is located against the interior side of the south wall.

**FEATURE B:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 2.14 m by 1.20 m by 0.28 m

**DESCRIPTION:** Feature B consists of an excavated face along a flow edge. The excavation is situated immediately south of Feature A, and may have functioned as a quarry site for the basalt blocks used in the construction of the wall.

**SITE NO.:** State: 13263 PHRI: T-10**SITE TYPE:** Overhang**TOPOGRAPHY:** Sinkhole within smooth pahoehoe.**VEGETATION:** Grasses, few lantana, and one kiawe tree**ELEVATION:** c. 17.5 feet**CONDITION:** Fair**INTEGRITY:** Unaltered**PROBABLE AGE:** Indeterminate**FUNCTIONAL INTERPRETATION:** Possible habitation

**DIMENSIONS:** 2.76 m by 2.16 m by 0.68 m maximum ceiling height

**DESCRIPTION:** Along the west side of a natural overhang opening, cobbles and slabs of pahoehoe appear to have been placed as a wind break. It is constructed perpendicular to the overhang opening, roughly bisecting the overhang area. This windbreak is possibly natural collapse, and since no other modifications are evident this site is questionable.

**SITE NO.:** State: 13264 PHRI: T-11**SITE TYPE:** Complex (6 Features)

**TOPOGRAPHY:** Undulating terrain consisting of smooth and ropy pahoehoe.

**VEGETATION:** Moderate density of grasses, a few lantana, one Christmas-berry, and one noni.

**ELEVATION:** c. 16.5 feet**CONDITION:** Good**INTEGRITY:** Unaltered**PROBABLE AGE:** Prehistoric-historic**FUNCTIONAL INTERPRETATION:** Agriculture

**DESCRIPTION:** The site is located in the southwest corner of the project area near the fence. Overall complex area measures c. 44.0 m (E-W) by 20.0 m (N-S). The site consists of five mounds (Features A, C thru F), and a pahoehoe excavation (Feature B).

**FEATURE A:** Mound (Figure A-5)**FUNCTION:** Agriculture

**DIMENSIONS:** 2.93 m by 2.25 m by 0.47 m maximum height

**DESCRIPTION:** Feature A is constructed with angular pahoehoe cobbles and clinkers, placed in a circular concentration on top of a smooth pahoehoe surface. It is generally circular shape in plan and is centrally raised in profile. A very roughly rectangular alignment exists on top of the mound, outlined by large angular pahoehoe blocks with small cobble and clinkers as paving.

**FEATURE B:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 2.70 m by 1.30 m by 0.47 m

**DESCRIPTION:** Feature B is located 6.5 m northeast from Feature A. It consists of a clearly excavated face within the pahoehoe flow. Excavated basalt blocks are piled above and c. 0.5 m to 1.0 m to the northwest.

**FEATURE C:** Mound**FUNCTION:** Quarry/agriculture**DIMENSIONS:** 1.03 m by 0.92 m by 0.35 m

**DESCRIPTION:** A random arrangement of excavated blocks of basalt on top of smooth pahoehoe. Feature B is located 5.0 m to the northwest.

**FEATURE D:** Mound**FUNCTION:** Agriculture**DIMENSIONS:** 1.55 m by 1.22 m by 0.30 m

**DESCRIPTION:** A low circular rock mound constructed on top of smooth pahoehoe. It is constructed with angular slabs and blocks of pahoehoe. Small cobbles are used as fill. Roughly circular shape in plan, it contains some facing along the north and northeast sides. Two uprights are visible, one north of the facing and the other south of the facing. The surface interior is of roughly level fill of pahoehoe slabs and cobbles. Feature E is located 3.00 m to the southwest.

**FEATURE E:** Mound**FUNCTION:** Agriculture**DIMENSIONS:** 1.95 m by 1.38 m

**DESCRIPTION:** Feature E is a small low flat rock mound. Two rough alignments parallel to each other and oriented c. E-W are situated on the north and south sides of the mound. These alignments consists of medium to large angular pahoehoe blocks. Small cobbles are used in between. The mound is roughly circular shape in plan and centrally raised. It is located 3.20 m south from Feature D.

**FEATURE F:** Mound**FUNCTION:** Agriculture**DIMENSIONS:** 2.13 m by 1.36 m

**DESCRIPTION:** Feature F is located 3.40 m east from Feature E. It is roughly rectangular shape in plan, and



*Figure A-5. SITE 13264, FEATURE A. View to Northeast. (PHRI Neg.1231-4)*

constructed with small angular pahoehoe boulders and small to large angular cobbles. At the top of the centrally raised mound, there appears to be a partially faced circle of larger angular cobbles with smaller cobble interior fill.

**SITE NO.:** State: 13265 PHRI: T-12

**SITE TYPE:** Mound

**TOPOGRAPHY:** Undulating terrain consisting of smooth pahoehoe.

**VEGETATION:** Sparse grasses and lantana.

**ELEVATION:** c. 18 feet

**CONDITION:** Good

**INTEGRITY:** Unaltered

**PROBABLE AGE:** Prehistoric

**FUNCTIONAL INTERPRETATION:** Agriculture

**DIMENSIONS:** 1.77 m by 1.47 m by 0.42 m maximum height

**DESCRIPTION:** This relatively isolated rock mound is constructed with small to large pahoehoe blocks and slabs piled on top of smooth pahoehoe. It is roughly circular in plan and centrally raised. Perimeter stones on the north, east, and northwest sides are turned on edge, up to 0.20 m in height. One piece of coral was observed on the surface near the mound.

A 1.0 by 1.0 m square test unit was excavated into the center of the mound, in order to determine if a subsurface feature or deposit was present. Beneath the surface layer of pahoehoe slabs, a fill of small to medium size irregular cobbles and pebbles was encountered. This fill overlaid a thin layer of surface duff which varied from less than 0.01 m to 0.02 m in thickness. Pahoehoe bedrock was encountered beneath the duff layer. A single unidentifiable fragment of marine shell was encountered in the duff layer; no other portable remains or cultural features were observed.

**SITE NO.:** State: 13266 PHRI: T-13

**SITE TYPE:** Complex (3 Features)

**TOPOGRAPHY:** Smooth pahoehoe

**VEGETATION:** Sparse grasses and kiawe around cave opening

**ELEVATION:** c. 16.5 feet

**CONDITION:** Fair-good

**INTEGRITY:** Unaltered-partially altered

**PROBABLE AGE:** Historic-possibly prehistoric

**FUNCTIONAL INTERPRETATION:** Temporary habitation

**DESCRIPTION:** The site consists of a cave (Feature C) that contains a wall (Feature A) and an alignment (Feature B).

**FEATURE A:** Wall

**FUNCTION:** Indeterminate

**DIMENSIONS:** 0.80 m by 0.50 m by 0.60 m maximum height

**DESCRIPTION:** A wall consisting of seven stacked slabs and blocks of pahoehoe, located immediately to the left of Feature C cave opening. It is constructed along the NNW side of the cave wall and built from the floor to the ceiling. Two slabs were removed from the wall in order to determine if any features were present behind it. Nothing was observed. One waterworn basalt is present c. 1.6 m east of Feature A.

**FEATURE B:** Alignment

**FUNCTION:** Indeterminate

**DIMENSIONS:** 0.90 m by 0.40 m by 0.35 m maximum height

**DESCRIPTION:** Roughly piled slabs of roof fall constructed into a short alignment with a single upright slab on the SE end. Scattered skeletal remains of a dog are partially under the NW portion of the alignment.

**FEATURE C:** Cave

**FUNCTION:** Temporary habitation

**DIMENSIONS:** 13.00 m by 4.50 m by 0.70 m maximum ceiling height

**DESCRIPTION:** A natural cave containing Feature A, Wall and Feature B, Alignment. A lot of recent garbage is concentrated at the cave opening. No soil deposits or portable remains other than recent refuse and dog remains were observed inside the cave.

**SITE NO.:** State: 13267 PHRI: T-14

**SITE TYPE:** Complex (3 Features)

**TOPOGRAPHY:** Gently undulating smooth pahoehoe flow.

**VEGETATION:** Moderate density of grasses, two Christmas berry trees, small ilima, and kiawe bushes.

**ELEVATION:** c. 12.5 feet

**CONDITION:** Good

**INTEGRITY:** Unaltered

**PROBABLE AGE:** Prehistoric

**FUNCTIONAL INTERPRETATION:** Quarry/agriculture

**DESCRIPTION:** Overall complex area measures c. 15.2 m (E-W) at 120 degrees by 6.7 m (N-S). The site consists of a pahoehoe excavation (Feature A), and two mounds (Features B and C).

**FEATURE A:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.37 m by 0.52 m by 0.50 m

**DESCRIPTION:** Feature A consists of an excavated crack along a pahoehoe fault edge located between two blisters. Excavated material is in a linear pile north of the excavated area. The excavated hole is fairly cleared of quarried material.

**FEATURE B: Mound****FUNCTION:** Agriculture**DIMENSIONS:** 1.81 m by 1.23 m by 0.32 m

**DESCRIPTION:** Roughly oval to circular shape in plan, it is bordered with large angular cobbles with clinkers and small angular cobbles on top. The east side is slightly faced, and crudely stacked 1-2 blocks high. The west border is collapsing with a couple of the larger pahoehoe blocks still intact. The boulders range in size from 0.19-0.32 m in length by 0.14-0.27 m in width and 0.12-0.13 m in height. The mound is constructed on top of a pahoehoe blister.

