Hawai`i Volcanoes National Park
Island of Hawai`i

KEONEHELELEI - THE FALLING SANDS

UNCOVERING THE ORIGIN OF PRESERVED FOOTPRINTS AND ASSOCIATED KA‘Ū DESERT FEATURES:

A HISTORICAL OVERVIEW AND ARCHEOLOGICAL SURVEY OF THE KA‘Ū DESERT

by
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U.S. Department of the Interior

Publications in Anthropology #2
2003

Keonehelelei - The Falling Sands

Hawaiÿi Volcanoes National Park Archeological Inventory of the Footprints National Register

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EXECUTIVE SUMMARY

At the request of the National Park Service (NPS), staff from the Research Corporation of the University of Hawaiÿi (RCUH) and Hawaiÿi Volcanoes National Park (HAVO) carried out an inventory survey of surface cultural remains. The survey took place within the Footprints National Register parcel, which covers approximately 4,284 acres. Located in the District of Kaÿü, on the Island of Hawaiÿi, Footprints lies within the *ahupuaÿa* (traditional land unit) of Kapäpala (TMK #399001001 and 398001001).

The National Park Service nominated the Footprints area to the National Register of Historic Places in 1974. This area was nominated to the Register because of the presence of "fossilized" human footprints (State Site 50-10-61-5505) found in two layers of hardened desert ash.

Archeologists carried out a survey of Footprints over a two-year period. Between August and December 1998 archeologist Warren Wulzen, B.A. directed Phase I of the survey. Two goals were identified by Wulzen for his project: 1) to "identify archaeological features in the Kaÿü desert;" and 2) to "record the frequency and location of fossil footprints in the volcanic ash deposits found in the area" (Wulzen unpubl. ms 1999).

In four months, Wulzen's team identified 711 archeological features. The most significant result of the 1998 survey was the discovery and documentation of archeological structures, trails, and historic artifacts in the 1790 Footprints National Register area. Wulzen and his crew were the first archeologists to record and identify these features.

Wulzen produced a draft report of his survey results. However, a review of the draft in 2000 suggested that the 1998 crew had not sufficiently documented the archeological features; they did not obtain baseline inventory data and survey methods were inconsistent. In addition, site function and significance was not assessed; more field data needed to be collected. Thus, Phase II was redesigned to collect enough data to complete the survey report.

Between June and September 2000 and again between July 10 and August 2, 2001, archeologists from Hawaiÿi Volcanoes National Park undertook Phase II of the Footprints survey. The 2000 survey relocated many of the features identified in 1998 as well as identified new features in the area. The 2000 survey crew formally recorded these features, conducted two test excavations and started a monitoring program.

Combined, the 1998 and 2000 field crews identified 55 sites consisting of 516 individual structures and features. A total of 73 isolated artifacts and 1,773 footprints representing a minimum of 441 individuals were recorded.

The results of the 1998 and 2000 survey projects suggest that surface structures cluster along the edge of the Keÿämoku lava flow. The structures are nearly continuous starting from the terminus of the flow, then heading northeast, towards Kïlauea Caldera. At least two trail systems used during the Pre-contact and Post-contact periods parallel the Keÿämoku flow on the east. Archeologists also identified several other trails and road segments in the project area, thus suggesting frequent use in the Pre-contact and Post-contact periods.

Results of radiocarbon dating of charcoal collected from a 1998 test unit suggest that construction of the feature occurred some time during a break in the explosive phase of eruptive activity at Kïlauea (between A.D. 1500 and 1790). Archeologists did not find any charcoal during the two excavations conducted in 2000. However, because both excavation units were placed within the features, construction sequences suggested both features were built before the 1790 explosive ash eruption.

Finally, a piece of charcoal extracted from a fossilized footprint held in the HAVO museum collection was submitted for radiocarbon dating. The results of the analysis correlated with the data obtained in 1998. The charcoal dated from A.D. 1522 to A.D. 1811.

ACKNOWLEDGEMENTS

Recognition must foremost be given to the 1998 field crew, Warren Wulzen, Taylor Houston and Jill Rivoli. These individuals were the first to record the architectural structures, resource procurement areas and trails in the Kaÿü Desert.

I would also like to express my appreciation to my 2000 - 2001 field crew, Warren Costa, Taylor Houston, Christopher Quiseng and Mara Durst. Their dedication to the project has made the completion of this report possible.

A very sincere thanks to Don Swanson, USGS Hawaiian Volcano Observatory Scientist in Charge. His knowledge of the geologic history of the Kaÿü Desert was an enormous help in understanding the cultural history of the area.

Thanks also go to Laura Carter Schuster whose continued support throughout this project has made its successful completion possible. Mahalo to the Administration and Staff at Hawaiÿi Volcanoes National Park for their continued support of the Cultural Resources Management (CRM) program. Thanks to Bobby Camara who provided useful information of the area and to Paul Chattey who reviewed the draft report. Taylor Houston was exceptional in his fieldwork and GIS and drafting production; he produced a majority of the final maps for this report.

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Chapter I

INTRODUCTION

In the year 1857, a 19 year old tax assessor named Frederick S. Lyman was travelling around Hawai`i Island. Lyman's job was to collect data on the age of citizens of the Kingdom of Hawai`i. The Hawaiian government wanted this data as a means to account for its citizens so that it could levy taxes on the people. Most Hawaiians did not know their ages but could associate their births with famous "occurrences." Thus, in addition to collecting statistical information Lyman recorded ethnographic information as well. To supplement the oral histories he collected from his native informants in the field, Lyman also gleaned data from Hawaiian language newspapers. Using the results collected from these surveys and his research, Lyman compiled a List of Dates of famous events. This list served as a means of estimating the ages of individuals living in the Kingdom of Hawai`i.

In his List of Dates, Lyman recorded five events for the year 1790. Amongst these events was the arrival of John Young and Isaac Davis. Young and Davis were European sailors who came to be two of the most trusted advisors of Kamehameha, then ruler of a majority of Hawai`i Island. Of most relevance to this report is an event buried within the list called *Keonehelelei*, "the falling sands."