**FEATURE C: Mound****FUNCTION:** Agriculture**DIMENSIONS:** 1.38 m by 1.30 m by 0.41 m

**DESCRIPTION:** Roughly circular in shape, it is constructed mostly of single stacked (with some portions stacked 2-3 courses high) angular pahoehoe blocks. The north and east sides of the mound are partially intact and standing. One opihi shell is visible in the NW portion of the mound.

**SITE NO.:** State: 13268 PHRI: T-15**SITE TYPE:** Complex (6 Features)**TOPOGRAPHY:** The terrain consists of undulating smooth pahoehoe.**VEGETATION:** Moderate amounts of grasses, large Christmas-berry tree, 'ilima, and lantana.**ELEVATION:** c. 13 feet**CONDITION:** Fair-good**INTEGRITY:** Unaltered**PROBABLE AGE:** Prehistoric**FUNCTIONAL INTERPRETATION:** Agriculture/possible habitation

**DESCRIPTION:** Overall complex area measures c. 16.2 m (E-W) by 30.5 m (N-S). The site consists of an enclosure (Feature A), a terrace (Feature B), two paved areas (Features C and D), a walled sinkhole (Feature E), and a filled crevice (Feature F).

**FEATURE A: Enclosure****FUNCTION:** Agriculture/possible habitation**DIMENSIONS:** 4.60 m by 3.60 m by 0.47 m

**DESCRIPTION:** The enclosure is roughly square shape in plan with walls ranging in height from 0.32-0.47 m and in width from 0.60-1.0 m. The walls are partially faced on both the interior and exterior sides with small to medium pahoehoe boulders. The north, south and east interior corners are still clearly defined. The southwest wall appears to be very collapsed but a few of the boulders seem to be intact so that the boundary of the southwest wall is fairly evident. A possible stepped terrace is in the east corner. One small waterworn basalt cobble is present. A soil deposit up to 0.15 m thick occurs in this feature.

**FEATURE B: Terrace***(Figure A-6)***FUNCTION:** Agriculture/possible habitation**DIMENSIONS:** 4.50 m by 3.66 m by 0.65 m maximum height

**DESCRIPTION:** This rectangular terrace is raised on the north (0.35 m), south (0.45 m) and east (0.65 m) sides. The raised perimeters are constructed with large pahoehoe angular cobbles and small boulders, stacked to three courses high. The surface interior is fairly flat with small angular pahoehoe cobbles and pebbles. A small pahoehoe excavation is situated NE of Feature B and measures c. 0.85 m wide and c. 0.60-0.65 m deep. Feature A is located 2.00 m to the north.

**FEATURE C: Paved area****FUNCTION:** Indeterminate**DIMENSIONS:** 1.95 m by 1.55 m by 0.16 m

**DESCRIPTION:** Feature C is located 11.0 m southeast of Feature A. This small paved area is roughly triangular shape in plan and is constructed with a single layer of small angular pahoehoe cobbles and slabs. Portions of the perimeter are defined with slightly larger pahoehoe cobbles. Feature C is constructed on top of smooth pahoehoe.

**FEATURE D: Paved area****FUNCTION:** Indeterminate**DIMENSIONS:** 2.68 m by 2.31 m by 0.18 m

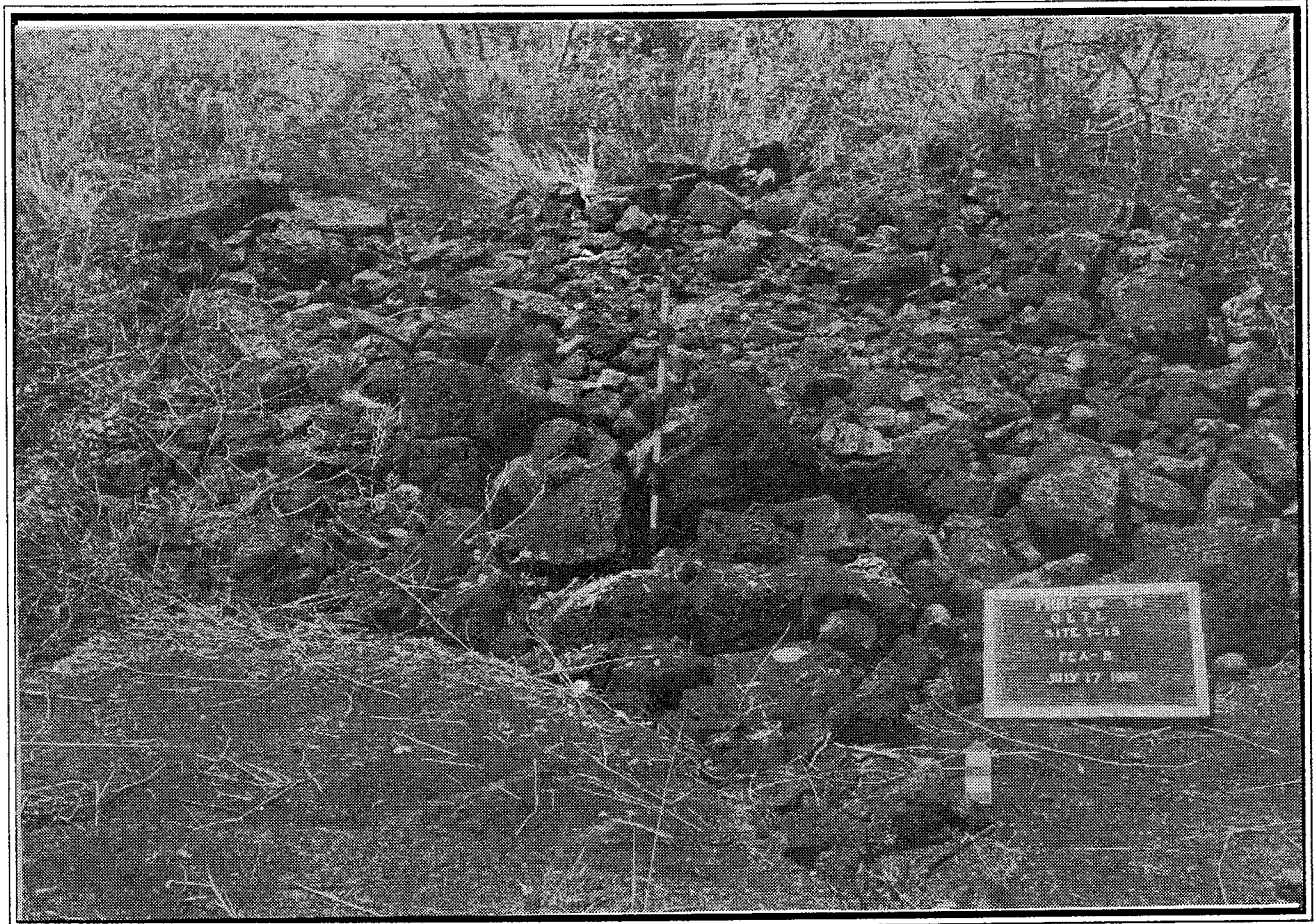
**DESCRIPTION:** A paved area, roughly circular in shape. It is constructed with pahoehoe boulders along its perimeter and with angular cobbles and pebbles within the center. The northern end appears to be c. 0.12 m higher than the southern half. This raised area appears to be delineated by a rough boulder alignment oriented c. E-W. It is located 0.65 m southwest from Feature C.

**FEATURE E: Walled sinkhole****FUNCTION:** Possible cupboard**DIMENSIONS:** 2.00 m by 1.00 m by 0.92 m

**DESCRIPTION:** The sinkhole is oriented c. N-S and consists of a cobble paved floor and a wall. The wall measures c. 1.0 m (E-W) and 0.35-0.45 m (N-S). It is constructed with small angular pahoehoe boulders, stacked three courses high, and bisecting the sinkhole into western and eastern halves. The height of the west side of the wall is 0.5 m and the height of the east side of the wall is 0.92 m. Feature E is located c. 7.00 m northwest from Feature F.

**FEATURE F: Filled crevice****FUNCTION:** Agriculture**DIMENSIONS:** 0.90 m by 0.60 m by 0.20 m maximum depth

**DESCRIPTION:** This feature is located 10.20 m southeast from Feature A. It consists of a filled, leveled area situated



*Figure A-6. SITE 13268, FEATURE B. View to North  
(PHRI Neg.1231-13)*

between three large, naturally uplifted pahoehoe slabs. A 0.80 by 0.80 m square test unit was excavated into the filled area, in order to determine if buried materials or deposits were present. Beneath a relatively homogenous fill of angular pahoehoe pebbles was a thin (0.01 m) soil deposit, which overlaid bedrock. No cultural material or portable remains were observed. A soil sample was collected from this feature, for comparison with soil from other tested agricultural features (see subsurface findings).

An associated pahoehoe excavation is c. 1.1 m to the NE of the feature. The pahoehoe excavation measures c. 0.65 m by 0.8 m with a depth of c. 0.9 m. One piece of waterworn coral is present c. 4.2 m northeast of the pahoehoe excavation.