Keonehelelei is the name given by Hawaiians to the explosive eruption of Kīlauea in 1790. Hawaiians probably called the 1790 eruption the time of "the falling sands" because this eruption involved an explosion of hot gas, ash, and sand that rained down across the Ka`ū Desert. The 1790 eruption was unlike most magmatic eruptions Hawaiians were accustomed to: Hawaiians may not have commonly witnessed these kinds of explosive phreatic eruptions. Thus, the character of the eruption was likely distinct enough to warrant a special name.

Another reason this event may have stood out in the minds of local Hawaiians was because of the fatalities involved. The 1790 explosion led to the death of one-third of the warrior party of Kaʻū Chief Keōuakūʻahuʻula also known as Chief Keōua. In 1790, Keōua ruled half of Hāmākua and all of Puna and Kaʻū districts (Desha 2000:278). He, his warriors, and accompanying family members were passing through the Kīlauea area at the time of the eruption. The explosion trapped and killed several individuals. The exact number is unknown, but reports range from a low of about 80 to a high of 5,405 (Ellis 1963; Douglas 1834).

Although the name Keonehelelei does not appear in writing until 1857, native Hawaiians who lived in the shadow of Kīlauea did not forget the event. This event was so memorable to the Puna and Kaʻū communities that they twice told the story to the first European (William Ellis) who traveled through the area in 1823 (Ellis 1963). Over the years, the description of this event has grown. The eruption and features associated with the time of Keonehelelei is the primary motivating force for an inventory survey conducted between 1998 and 2001 at Hawaiʻi Volcanoes National Park (HAVO).

At the request of the National Park Service (NPS), staff from the Research Corporation of the University of Hawaiʻi (RCUH) and HAVO carried out an inventory survey of surface cultural remains. The survey took place within the 1790 Footprints National Register parcel, henceforth referred to as Footprints. The Footprints area covers approximately 4,284 acres. The area is located in the District of Kaʻū, on the Island of Hawaiʻi (Figure 1 and 2). Footprints lies within the *ahupuaʻa* (traditional land unit) of Kapāpala, southwest of Kīlauea Caldera on the western-most boundary of HAVO (TMK #399001001 and 398001001) (Figure 2).

The National Park Service nominated Footprints to the National Register of Historic Places in 1974. This area was determined as historically significant and was nominated to the Register because of the unique "fossilized" human footprint impressions (State Site 50-10-61-5505, henceforth referred to as Site 5505) found in two separate layers of hardened desert ash. Although the authors of several books and articles commonly applied the term fossil to the Footprints features, the features do not meet the definition of a fossil or paleontological resource. A fossil must be at least 10,000 years old (Encyclopedia Britannica on-line resource). Archeologists believe Polynesians colonized the Hawaiian Islands some time after A.D. 600 (Graves and Addison 1995). Thus, the Footprints clearly do not meet the criteria of a fossil.

It is a common belief that the footprints are from members of the warrior party of Kaʻū Chief Keōua. The prints are thought to have been created as the warriors marched through the area during the eruption of 1790. The ash fell wet on the ground, and humans walked through it. As the ash hardened the footprints of the people who were walking through the area were preserved. Ruy Finch, a geologist at the Hawaiian Volcanoes Observatory, was the first to identify the prints in 1920. Fifty-four years later, the Park Service recognized their historic value and nominated the area to the National Register of Historic Places.