**SITE NO.:** State: 13269 PHRI: T-16

**SITE TYPE:** Wall

**TOPOGRAPHY:** Relatively level pahoehoe flow.

**VEGETATION:** Predominantly fountain grass, lantana, 'uhaloa, kiawe, kolu, noni, cappariss, Christmas-berry, and indigo

**ELEVATION:** c. 12.5 feet

**CONDITION:** Poor

**INTEGRITY:** Unaltered

**PROBABLE AGE:** Prehistoric

**FUNCTIONAL INTERPRETATION:** Indeterminate

**DIMENSIONS:** 2.60 m by 2.40 m by 0.30 m

**DESCRIPTION:** This low wall consists of subangular blocky basalt boulders crudely stacked 1-2 courses high and 1-2 wide. The rock wall is circular shape in plan, and incorporates several upright boulders. The sides are not faced. The structure is built on pahoehoe bedrock; no deposits or portable remains were observed.

**SITE NO.:** State: 13270 PHRI: T-17

**SITE TYPE:** Pahoehoe excavation

**TOPOGRAPHY:** Relatively level pahoehoe flow.

**VEGETATION:** Predominantly fountain grass, lantana, 'uhaloa, Christmas-berry, with scattered 'ilima, kolu, and kiawe.

**ELEVATION:** c. 13 feet

**CONDITION:** Poor

**INTEGRITY:** Unaltered

**PROBABLE AGE:** Prehistoric

**FUNCTIONAL INTERPRETATION:** Possible agriculture

**DIMENSIONS:** 2.20 m by 1.70 m by 0.70 m

**DESCRIPTION:** The overall area measures c. 10.0 m (E-W) by 12.0 m (N-S). Site consists of artificially broken and excavated pahoehoe bedrock. The excavated pahoehoe bedrock creates a pit-like feature. Most of the broken pahoehoe boulders have been removed and piled on the

south side of the excavated area. The remaining boulders and cobbles have been used to fill in low areas north of the pahoehoe excavation.

**SITE NO.:** State: 13271 PHRI: T-18

**SITE TYPE:** Alignment

**TOPOGRAPHY:** Relatively level pahoehoe flow.

**VEGETATION:** Low cover of fountain grass, lantana, kolu, 'uhaloa, cappariss, noni, kiawe, Christmas-berry, and koa-haole

**ELEVATION:** c. 17 feet

**CONDITION:** Poor

**INTEGRITY:** Unaltered

**PROBABLE AGE:** Possibly prehistoric

**FUNCTIONAL INTERPRETATION:** Indeterminate

**DIMENSIONS:** 1.90 m by 1.80 m by 0.35 m

**DESCRIPTION:** The rock alignment is generally circular shape in plan. It is constructed of subangular blocky basalt boulders placed one course high and wide. It ranges in height from 0.15-0.35 m and in width from 0.2-0.35 m wide.

Basalt boulders and cobbles are also scattered on the surface, inside and outside the alignment. The structure is built on unbroken pahoehoe bedrock; no soil is present.

**SITE NO.:** State: 13272 PHRI: T-19

**SITE TYPE:** Complex (36+ Features)

**TOPOGRAPHY:** Collapsed tube formation around rim of kipuka generally consisting of faulted pahoehoe. Some flat area inside of the kipuka. The rim tube looks like later flow compared to the floor of the kipuka.

**VEGETATION:** Scattered 'ilima, some pili grass, vines and lantana outside of kipuka. Grasses, kiawe, lantana along the rim. Christmas-berry, noni in low places and some ferns in small crevices inside of kipuka.

**ELEVATION:** c. 18-20 feet

**CONDITION:** Good

**INTEGRITY:** Unaltered

**PROBABLE AGE:** Prehistoric-possibly historic

**FUNCTIONAL INTERPRETATION:** Agriculture-quarry

**DESCRIPTION:** The site consist of various excavations and rock discard features, most of which are located on the kipuka rim or on high upthrusts of pahoehoe inside of the kipuka. Overall complex size is 75.00 m (N-S) by 46.0 m (E-W).

**FEATURE A:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.55 m by 0.65 m by 0.68 m

**DESCRIPTION:** This excavated pahoehoe crevice is located along the center of the upthrust, collapsed tube which forms the rim of the kipuka. A buried flow is also



cracked within the excavated crevice, and two layers of pahoehoe were penetrated during excavation.

The uppermost pahoehoe layer is c. 0.25 to 0.40 m thick, fairly vesicular and dense, with weathered surface cortex. The lower layer has air pockets above and below it and is denser with fewer holes than the upper layer. Average thickness is 0.28 m. The excavated blocks removed from this layer are more regular in size and shape than pieces removed from the upper layer of pahoehoe.

The excavated blocks are in linear alignments on either side of the crevice, and some are scattered in the center of the excavation. The overall area of the associated excavated scatter is c. 2.8 m (N-S) by 3.0 m (E-W).

**FEATURE B:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.50 m by 0.70 m by 0.45 m

**DESCRIPTION:** A flow edge that has been excavated through one upper layer of pahoehoe. The quarried material consists of a honeycombed type with red mineral deposits in air pockets within a black matrix. The quarried material is placed on the west side of the edge. The scatter area measures c. 2.2 m (E-W) by 2.3 m (N-S). The west side of the excavated area is not quarried and also contains upturned slabs of older pahoehoe.

**FEATURE C:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.80 m by 0.55 m by 0.60 m

**DESCRIPTION:** The excavated opening is cleared of quarried material. Small cobble and pebble sized pieces are at the bottom, where the crevice in the older flow continues. Only the upper pahoehoe material is mined, and only along the south and east faces. The total linear area on the south side is 0.64 m and on the east side it is 1.8 m.

The removed blocks are in a linear pile at the base of the tube c. 1.0 m to the east. A few smaller blocks are placed on the west side along the ridged and upturned lava plates. The excavated material is layered with red mineral bands, honeycomb type with thin weathered zone on top.

**FEATURE D:** Pahoehoe excavation

**FUNCTION:** Quarry/agriculture

**DIMENSIONS:** 4.00 m by 3.40 m by 0.35 m

**DESCRIPTION:** Feature D is located at the base of the northwest rim along the side of the rim formation, at c. 3.0 m at 350 degrees from Feature K. It consists of two depression areas c. 0.50 m apart. The NW depression is excavated along its southern end for a length of c. 0.75 m. The SE depression is excavated along the north and south

edges. The excavated crevices contain flat floors with a drop off shelf that is filled with basalt blocks. The blocks are piled inside the depression adjacent to the NW (upper) hole and in a crude line to the north. In the SE (lower) excavation it is also piled inside the depression adjacent to the hole and in a less distinct alignment outside of the depression. There are thin mantles of relatively damp soil under the blocks in both depressions mixed with smaller pieces of debris.

**FEATURE E:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.90 m by 1.20 m by 0.31 m

**DESCRIPTION:** An excavated pahoehoe blister with a crude wall. The interior of the excavation is cleared; the floor is a very level surface of older flow with no cobbles and very few pebbles on top of it.

The wall is situated exterior of the excavated face to the south side on top of the mined flow. The wall is constructed with loosely stacked blocks, c. one to three courses wide and two courses high and measures c. 2.5 m long and 1.9 m wide. One large slab measuring c. 0.80 m by 0.50 m is set on end and propped up by smaller blocks. A couple of large blocks are set together in an alignment

A very heavy waterworn basalt boulder with pecking scars on one end is present on the wall. The edges are not extensively battered and it measures c. 30x27x20 cm.

Basalt blocks are piled in an area adjacent to the excavated face to the west. The overall area measures c. 4.3 m (E-W) by 6.5 m (N-S). The basalt blocks are haphazardly piled three high with a few additional blocks located c. 2-3 m to the north in addition to a few blocks to the west side of the excavated rim.

A small shallow cave is situated along the SE excavated face. It is c. 1.0 m wide to the NW under the upper flow, and it is c. 0.65 m deep. The opening measures c. 0.80 m by 0.27 m.

This feature may be possibly historic because portions of the excavated face exhibits vertical gouge marks that were possibly made with metal chisels.

**FEATURE F:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 3.50 m by 2.10 m by 0.60 m

**DESCRIPTION:** A partially cleared pahoehoe excavation within a vaulted pahoehoe blister forms an opening to a very low crawlspace. The excavation is mostly cleared except for a scattering of small cobbles and pebbles immediately below the opening. The floor inside of the crawlspace

slopes to the west, is very rough and contains no deposit. The opening is 0.6 m high on the south side and 0.3 m high on the north side. The crawlspace measures c. 8.0 m (N-S) by 5.0 m (E-W).

The quarried blocks are placed immediately at the rim on the north side and one on the south side. Others are scattered 2.0 m to the north, 1.7 m to the south and 1.0 m to the west. There are c. 21 pahoehoe blocks of various sizes in a dispersed arrangement. The excavated pahoehoe is c. 0.29 m to 0.32 m thick; honeycombed but dense, with white precipitates at bottom of layer.

**FEATURE G:** Pahoehoe excavation (Figure A-7)

**FUNCTION:** Quarry/agriculture

**DIMENSIONS:** 6.00 m by 4.50 m by 0.60 m

**DESCRIPTION:** A natural crevice and upturned pahoehoe slab are excavated. Quarried basalt are strewn along all sides, mostly to the east. The floor of the excavation is cleared with the natural crevice at the bottom. The crevice contains small cobbles and pebbles. A large waterworn basalt cobble with battered ends is visible immediately exterior of the excavation, to the north.

In addition, two separate crawlspaces are opened from different excavations. One to the east and one to the south.

The feature is situated on a blistered area in the center of the kipuka, c. 2.0 m below the top of the rim, in the area of the later flow. The soil deposit present in this feature was sampled, for comparison with soils from other agricultural features (see subsurface findings).