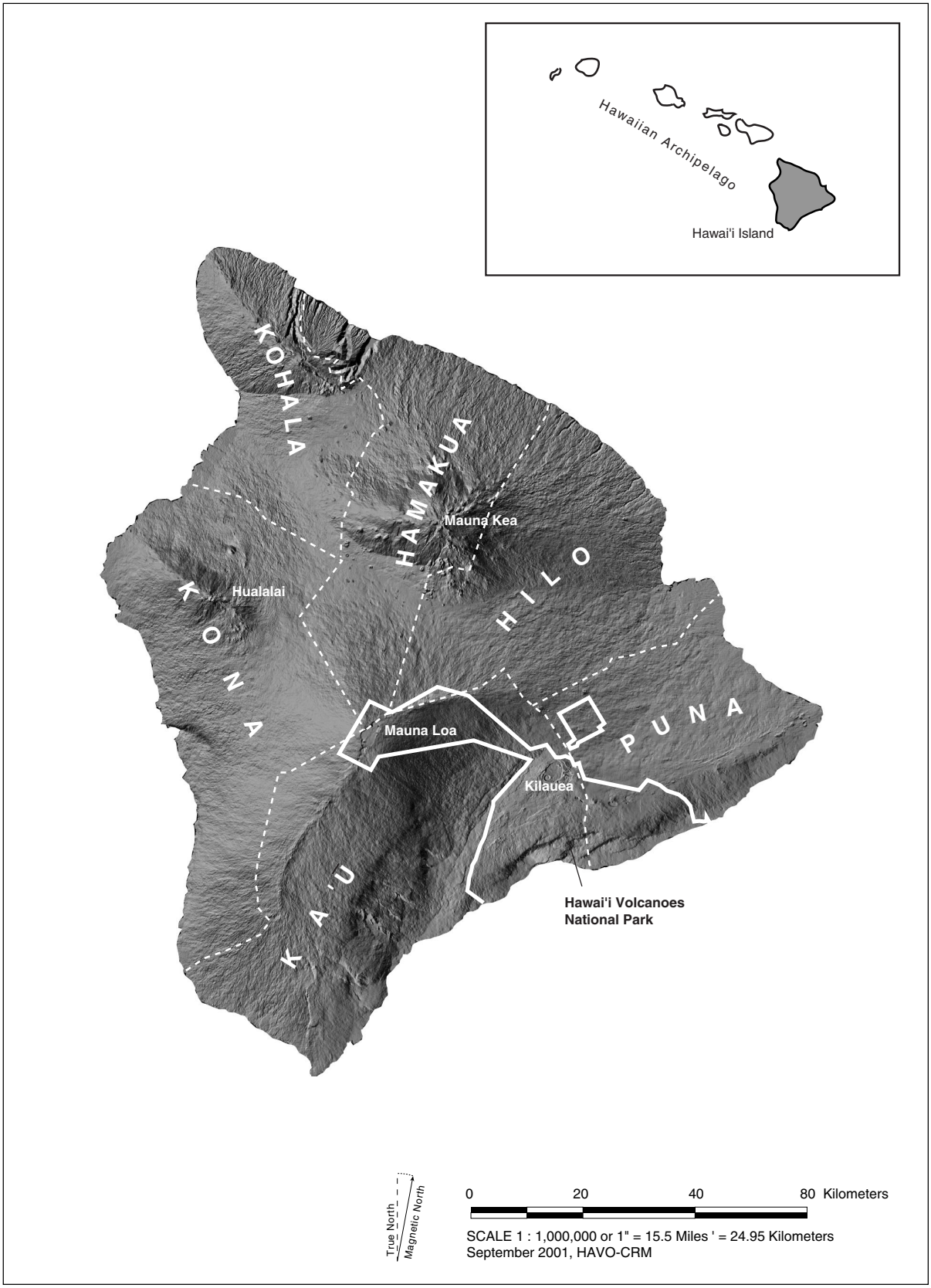


Figure 1. Location of Hawai'i Volcanoes National Park.

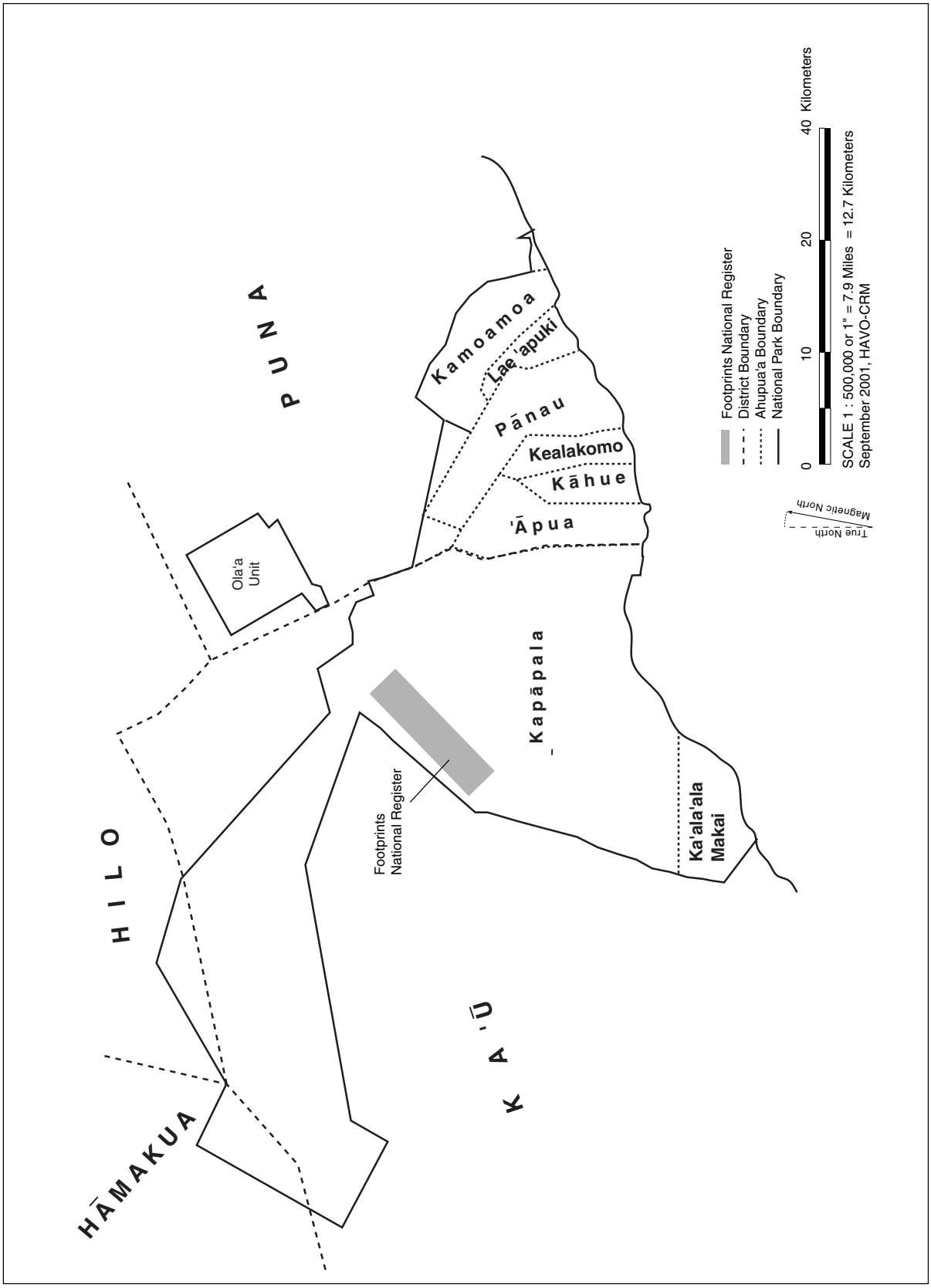


Figure 2. Location of 1790 Footprints National Register Parcel.

Scope of Work

No further archeological survey was conducted in the Footprints area since its nomination to the National Register in 1974. In 1997, cultural resource managers developed the Scope of Work (SOW) for an archeological survey of the Footprints area. In the 1994 Park managers reported several incidents of vandalism to the footprint features (Criminal Incident Report #940663 and #940880). In addition, after years of public interpretation and the impact of natural erosion and volcanism, Park managers recognized that the fragility of the resource posed special concerns for their preservation.

Thus, the intent of the proposed survey was to address concerns over the absence of systematic archeological surveys in the area and the need to document damage to the footprint impressions. Damage to the footprints is a result of natural erosion, active volcanism, and human trampling. Archeologists developed the SOW for the current project from a review of known records including National Register nomination forms and Archaeological Resource Protection Act (ARPA) reports.