**FEATURE H:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 0.80 m by 0.80 m by 0.40 m

**DESCRIPTION:** Feature H is situated at the northern base of a pahoehoe blister near the center of the kipuka. The quarried blocks are placed in a linear arrangement 0.25 m west of the excavation and aligned 0.6 m in length. Some smaller pieces are scattered within the sloping floor.

**FEATURE I:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 4.50 m by 1.15 m by 0.65 m

**DESCRIPTION:** Feature I is situated inside the west rim of kipuka, c. 5.5 m east of Feature G. The excavated area has the basalt blocks on the floor interior. In the southern end it appears to be in a C-shape, open to the northwest and c. 0.27-0.37 m wide.

**FEATURE J:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 0.60 m by 0.57 m by 0.47 m

**DESCRIPTION:** Three large quarried blocks are piled on top of smooth pahoehoe on the eastern edge of faulted and broken area. The blocks average c. 18x18x33 cm in size.

**FEATURE K:** Pahoehoe excavation

**FUNCTION:** Agriculture

**DIMENSIONS:** 4.21 m by 4.12 m by 0.62 m

**DESCRIPTION:** An excavated and cleared blister with a floor interior that slopes southeast toward the kipuka. Nearly circular in shape, all sides of the feature are mined except for the northwest side. The quarried rock is piled immediately to the southeast and northwest of the feature. Soil is present on the floor of the feature, along the southeast side.

**FEATURE L:** Pahoehoe excavation

**FUNCTION:** Agriculture

**DIMENSIONS:** 4.00 m by 3.20 m by 0.70 m

**DESCRIPTION:** The excavated hole measures c. 1.3 m (N-S) by 1.2 m (E-W). It is excavated along all sides. The floor interior is gently sloping and filled with pebbles, few small cobbles and dark soil. The soil deposit was sampled for purposes of comparison with other agricultural features within the project area (see subsurface findings).

Blocks excavated from this feature are concentrated in a linear pile adjacent to the east side at the base of the slope. The pile measures c. 3.0 m in length and 1.2-1.5 m in width and is mostly 1-2 courses high.

A small crawlspace along the north side opens to Feature K. This crawlspace measures c. 0.9 m wide with a ceiling height of 0.42 m.

**FEATURE M:** Pahoehoe excavation

**FUNCTION:** Quarry/possible agriculture

**DIMENSIONS:** 2.20 m by 2.00 m by 0.55 m

**DESCRIPTION:** Feature M is 1.4 m north from Feature L, along the southwest side of the kipuka rim, just above the floor of the kipuka. It is an excavated and cleared blister, with a floor interior sloping to the west. It contains an overhang/lip that opens again to the west forming a bridge. The excavated hole measures 1.7 m by 0.8 m. This feature appears to be mostly cleared with minimal excavation, with the removed blocks piled in a natural depression immediately to the north. Another possible basalt source is immediately to the east.

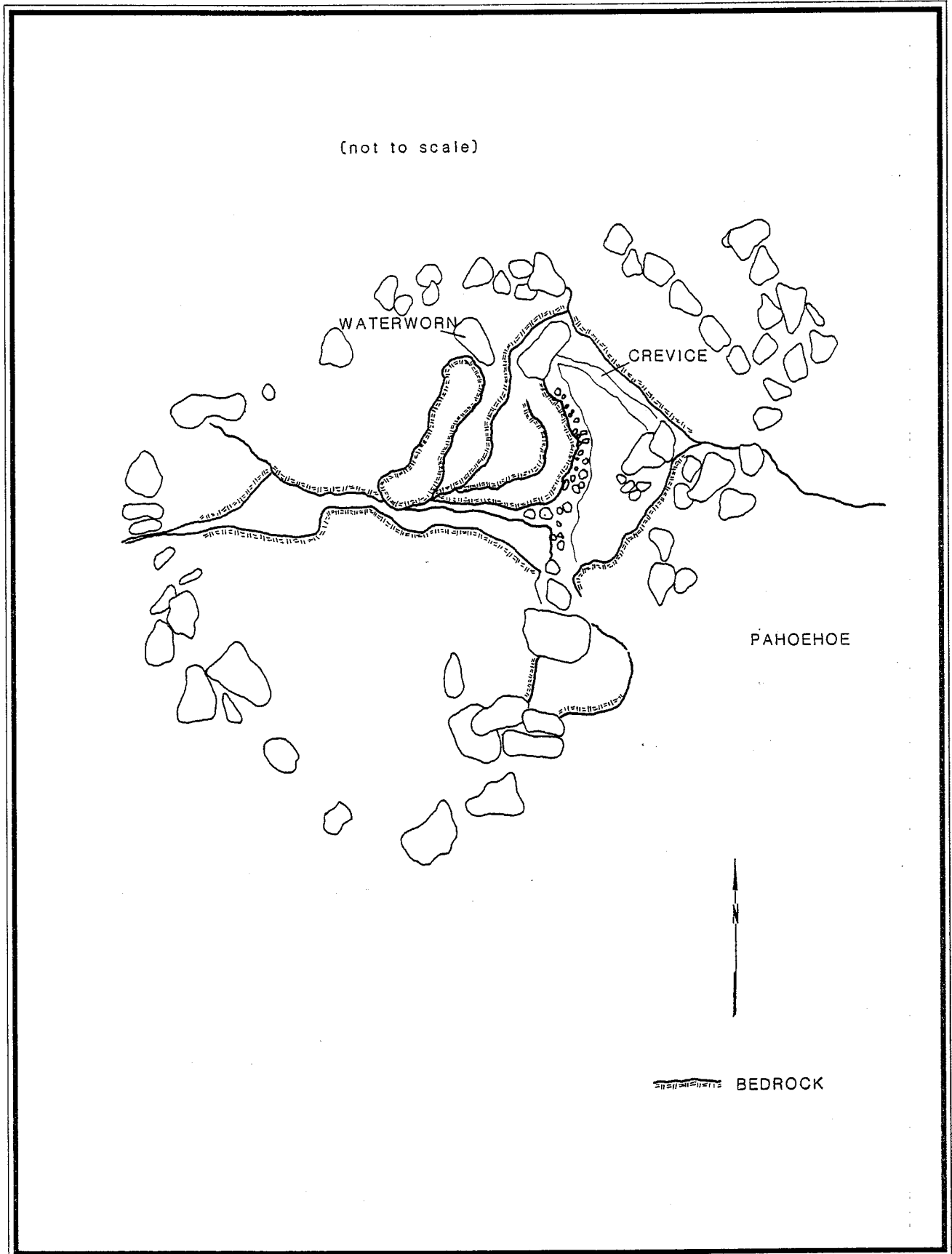


Figure A-7. SITE 13272, FEATURE G

**FEATURE N:** Pahoehoe excavation (Figure A-8)**FUNCTION:** Agriculture**DIMENSIONS:** 5.00 m by 4.30 m by 0.80 m

**DESCRIPTION:** Excavated crevice in area of natural collapse, some of which was cleared and then excavated along two faces. The opening measures c. 1.7 m (N-S) by 1.6 m (E-W). The blocks were removed and placed in a rough wall-like stack around the perimeter of the opening. Only a few blocks are to the north, under a shelf, that leads into a crawlspace. The crawlspace measures c. 2.0 m deep with a ceiling height of 0.4 m. There is moist dark soil present under a layer of basalt pebbles. This deposit was sampled for purposes of comparison with soil from other similar features.

**FEATURE O:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 1.90 m by 0.70 m by 0.60 m

**DESCRIPTION:** A small nearly circular hole in a recent flow. The floor is flat with one crevice that has small cobbles and pebbles inside. The removed blocks are in a haphazard scatter mostly to the south side. A single piece of branch coral was noted. Feature O is located on the west rim of the kipuka that is associated with Site 13272 (T-19), which is also the east rim of the kipuka associated with Site 13281 (T-28).

**FEATURE P:** Pahoehoe excavation**FUNCTION:** Possible agriculture/quarry**DIMENSIONS:** 3.00 m by 2.20 m by 0.50 m

**DESCRIPTION:** An excavated pahoehoe crevice with a flat bottom and small air pockets on all sides. The rocks are removed but scattered to the north, northwest, and west sides of the hole. A relatively thick brown soil mixed with pebbles is present on the floor interior. The opening measures 0.9 m (E-W) by 0.74 m (N-S).

**FEATURE Q:** Mound**FUNCTION:** Agriculture**DIMENSIONS:** 0.85 m by 0.35 m by 0.40 m

**DESCRIPTION:** A mound constructed with piled subangular basalt blocks in a linear formation. Large rocks are used at the bottom, with smaller ones in between. There are c. 12 rocks used stacked c. four courses. Other cobble sized blocks are haphazardly scattered to the north and east of the pile. The overall feature including the scatter measures c. 2.7 m by 3.2 m.

**FEATURE R:** Pahoehoe excavation**FUNCTION:** Indeterminate/quarry**DIMENSIONS:** 4.00 m by 3.80 m by 0.50 m**DESCRIPTION:** One excavated crevice and a cleared area

along a fault looks like broken rocks were removed from the fault rim and the excavated crevice to a localized pile along the slope in a crevice. Over 50 pieces are used. A chain and leather collar and dog tag (dated 1960, Reg. 5437) are caught in the rocks; no evidence of dog.

**FEATURE S:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 3.60 m by 3.00 m by 0.35 m

**DESCRIPTION:** An excavated flow edge is cleared of rocks and the rocks are piled to the southeast side along the opening of the excavated area. A small overhang with a shaded area at the west end of the opening measures c. 0.6 m wide by 0.19 m deep and with a ceiling height of 0.2 m.

**FEATURE T:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 0.90 m by 0.60 m by 0.92 m

**DESCRIPTION:** An excavated pahoehoe blister is situated on a southern slope of pahoehoe. It is along the south wall c. 12.0 m east of Feature S. The basalt blocks are piled northeast of the excavation.

**FEATURE U:** Pahoehoe excavation**FUNCTION:** Agriculture**DIMENSIONS:** 1.00 m by 0.85 m by 0.45 m

**DESCRIPTION:** An excavation with the quarried rocks tossed exterior of the excavation, mostly to the west. Fine brown loam visible on the floor interior.

**FEATURE V:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 3.60 m by 3.40 m by 0.80 m

**DESCRIPTION:** An excavated crevice, only partially cleared; some of it is natural collapse that is still in place. The cleared area is a shelf and a portion of a relatively deep crevice. The quarried blocks are removed and arranged in a definite circular pattern to the northeast side of the excavation along the sloping rim into the kipuka.

**FEATURE W:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 5.80 m by 0.80 m by 0.32 m

**DESCRIPTION:** Feature W is situated on a very cracked, faulted and steep, smooth pahoehoe slope leading downward to the kipuka floor. The floor of the excavation is smooth with a few cracks and some small pebbles scattered about. The NE face is excavated, and possibly the SW face. No vegetation is in the immediate area.

**FEATURE X:** Pahoehoe excavation**FUNCTION:** Quarry/possible agriculture

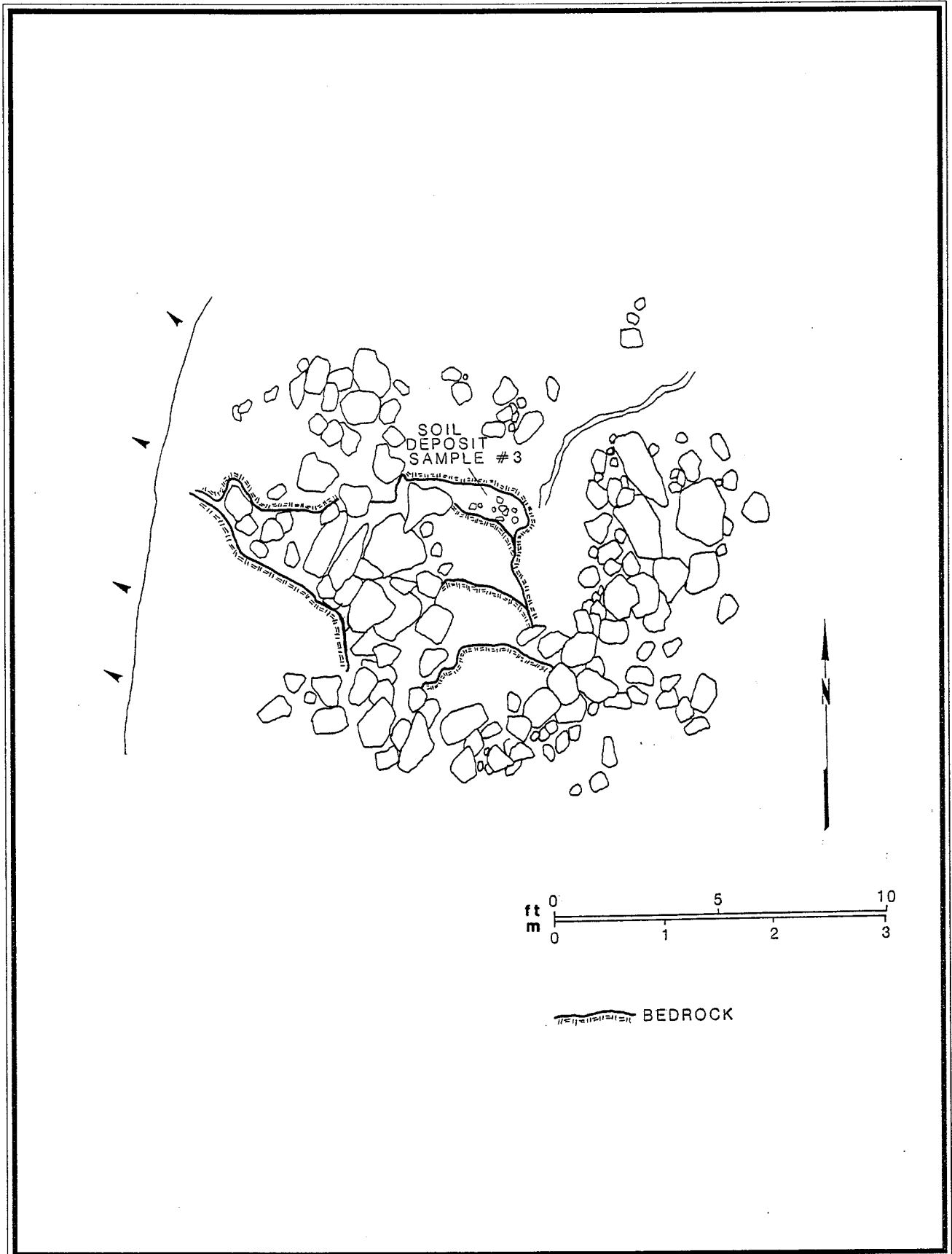


Figure A-8. SITE 13272, FEATURE N

**DIMENSIONS:** 3.20 m by 2.10 m by 0.24 m

**DESCRIPTION:** Feature X is situated in an area of natural collapse, on the west slope of the kipuka ridge, on the base of the NW slope. Some pahoehoe blocks have been removed and scattered in and around the crevice holes in close proximity to each other forming two depressions in the newer pahoehoe flow, exhibiting the older pahoehoe flow inside the openings. There are c. 20+ blocks in various sizes ranging from 0.9 m to 0.44 m.

**FEATURE Y:** Terrace

**FUNCTION:** Possibly agriculture

**DIMENSIONS:** 3.95 m by 2.85 m by 0.91 m

**DESCRIPTION:** An area of natural collapse, some of which large blocks have collapsed and were moved to form a terrace in front of the NW wall of the kipuka ridge. The retaining east edge consists of large basalt blocks with small to large angular cobbles used as fill between the terrace and ridge wall.

**FEATURE Z:** Boulder concentration

**FUNCTION:** Quarry

**DIMENSIONS:** 3.24 m by 1.84 m by 0.29 m

**DESCRIPTION:** A concentration of c. 30 angular pahoehoe blocks. It is built on top of smooth but cracked pahoehoe.

**FEATURE Aa:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.92 m by 1.45 m by 0.26 m

**DESCRIPTION:** A naturally cracked and smooth pahoehoe area with a small fault or upthrust where possible excavation occurred. Associated blocks are located immediately downslope from the excavation area. The blocks range in size from 0.11-0.35 m in length, 0.6-0.33 m in width and 0.14 m high.

**FEATURE Ba:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.46 m by 1.28 m by 1.00 m

**DESCRIPTION:**

A partially excavated blister with many basalt blocks surrounding the area. A large boulder is protruding from the center of the excavation with smaller boulder blocks around it. It is located c. 10.0 m at 233 degrees northeast of Feature Ca on top the rough and sloping southwest edge of kipuka.

**FEATURE Ca:** Pahoehoe excavation

**FUNCTION:** Agriculture/habitation

**DIMENSIONS:** 4.36 m by 2.30 m by 1.33 m

**DESCRIPTION:** An excavated blister in area of natural collapse, some of which was cleared and excavated to form a cave. The opening is cleared with some blocks possibly

piled on the bottom of the entrance floor. Blocks are also piled along the west side of the cave.

The cave entrance is c. 1.0 m wide and 0.8 m high. The opening faces to the NE and is situated on the SW rim of the kipuka. Northwest of the cave is a linear pile of stacked blocks roughly oriented c. N-S. The average height of the SE side of the cave is c. 0.97 m while towards the NW portion it starts to narrow to a average height of c. 0.42 m in addition to widening. The length of the cave is c. 6.55 m (NW-SE) and 2.92 m (E-W). The cave continues to turn to the north, but the cave opening is small c. 0.25 m wide with heights of 0.30-0.40 m. Here, the cave is smaller, c. 2.6 m (NE-SW), and it appears to continue northeast.

**FEATURE Da:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 3.68 m by 1.00 m by 0.33 m

**DESCRIPTION:** A pahoehoe excavation along a fault area. Parts of one face along the fault show excavation activity. A large crevice between the faulted slabs may have been filled.

**FEATURE Ea:** Petroglyph

**FUNCTION:** Rock art

**DIMENSIONS:** 0.30 m by 0.30 m by 0.03 m

**DESCRIPTION:** A human figure, stick form petroglyph on a flat and fairly smooth pahoehoe. It is oriented c. 318 degrees NW. It is located near the center of the kipuka at c. 16.0 m at 350 degrees north of Feature Fa.

**FEATURE Fa:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.67 m by 1.29 m by 0.52 m

**DESCRIPTION:** Excavation along a crack of a pahoehoe blister which is oriented c. E-W. It is excavated through the top layer of pahoehoe with the associated quarried basalt scattered to the SSW and to the north of the excavation. An area running along the northeast edge consists of naturally broken blocks, some still in place. This area was not excavated, but blocks simply pulled out of place.