The available records for the Footprints area suggest that since its nomination in 1974, several individuals have reported footprint features outside of the roughly rectangular 4,284-acre boundary area identified on the Register. HAVO CRM staff determined that further survey and recording was necessary to fully understand the nature of the footprint features as well as to gather sufficient information to revise the 1974 National Register boundary for the 1790 Footprints parcel.

The location and nature of Site 5505 poses a problem for preservation. Composed of hardened volcanic ash, damage to the features from human trampling and on-going erosion by wind and rain is continuous and cumulative. In addition, because the site lies on the slopes of Kīlauea and Mauna Loa volcanoes, there is a constant threat from lava and other volcanic activities.

The research design developed by the SOW divided the archeological investigations of Site 5505 into three phases. Phase I covered a review of existing records and a reconnaissance level survey. Phase II was a one-year inventory survey of selected areas identified during the Phase I reconnaissance survey, and testing of selected archaeological features and footprints. Combined, Phase I and II required two years of funding. Phase III is a one-year funded project that focuses on the preservation of selected footprints and development of a monitoring program to identify and track impacts to selected archeological features. Phase III funding will be received in Fiscal Year 2003. The report for Phase III will be completed separately.

The following tasks were determined to satisfy Phase I and II funding requirements by NPS for an adequate inventory of surface and selected subsurface cultural remains at Footprints:

(1) **review of existing research.** Field notes, maps, published and unpublished manuscripts, ethnographic data and interviews, existing aerial photographs and geologic maps will be located and reviewed for relevant data pertaining to the area.

(2) **documentation of all sites in a 200-acre area at a reconnaissance survey level**. Sites will be recorded using a Geographic Positioning System (GPS) unit. Features will be documented, plotted on USGS 7.5 minute quadrangle maps, and categorized by formal type. All information will be entered into a Geographic Information System (GIS) and linked to a database. Phase II will document the sites at an inventory-level survey including collection of structural data and detailed planar mapping.

(3) **subsurface testing of structures.** Small, temporary "C"-shapes and other features associated with human habitation will be examined to determine feature function, and to make inferences of feature use and duration of use.

(4) **field checks of footprint locations.** Field checks will be conducted to determine the limits of the Footprints area in relation to the National Register boundary. Randomly chosen areas will be surveyed for footprint impressions, and systematic analysis of the number, angle, size, integrity, and nature of the prints will be conducted in random and nonrandom fashion. During Phase III, researchers propose to design and test appropriate preservation techniques for deteriorating footprints.

(5) **laboratory analysis of collected materials.** Materials will be identified, sorted, and entered onto a computer database. Charcoal samples will be submitted for radiocarbon assay.

(6) **report describing procedures and results of the survey, systematic analysis, and test excavations.** This report will be an inventory survey level document. Background research will cover all existing documentation on the area because no previous work has been done here. The resultant report will provide a basic understanding of human use of the area. Recommendations for preservation and future (Phase III) survey will also be made.

Project Summary

The reconnaissance survey for Footprints occurred sporadically over a two-year period. Between August and December 1998 archeologist Warren Wulzen, B.A. directed Phase I of the survey. Wulzen identified two goals for his project. The first was to "identify archaeological features in the Ka`ū desert" and the second was to "record the frequency and location of fossil footprints in the volcanic ash deposits found in the area" (Wulzen unpubl. ms. 1999). Wulzen was able to inventory 711

archeological features in 1998. At least 120 of these features are well outside of the project area; most of the features are near the Hilina Pali Trail and are not only spatially distinct but also likely temporally and functionally divergent from the Footprint features. Therefore, the author is not considering these features in this report.

An important outcome of the 1998 survey was the discovery and documentation of archeological structures, trails, and historical artifacts in the 1790 Footprints National Register parcel. Wulzen was the first archeologist to formally record and identify these features. During his survey Wulzen collected Universal Trans Mercator (UTM) coordinate positions using a Global Positioning System (GPS) for all of the archaeological features his crew identified. His survey crew did not complete feature forms containing descriptive site documentation and they did not produce any sketch maps.

In the summer of 2000, a draft survey report prepared by Wulzen was available but incomplete. A review of the draft suggested that the 1998 crew had not sufficiently documented the archeological features; baseline inventory data were not obtained and survey methods were inconsistent. Because preliminary site function and significance could not be assessed, more field data needed to be collected. Thus, Phase II was designed to collect enough data to complete the survey report.

The second phase of the Footprints survey project took place between June and September 2000 and again for 11 days between July 10 and August 2, 2001. The original goal of the 2000 survey was to formally record the features identified in 1998, evaluate the sites for significance, and identify future field projects. As the 2000 inventory proceeded, it became apparent that the 1998 field crew had missed features in areas that they identified as surveyed. Because systematic transects were not done in 1998, and because of time and budget constraints, the 2000 survey methodology was altered. The author limited the scope of the inventory to features found along the base of the Ke`āmoku flow. Efforts were concentrated along the flow because sites appeared to cluster in this area and the flow represented an obvious natural boundary.

Combined, the 1998 and 2000 field crews identified 55 sites consisting of 516 individual structures and features. A total of 73 isolated artifacts and 1,773 footprints representing a minimum of 441 individuals were recorded. Test excavations were carried out in three structures in three sites. The primary purpose of testing was to identify the function of structures, collect material for radiocarbon dating, and correlate construction sequences with geologic events. Archeologists excavated all test units by natural layers, with 5 cm arbitrary levels used. All sediments were screened through ¼" mesh screen. Profiles and plan views were drawn.

Summary of Field Results

The results of the 1998 and 2000 survey projects suggest that surface structures cluster along the edge of the Ke`āmoku lava flow. The structures are nearly continuous starting from the terminus of the flow north, towards Kīlauea Caldera. At least two

trail systems used during the precontract and postcontact periods parallel the Ke`āmoku flow on the east. They are identifiable for nearly 7,786 m (4.84 miles) on the adjacent *pāhoehoe* flow described by geologists as "p4o" (of Kīlauea origin). These summit flows date to the 14th century, in a period between 1300 - 1400 A.D., or 600- 700 years ago (D. Swanson pers. comm.) The Ke`āmoku flow is a more recent flow. Thus, assuming all of the the features constructed along or on top of the Keāmoku lava flow are temporally related, they must have been constructed some time after A.D. 1400.

The trail systems stretch from the terminus of the Ke`āmoku flow almost to the southwestern edge of Kīlauea Caldera. The structures both along and on the Ke`āmoku flow are in close proximity to and would have been easily accessible from the trails. Architectural features also cluster around a portion of a historic era trail within the Park 4,725 m (2.94 miles) southwest of the terminus of the Ke`āmoku flow.

The 1998 and 2000 field crews also identified shorter trail segments perpendicular to the Ke`āmoku flow. These trails often cross narrow segments of the Ke`āmoku flow. Thus, the trails provide the greatest ease of access to the "p4o" flow and provided connecting links to the `Ainapō Trail (Site 5501), Puna Coastal Trail and the Halfway House. A majority of the footprints appear to parallel precontact and postcontact trail systems as well as the Mauna Iki flow. However, this is likely just a factor of survey bias. Computer-generated random plots suggest there may be a nonrandom correlation between trails and footprint impressions. Additional survey is required however to fully document the distribution of prints across the desert and beyond the established National Register boundary.

At the northern end of the survey corridor, towards Kīlauea Caldera, the concentration of structures and footprints sharply decrease as the terrain increases in elevation and the amount of sand in the area gets deeper. The decrease in feature abundance may be due to several factors. First, sand may be covering some of the structures and footprints in this area making it difficult to identify. Secondly, the distribution of features may be biased towards the area closest to the Ke`āmoku lava flow and along the trail systems because of survey methodology used in 1998 and 2000. In the 1998 survey archeologists closely followed the trails and recorded archeological sites found along them. Survey methodology used in 2000 also restricted spatial coverage to the edge of the Ke`āmoku flow.

The decrease in feature abundance, however, may be real and due to other cultural factors associated with precontact use of the area. While lava flows may have covered any existing features in the area, the mere threat of eruptions may have discouraged people from establishing habitation and procurement sites too close to the crater. Spiritually, the sacredness of this area may have prohibited a physically close association to the Caldera out of respect for Pele.

Test excavations revealed virtually no cultural material. Very little charcoal sufficient for dating was obtained, and only from the 1998 excavation at Site 23026. Dates obtained from this structure suggest that construction occurred some time during a break in the explosive phase of eruptive activity at Kīlauea (between A.D. 1500 and

1790). Archeologists did not find any charcoal during the two excavations conducted at Sites 22973 and 22974. Both features, however, were constructed on the flat *pāhoehoe* surface and evidence of ash having fallen after their construction suggests they were built before the tragic 1790 event. A piece of charcoal was found by the author lodged in a footprint impression held in the HAVO collection. This charcoal was dislodged and submitted for radiocarbon dating. The results show that the charcoal, and the associated footprint dates from A.D. 1522 to A.D. 1811.

Report Organization

This report presents the results of the survey and test excavations conducted in Footprints at Hawai`i Volcanoes National Park. Chapter II focuses on the natural history of the project and the larger Kapāpala/Ka`ū Desert region. In Chapter III, the rich cultural history of the area is reviewed. In Chapter IV, the impact of changes in land tenure on Kapāpala is discussed. Chapter V presents the story of Keōua and a review of the historic records that have tied the creation of the prints to his warrior party. In Chapter VI, previous research carried out in the area is discussed. Chapter VII summarizes the current project. Included in the summary is a review of the various survey and excavation methods and results as well as a summary of the nature of the Footprints area. In Chapter VIII the focus shifts to issues surrounding management of the National Register parcel including a review of current use of the area and future recommendations.

This report also includes two appendices. Appendix I lists all of the data collected, to date, on the footprint impressions. This data primarily comes from the work of Al Miller, a volunteer at HAVO. Miller's data was recorded by hand on topographical maps, therefore the specific site locations were not collected using Global Positioning System (GPS) units. All of the site and feature data other than that pertaining to the footprint impressions is described in detail in Appendix II. The maps provided in Appendix II do not identify the location of Wulzen's 1998 features because either the features were not relocated and therefore not confirmed, or they were relocated and a new feature number was assigned.

Chapter II

NATURAL HISTORY OF THE PROJECT AREA

This section of the report presents background information on the land in and around the Footprints area at HAVO. This chapter focuses solely on the natural history of the Kaʻū Desert. The general environment of the Kaʻū desert, including geology and vegetation is presented. All of this information will be used to understand the distribution of sites across the project area.

Boundaries

The original purpose of this project was to do an inventory survey of the place called the Footprints area. The goal of the project was to formally document features in the National Register boundary because no formally documented survey existed. The Footprints area was listed on the National Register of Historic Places on August 7, 1974. The area was nominated to the Register because the prints were recognized as unusual features found nowhere else in Hawaiʻi, and the story behind the creation of the prints associated this area with a unique event in Hawaiian history.

The 1790 Footprints National Register property is a rectangular shaped parcel covering approximately 4,284 acres (6.69 mi^2.). It lies within the *ahupuaʻa* of Kapāpala, District of Kaʻū (Figure 2). The boundaries of the parcel, as identified in the National Register Nomination form, are the edge of the Keʻāmoku *ʻaʻā* lava flow on the west, the Kaʻū Desert Trail on the southeast, and "irregular lines" on the northeast and southwest (Apple 1954). This boundary was arbitrarily determined; no systematic surveys were done at the time of nomination to identify the extent of the footprints. Architectural features, recently identified within the boundary area had not been identified at the time of the nomination and therefore were not included on the National Register.

Because there has been no formal survey of the area, the actual distribution of footprint features has never been determined. Since 1974, it became evident that the footprints extend beyond the 4,284 acre National Register parcel. The need to identify the boundaries of these features has become increasingly urgent. There has been great concern that the area, which is a popular interpretive site, is being adversely affected from years of use (Somers 1992). In the early 1990's, several incidents of site damage were reported. The need for a complete survey to identify the extent of the prints and to assess their condition before they disappeared became a priority.