**FEATURE Ga:** Mound

**FUNCTION:** Possible agriculture

**DIMENSIONS:** 1.97 m by 1.84 m by 0.26 m

**DESCRIPTION:** Midway along the slope at the SE end of the kipuka is a circular mound of piled large and small angular cobbles. There are a few additional blocks scattered around the mound. It is constructed with c. 15 small and large angular rocks ranging in size from 0.8-0.17 m by 0.14-0.28 m by 0.5-0.13 m in height.

**FEATURE Ha:** Pahoehoe excavation**FUNCTION:** Quarry/possible agriculture**DIMENSIONS:** 4.40 m by 3.90 m by 0.48 m**DESCRIPTION:** This feature is in more recent pahoehoe, along the east side of the *kipuka* ridge. It consists of a partially excavated crevice, on an area of natural collapse. Some of the lava blocks were removed and scattered around the excavation. There are c. 30 basalt blocks concentrated at the bottom of the slope.**FEATURE Ia:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 1.67 m by 0.65 m by 0.64 m**DESCRIPTION:** A pahoehoe excavation that has been cleared of its quarried material. The quarried blocks are crudely piled west of the excavated area. Roughly square shape in plan, the piled rocks appears not to be formally arranged.**FEATURE Ja:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 0.61 m by 0.47 m by 0.54 m**DESCRIPTION:** Small triangular shaped area with three faces excavated. The floor of the excavation is covered with pahoehoe cobbles and pebbles. Excavated material is located southeast of the excavated area.**SITE NO.:** State: 13273 PHRI: T-20**SITE TYPE:** Mound**TOPOGRAPHY:** Fairly flat pahoehoe.**VEGETATION:** Sparse grass and one lantana bush.**ELEVATION:** c. 20 feet**CONDITION:** Fair**INTEGRITY:** Unaltered**PROBABLE AGE:** Indeterminate**FUNCTIONAL INTERPRETATION:** Agriculture**DIMENSIONS:** 1.16 m by 0.81 m by 0.28 m**DESCRIPTION:** Situated on smooth and ropy pahoehoe. It is constructed with 25 angular blocks ranging in size from 15x8x7 to 25x21x13 cm. The blocks are placed in a low pile, no more than two courses high.**SITE NO.:** State: 13274 PHRI: T-21**SITE TYPE:** Complex (6 Features)**TOPOGRAPHY:** The site is situated on top of a pahoehoe ridge with a depression area to the southwest.**VEGETATION:** Sparse grass, a few Christmas-berry trees, and *noni* bushes.**ELEVATION:** c. 20-23 feet**CONDITION:** Good**INTEGRITY:** Unaltered**PROBABLE AGE:** Prehistoric**FUNCTIONAL INTERPRETATION:** Agriculture-quarry**DESCRIPTION:** The overall complex area measures c. 16.0 m (E-W) by 27.0 m (N-S). The site consists of four pahoehoe excavations (Feature A, Features C and D, and F), an alignment (Feature B), and a mound (Feature E). An additional 21 pahoehoe excavations are situated along the perimeter of the depression area.**FEATURE A:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 6.00 m by 6.00 m by 0.87 m maximum height**DESCRIPTION:** This feature consists of a large pit quarried into the northeast edge of a large circular pahoehoe flow edge. The pit is linear and measures c. 3.24 m (NW-SE). Most of the excavated boulders and large cobbles are stacked in a N-S alignment on the east edge of the excavated pit. Boulders are piled along the south edge with some smaller boulders and cobbles on the west edge. Some rubble has collapsed into the excavation. Two waterworn basalt stones, possible hammerstones, are situated at the bottom of the excavated pit.**FEATURE B:** Alignment**FUNCTION:** Indeterminate**DIMENSIONS:** 1.50 m by 1.20 m by 0.15 m**DESCRIPTION:** A small semicircular alignment of excavated pahoehoe blocks, on smooth, unbroken pahoehoe. It is constructed with eight blocks ranging in size from 17x18x13 cm to 36x23x27 cm. The boulder blocks are spaced an average of 5 cm apart. The alignment is 4.63 m northeast from Feature A.**FEATURE C:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 2.16 m by 1.57 m by 0.34 m**DESCRIPTION:** Feature C is located 4.80 m northwest from Feature A. It consists of a pahoehoe excavation within a collapsed blister, with the excavated blocks placed along the south and southwest perimeter of the excavated area. There are c. 50 blocks ranging in size from 10x7x8 cm to 47x26x25 cm. No soil was observed in the excavation.**FEATURE D:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 6.36 m by 1.00 m by 0.50 m**DESCRIPTION:** This feature is 2.85 m southeast from Feature C. The pahoehoe excavation is generally rectangular shape in plan. The excavated blocks are piled along the northeast side of the excavated area. No soil was observed in the feature.

**FEATURE E:** Mound**FUNCTION:** Quarry/Agriculture**DIMENSIONS:** 2.26 m by 1.97 m by 0.57 m**DESCRIPTION:** Generally oval shape in plan, it is constructed with small to large pahoehoe blocks. The mound is built on top of smooth and ropy pahoehoe. The excavated pahoehoe blocks range in size from 10x10x6 cm to 50x33x21 cm, and were probably removed from Feature F, an adjacent pahoehoe excavation.**FEATURE F:** Pahoehoe excavation**FUNCTION:** Quarry/agriculture**DIMENSIONS:** 15.23 m by 2.20 m by 1.05 m maximum depth**DESCRIPTION:** Feature F occurs in a natural pahoehoe fault that is oriented c. N-S, 8.25 m south from Feature E. The sides of the fault are excavated, and the bottom of the excavation is covered with small excavated blocks. The excavated face is c. 0.4 m thick and the deepest portion of the crevice is c. 1.05 m.**SITE NO.:** State: 13275 PHRI: T-22**SITE TYPE:** Cave**TOPOGRAPHY:** Pahoehoe lava tube with a later intrusive flow.**VEGETATION:** A few unidentified vines in the entrance area.**ELEVATION:** c. 21 feet**CONDITION:** Poor**INTEGRITY:** Possibly altered**PROBABLE AGE:** Prehistoric-early historic**FUNCTIONAL INTERPRETATION:** Burial**DIMENSIONS:** 8.00 m by 3.20 m by 1.07 m**DESCRIPTION:** One lava tube which is oriented NNW-SSE with an entrance that is perpendicular to the tube at about a 45 degree angle. The lava tube entrance is full of angular blocks of pahoehoe, ranging in size from 3x4x2 cm to 30x24x10 cm.

The lava tube contains two chambers. The entrance to the first chamber measures c. 3.2 m by 5.95 m and 1.7 m in height. The floor is cleared of any roof fall.

The second chamber measures c. 1.63 m by 1.75 m and 0.55 m in height. This chamber contains a human burial. The skeletal remains are badly deteriorated and they occur in an area of c. 90 by 60 cm. The area of the burial is very moist with standing water in the cracks beneath the burial.

**SITE NO.:** State: 13276 PHRI: T-23**SITE TYPE:** Complex (2 Features)**TOPOGRAPHY:** Both smooth and ropy pahoehoe flow

are around the features. A small field of aa is c. 5.0 m SE, and a crest of pahoehoe is c. 10.0 m NW.

**VEGETATION:** Sparse grasses, ferns, and 'ilima**ELEVATION:** c. 28 feet**CONDITION:** Good**INTEGRITY:** Unaltered**PROBABLE AGE:** Prehistoric**FUNCTIONAL INTERPRETATION:** Quarry/agriculture**DESCRIPTION:** Overall complex area measures c. 12.0 m (E-W) by 15.0 m (N-S). The site consists of two pahoehoe excavations (Features A and B).**FEATURE A:** Pahoehoe excavation**FUNCTION:** Quarry/agriculture**DIMENSIONS:** 1.76 m by 1.53 m by 0.29 m average depth**DESCRIPTION:** A circular excavated area of pahoehoe with blocks placed on the immediate edge to the east and southeast. A single waterworn basalt cobble (17x15 cm) occurs inside the excavation. No soil is present.**FEATURE B:** Pahoehoe excavation**FUNCTION:** Quarry/agriculture**DIMENSIONS:** 1.21 m by 1.17 m by 0.36 m**DESCRIPTION:** Feature B is located 0.39 m north from Feature A. It is an oblong excavation area in pahoehoe, with blocks placed on the immediate west and northwest edge of the excavated area. Small cobbles and pebbles are scattered inside the excavation; no soil is present.**SITE NO.:** State: 13277 PHRI: T-24**SITE TYPE:** Complex (8 Features)**TOPOGRAPHY:** Smooth and ropy pahoehoe near a large depressed area. A bulldozed flat area with a road beyond to the north. Aa fields on all other sides of the site area.**VEGETATION:** Sparse grasses and noni**ELEVATION:** c. 28 feet**CONDITION:** Good**INTEGRITY:** Unaltered**PROBABLE AGE:** Prehistoric**FUNCTIONAL INTERPRETATION:** Quarry/ possible agriculture**DESCRIPTION:** The overall complex area measures c. 12.45 m (E-W) by 12.6 m (N-S). The site consists of eight pahoehoe excavations (Features A-H). No soil or deposits were observed in these features.**FEATURE A:** Pahoehoe excavation**FUNCTION:** Quarry**DIMENSIONS:** 3.45 m by 3.42 m by 0.25 m**DESCRIPTION:** Feature A is roughly circular shape in plan. The excavated blocks are concentrated in the west half of the excavated area and on top of the surface of the



pahoehoe to the west of the excavated area. The large depression of aa and pahoehoe is located immediately to the south.