Although the proposal for funding originally addressed only the area within the National Register boundary, the actual land surveyed for this project was much larger. In 1998, Wulzen (1999 unpubl. ms.) defined the project area for the reconnaissance survey as an irregularly shaped parcel covering approximately 37,641 acres (Figure 3). A majority of the 1998 survey area lies within the *ahupua'a* of Kapāpala, but a very small portion lies within the *'ili 'āina* (a traditional Hawaiian land division for which the chief paid tribute to the chief of the *ahupua'a*) of Keauhou.

The boundaries of the 1998 reconnaissance survey are roughly defined by the western boundary of HAVO, Hilina Pali road on the east, and Kīlauea Caldera on the north. There is no clearly defined natural boundary on the south. In 2000 the inventory survey was confined primarily to the eastern edge of the Ke'āmoku flow. The 2000 survey was not able to venture further from the flow due to timing and budget constraints.

General Environment and Background

The project area is approximately 48 km (30 miles) southwest of Hilo and 33 km (20 miles) northeast of Pāhala town. Located southwest of Kīlauea Caldera, the project area consists of primarily undulating *pāhoehoe* flows interspersed with pockets of ash and sand. The terrain is level, but elevation and slope increase as you move north towards Kīlauea. The southern boundary of the project area contains several large sand dunes formed primarily through aeolian processes. The western boundary is defined by the rough and expansive Ke'āmoku *'a'ā* lava flow.

Sand dunes, Ka'ū Desert. Photo Courtesy of National Park Service, Hawai'i Volcanoes National Park.

The project area falls within the greater Ka'ū Desert that is part of the mid-elevation woodland zone of HAVO. This zone is defined as the "area above Hilina Pali (2,000 ft. elevation) and below Kīlauea Caldera (4,000 ft.)" (Stone and Pratt 1994:125). On the west, the zone is bounded by State land while on the east it lies adjacent to the rain forests and lava flows from the East Rift of Kīlauea (Stone and Pratt 1994:125).

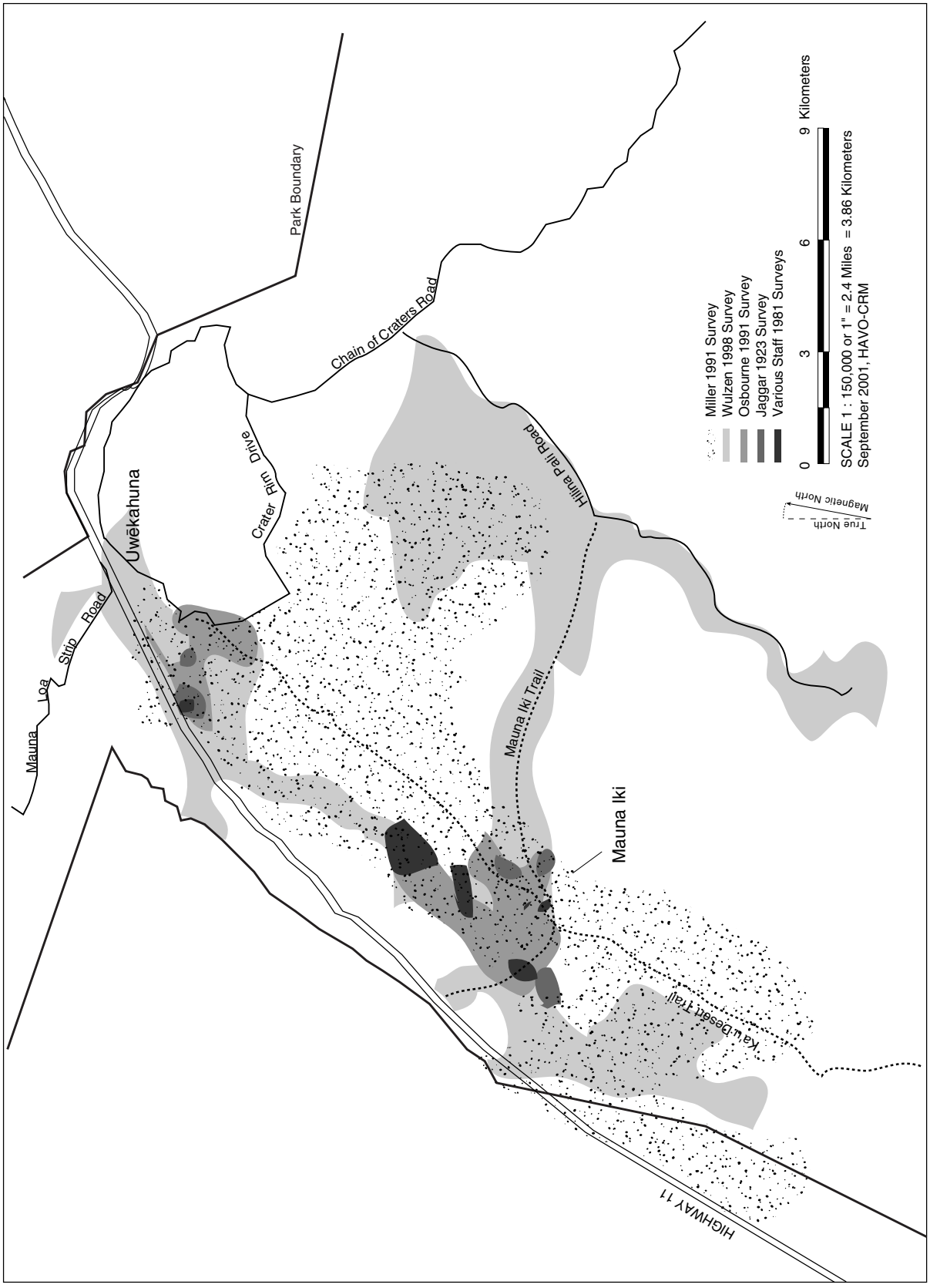


Figure 3. Previous Surveys.

The climate in the mid-elevation woodland's zone is highly seasonal. In the summer, visitors will routinely experience dry, warm days (Stone and Pratt 1994:126). Although it is called a desert, the Ka`ū Desert receives up to 127 cm (50 inches) of rainfall annually. Therefore, it does not exhibit the typical extremely low rainfall averages found in other desert environments (Stone and Pratt 1994:126).