**FEATURE B:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 0.00 m by 0.00 m by 0.36 m

**DESCRIPTION:** Located 3.95 m west from Feature A, this excavation is small and roughly oval in plan, with blocks ranging from 14 to 30 cm in length. The blocks are in and around the northwest edge of the excavated hole.

**FEATURE C:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.16 m by 0.00 m by 0.36 m

**DESCRIPTION:** The Feature C pahoehoe excavation is 2.29 m southwest from Feature B. It has a slightly raised south face which has been excavated. Large and small angular blocks, ranging in length from 12 cm to 53 cm, are tossed south of the excavated face.

**FEATURE D:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 0.82 m by 0.00 m by 0.31 m

**DESCRIPTION:** A single-faced excavated area with c. 20 angular blocks, ranging in length, from 9 cm to 54 cm. The blocks are placed c. 1.0 m to the north and northwest of the excavated face. This feature is 3.20 m south from Feature C.

**FEATURE E:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 0.91 m by 0.52 m by 0.26 m

**DESCRIPTION:** Roughly rectangular shape in plan, it has an excavated thickness of 13 to 26 cm. There are c. ten angular blocks ranging in size from 12x20x13 to 48x39x23 cm located inside and outside of the excavation. It is located 3.44 m west from Feature D.

**FEATURE F:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 0.38 m by 0.38 m by 0.32 m

**DESCRIPTION:** A small triangular excavated hole. Four angular pahoehoe blocks (14 to 20 cm long) are c. 1.0 m SE of the excavated opening. It is located 4.75 m south from Feature D.

**FEATURE G:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.09 m by 0.00 m by 0.22 m

**DESCRIPTION:** A small face of ropy pahoehoe is excavated

with many small thin pieces of pahoehoe in the immediate area of the excavation. Two medium angular blocks are directly NW of the excavated face. The excavation is 2.94 m southeast from Feature F.

One waterworn basalt is located c. 13 cm from Feature G. It contains pecked areas at the base and may be a possible hammerstone.

**FEATURE H:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.72 m by 0.00 m by 0.42 m

**DESCRIPTION:** An excavated face of pahoehoe with the quarried blocks located c. 1.0-1.4 m to the east. There are c. 28 blocks ranging in size from 10x7 to 39x17 cm. Located 2.52 m southeast from Feature G.

**SITE NO.:** State: 13278 PHRI: T-25

**SITE TYPE:** Complex (2 Features)

**TOPOGRAPHY:** On gently rolling pahoehoe at the edge of the flow, with aa along the flow edge.

**VEGETATION:** Sparse grass with 'ilima and lantana

**ELEVATION:** c. 26 feet

**CONDITION:** Fair-good

**INTEGRITY:** Unaltered

**PROBABLE AGE:** Prehistoric/early historic

**FUNCTIONAL INTERPRETATION:** Quarry/possible agriculture

**DESCRIPTION:** Overall complex area measures c. 7.0 m (E-W) by 13.0 m (N-S). The site consists of a mound (Feature A) and a pahoehoe excavation (Feature B).

**FEATURE A:** Mound

**FUNCTION:** Agriculture

**DIMENSIONS:** 1.25 m by 0.78 m by 0.40 m

**DESCRIPTION:** Feature A consists of c. 14 blocky boulder size pahoehoe in a linear pile c. two courses high. No formal construction evident. It is situated on a small depression in the ropy pahoehoe along the northern perimeter. The blocks average c. 0.23 m thick. One of the quarried blocks fits into the rim of Feature B.

**FEATURE B:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 1.50 m by 1.20 m by 0.23 m

**DESCRIPTION:** Feature B is a pahoehoe excavation, located 2.6 m at 140 degrees from Feature A. A spot along the rim of Feature B is the source for a particular block present at Feature A, and it is likely that other stones in the mound are from this excavation. Loose pahoehoe pieces are scattered in the excavation, along with decomposing lava.

**SITE NO.:** State: 13279 PHRI: T-26  
**SITE TYPE:** Complex (4 Features)  
**TOPOGRAPHY:** Undulating smooth and ropy pahoehoe flow on edge of aa flow.  
**VEGETATION:** Sparse grass, small 'ilima bushes, and lantana  
**ELEVATION:** c. 22 feet  
**CONDITION:** Good  
**INTEGRITY:** Unaltered  
**PROBABLE AGE:** Prehistoric-early historic  
**FUNCTIONAL INTERPRETATION:** Quarry/possible agriculture  
**DESCRIPTION:** Overall complex area measures c. 17.6 m at 185 degrees by 9.3 m. In all cases, the excavated blocks are piled in close proximity to their respective excavation holes. In addition, the features appear to have all faces excavated. Soil is present in Feature B.

**FEATURE A:** Pahoehoe excavation (*Figure A-9*)  
**FUNCTION:** Quarry  
**DIMENSIONS:** 5.23 m by 2.91 m by 0.39 m  
**DESCRIPTION:** Generally rectangular shape in plan. Feature A consists of at least three excavated faces. The excavated thickness is c. 24 cm with the maximum depth of the hole at 39 cm below surface. The excavated blocks range in size from 10x9x1 cm to 50x30x24 cm.

**FEATURE B:** Pahoehoe excavation  
**FUNCTION:** Quarry/agriculture  
**DIMENSIONS:** 3.30 m by 3.03 m by 0.44 m  
**DESCRIPTION:** A rectangular-shaped excavated area with three quarried faces. The excavated thickness is c. 21 cm. The excavated blocks range in size from 6x5x3 cm to 59x28x23 cm. A deposit of medium brown, loose gravelly loam, up to 0.07 m thick, is present inside the excavation.

**FEATURE C:** Pahoehoe excavation  
**FUNCTION:** Quarry  
**DIMENSIONS:** 3.26 m by 1.96 m by 0.62 m  
**DESCRIPTION:** A small, square shaped excavated area with all four faces quarried. The excavated hole measures 0.81 m by 0.82 m. The thickness of the excavated face is 29 cm. The average block measures c. 34x23x20.

**FEATURE D:** Pahoehoe excavation  
**FUNCTION:** Quarry  
**DIMENSIONS:** 5.48 m by 2.54 m by 0.50 m  
**DESCRIPTION:** The excavated hole measures c. 1.09 m by 2.69 m. The thickness of the excavated face is 0.22 m. The average block measures c. 34x31x23 cm.

**SITE NO.:** State: 13280 PHRI: T-27  
**SITE TYPE:** Complex (26+ Features)

**TOPOGRAPHY:** Undulating and smooth pahoehoe flow with small faults and upthrusts.  
**VEGETATION:** Grasses, kiawe, bushes, lantana, noni, impatiens, 'ilima bushes, and koa-haole  
**ELEVATION:** c. 22 feet  
**CONDITION:** Fair-good  
**INTEGRITY:** Unaltered  
**PROBABLE AGE:** Prehistoric-historic  
**FUNCTIONAL INTERPRETATION:** Habitation-quarry-rock art  
**DESCRIPTION:** Overall complex area measures c. 34.8 m (N-S) by 40.2 m (E-W). Soil deposits and ecofactual materials are present at a number of features, in addition to historic period portable remains and historic period petroglyphs.

**FEATURE A:** Cave  
**FUNCTION:** Habitation  
**DIMENSIONS:** 12.00 m by 6.60 m by 1.12 m  
**DESCRIPTION:** An excavated and cleared blister within an area of natural collapse. Some of the blocks were excavated and removed along two faces to form an opening. The opening of the cave faces to the NW with large and small angular rocks and collapsed rubble. It measures c. 1.17 m wide and 1.12 m high.