Currently, the project area is in a generally natural condition; few modern changes have affected the nature of the landscape. The Park Service has built at least two trail systems and one structure for interpretive purposes in the Footprints area. The structure was built by the Civilian Conservation Corps (CCC) in 1941 as is on the List of Classified Structures (LCS). Descriptive signage at the head of the Footprints trail located just off of the pullout on Highway 11 briefly introduces the visitor to the natural and cultural history of the desert area.

Natural resource management actions in the project area have been limited to out-planting of `ihi mākole (*Portulaca sclerocarpa*) a critically rare and endangered plant. A total of 500 plants were planted on three separate occasions. Five groups of 100 plants each were planted in approved plot areas. The plots are discontinuous but are located in areas that would: 1) ease the burden of watering and monitoring for the resource management crew; 2) avoid areas determined to be sensitive due to cultural resources; and 3) be in deeper sand for the ease of planting (J. Chase HAVO Vegetation management personnel, 2001 pers. comm.).

Geology

The Hawaiian Islands are volcanic in origin. Stretching nearly 6,000 km (3,728 mi.) across the north Pacific Ocean, the islands are composed of at least 107 individual volcanoes (Clague and Dalrymple 1987:5). Both the islands of Maui and Hawai`i are considered volcanically active. However, only the Island of Hawai`i has a currently active and ongoing eruption. Hawai`i Island is the youngest and largest island in the Hawaiian chain; it is approximately 4028 square miles (10432 $km^2$) (Figure 1) (Juvik and Juvik 1998:22). The shorter temporal period for erosion activities on the Island of Hawai`i, as well as its active volcanism, play predominant roles in the development of its size.

Hawai`i Island consists of five shield volcanoes: Kohala, Mauna Kea, Hualālai, Mauna Loa, and Kīlauea (listed in order of latest activity) (Figure 1) (Peterson and Moore 1987:149). The surface flows in the project area is a combination of flows from Mauna Loa and Kīlauea. Although Kīlauea flows predominate in the project area, the Ke`āmoku, a large, visible feature on the western boundary of the project area, is of Mauna Loa origin. The Ke`āmoku flow is composed of two separate events (Figure 4). Both flows are described by Wolf and Morris (1996) as "k4" *`a`ā* flows and date to 200 – 750 years ago.

Other flows adjacent to the Ke`āmoku flow have also been dated. The results suggest that all of the flows in the project area are relatively young, less than 1,000 years old. Polynesians are believed to have colonized the Hawaiian Islands some time after A.D. 600 (Graves and Addison 1995). Thus, all of the eruptive events in the project

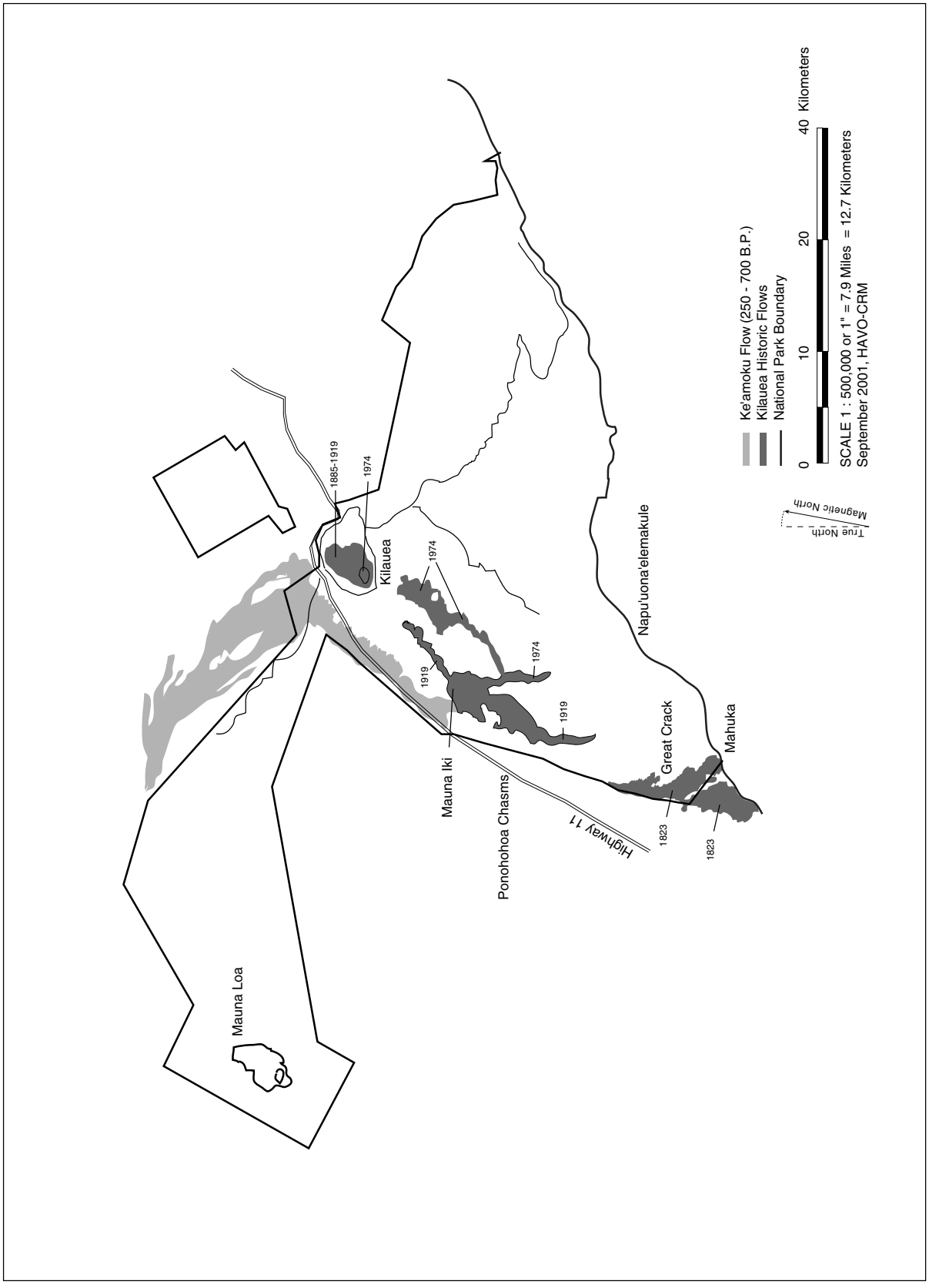


Figure 4. Map showing Ke‘āmoku flow and other early historic eruptions.

area that occurred within the last 1,000 years occurred during a time of human habitation.