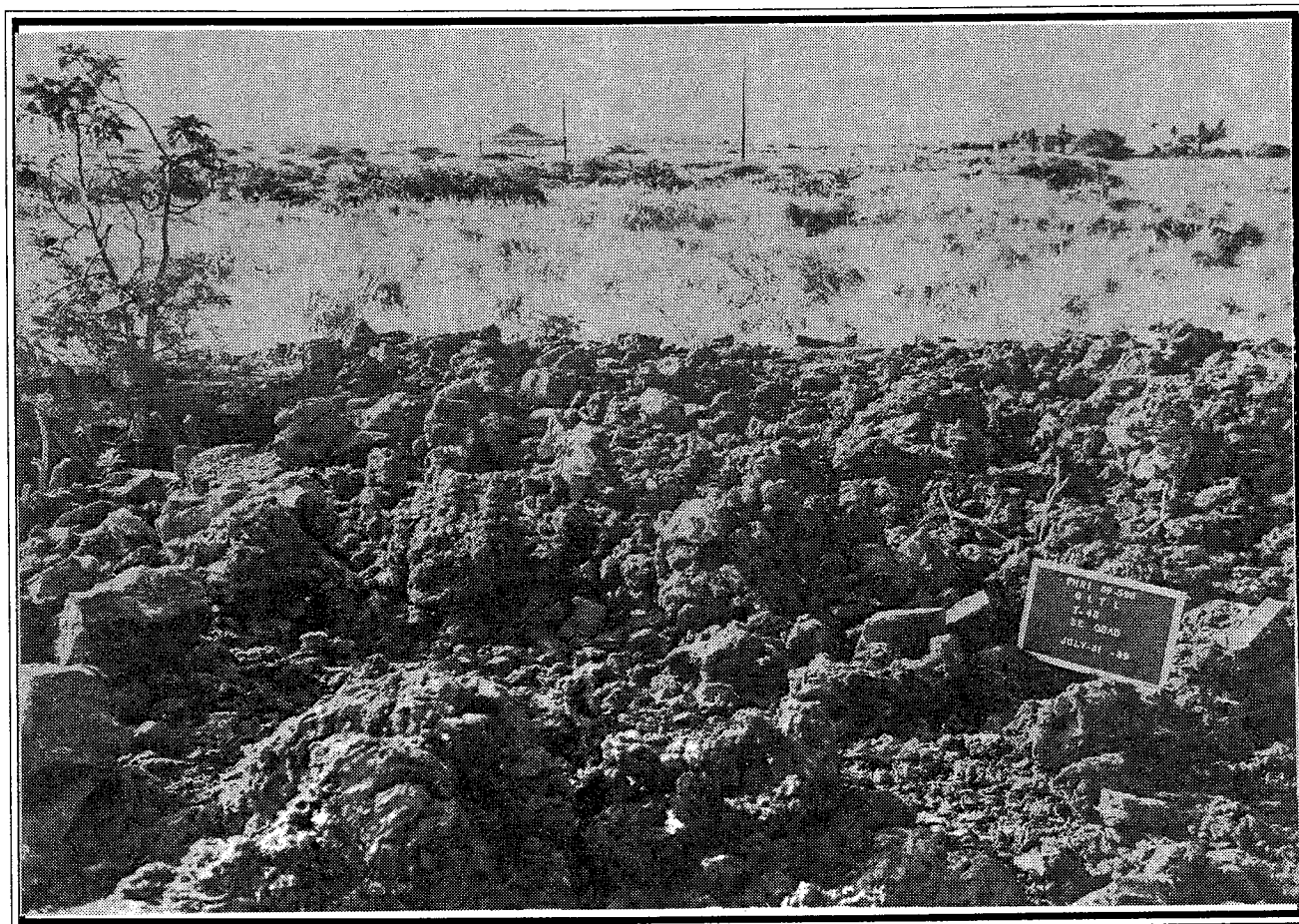
Basalt blocks are placed around and on the floor of the entrance of the cave on the SE end. The interior dimensions of the cave are c. 4.16 m (N-S) by 7.10 m (E-W) with a ceiling height between 0.55-0.90 m.

The floor interior consists of pahoehoe with dark brown moist soil and scattered cobbles on the surface. The northern end of the cave has kukui, faunal remains and marine shell.

The cave narrows but continues to the east and joins with a lava tube that is oriented c. NW-SE. The lava tube measures c. 9.0 m by 1.5 m and with a ceiling height of 0.40 m.

**FEATURE B:** Pahoehoe excavation  
**FUNCTION:** Quarry/possible agriculture  
**DIMENSIONS:** 5.10 m by 4.05 m by 0.36 m  
**DESCRIPTION:** Feature B is an excavated and partially cleared crevice in an area of natural collapse. There are c. 50+ large and small angular rocks placed to the west and southeast side of the hole. Some soil with pebbles is present on the north side of the excavation. There are some gouge marks on the northwest and southeast interior face of the hole.

**FEATURE C:** Pahoehoe excavation  
**FUNCTION:** Quarry/possible agriculture



*Figure A-9. SITE 13279, FEATURE A, View to East (PHRI Neg. 1236-13)*

**DIMENSIONS:** 4.00 m by 3.18 m by 0.29 m  
**DESCRIPTION:** A pahoehoe excavation with evidence of quarrying is present on the SE side. The excavation area measures c. 1.7 m (NW-SE) by 2.1 m (NE-SW). Some of the quarried blocks were removed and shifted around the feature opening. Displacement of rocks is on the NE side and scatter of smaller angular basalt is on the SW and NW side of the feature. A thin layer of soil deposit is present on the top and bottom slope of the crevice where the excavation is located.

**FEATURE D:** Pahoehoe excavation

**FUNCTION:** Quarry

**DIMENSIONS:** 13.50 m by 4.70 m by 0.50 m

**DESCRIPTION:** Located 8.0 m southeast from Feature C, this excavated area measures c. 0.23 m by 0.45 m. There are c. 100 + small and large blocks in various sizes displaced and scattered in and around the feature. The thickness of the excavated pahoehoe on the SW side is c. 0.30-0.32 cm and on the NE side it is 0.18-0.20 m.

**FEATURE E:** Petroglyph (Figure A-10)

**FUNCTION:** Rock art

**DIMENSIONS:** 0.47 m by 0.45 m by 0.02 m

**DESCRIPTION:** A geometric petroglyph of a male figure, situated on the NW side of the kipuka. It is located c. 13.6 m southwest from Feature A.

**FEATURE F:** Alignment

**FUNCTION:** Indeterminate

**DIMENSIONS:** 1.42 m by 0.36 m by 0.23 m

**DESCRIPTION:** A slightly curved alignment of five pahoehoe blocks, with two other blocks within 10-50 cm of the alignment. The pahoehoe blocks range in size from 20x18x12 cm to 31x19x26 cm and are placed end to end on top of smooth pahoehoe.

**FEATURE G:** Pahoehoe excavation

**FUNCTION:** Water catchment

**DIMENSIONS:** 1.85 m by 1.40 m by 0.22 m

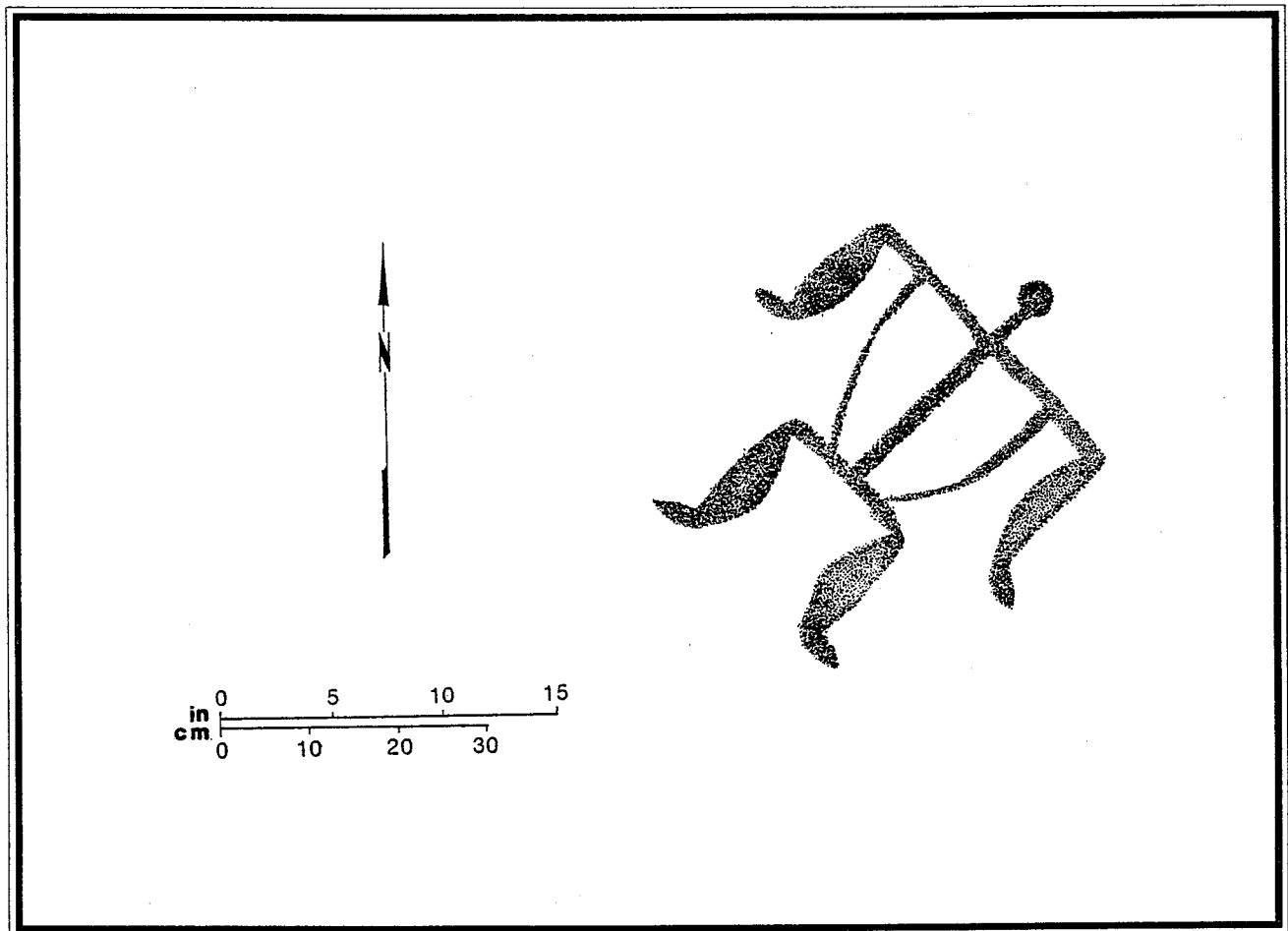


Figure A-10. SITE 13280, FEATURE E