Hawaiian volcanic explosions are much less common than lava flows, but have contributed importantly to the geology of the Footprints area. In particular, phreatic explosions produced wet volcanic ash that rained from the sky and formed the substrate for the footprints.

Phreatic and Phreatomagmatic Explosions

The kind of event that contributed to much of the deposited material in the Kaʻū Desert was the result of phreatic explosions associated with Kīlauea. Today geologists more clearly understand the processes associated with these kinds of explosive steam-driven eruptions. Information such as the timing of the events, and the nature of the materials that was exploded out of the caldera and then deposited across the desert floor has been analyzed. Geologists have also developed predictive models that demonstrate the role of the caldera in these eruptions. All of this information has added to our understanding of the nature of the eruptive events in the project area.

The Kaʻū Desert has been greatly influenced by phreatic and phreatomagmatic explosions and lava fountains from Kīlauea. These eruptions produced pyroclastic deposits, chiefly made of volcanic ash. Pyroclasts are "fragmental materials thrown into the air during a volcanic eruption and deposited from the air" (Wentworth 1938:172). The term does not include all fragmental volcanic rocks, such as lava balls and "much of the material of *ʻaʻā* flows" (Wentworth 1938:172). It does, however, include volcanic ash. This is the material that fell in 1790 and will be the focus of the remainder of this discussion.

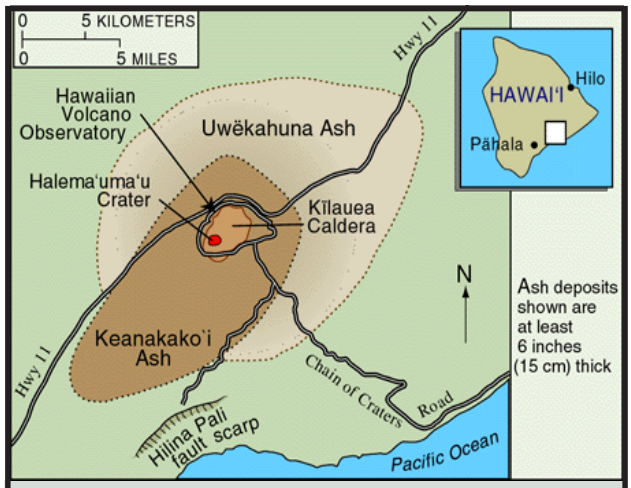
Kīlauea is an explosive volcano. At least six "phreatic or phreatomagmatic eruptions have occurred in the past 1200 years (Swanson et. al.1998). The volcanic ash and sand that overlies lava flows in the project area belong to a geologic unit called the Keanakāko'i Ash. The Keanakāko'i Ash is the "best known and most widespread of the Kīlauea ash deposits" (Swanson et. al.1998). It is located in an area closely surrounding Kīlauea Caldera.

Over the years, the Keanakāko'i series has been erroneously referred to as the 1790 ash event because it was believed that this eruptive episode was the primary source of the ash in the Kīlauea area. Several explosive eruptions of Kīlauea, however, have contributed to the Keanakāko'i formation starting about A.D. 1500. The latest major explosive eruption was probably in 1790. Thus, the Keanakāko'i Ash is now more correctly defined as comprising pyroclastic layers deposited between about A.D. 1500 and 1790 (Swanson 2001 pers. comm).

McPhie et al. (1990) describe the Keanakāko`i eruption as follows:

> *"The... ash eruption commenced within a long series of phreatomagmatic explosions separated into two phases by a period of repose during which the deposits were partially eroded. Phreatic explosions of the third phase followed after another pause. Most of the Keanakāko`i ash comprises fall deposits accompanied by base surge deposits generated during the third phase."*

All three phases were separated by periods of quiet. During these periods, deposits were eroded and transported downwind (southwest) via wind and water (McPhie et al. 1990:334). It is not known how long the eruptions lasted. However, the entire eruptive phase may have lasted for weeks or even months (McPhie et al. 1990:334). Swanson (pers. comm.) suggests the Keanakāko`i was deposited over a period of time lasting decades to as much as 300 years from 1470 - 1500 to about 1790.



Distribution of Keanakāko`i Ash. Image USGS web site.

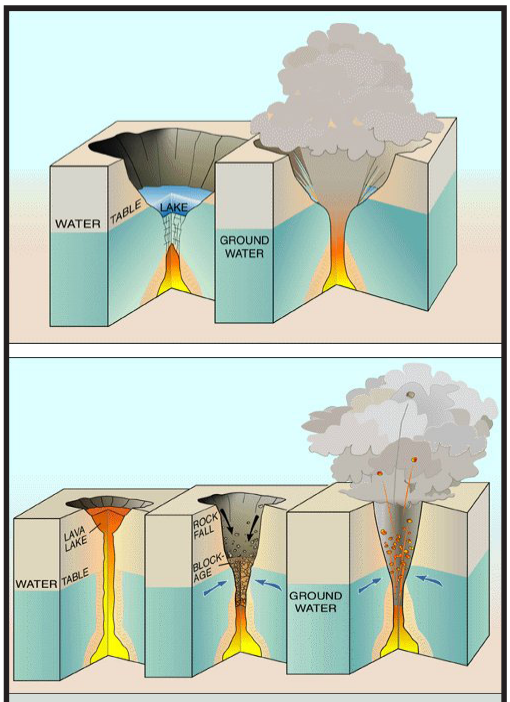
The third and final stage of the Keanakāko`i eruption is of most interest to this project. This final stage was "phreatic and deposited lithic-rich lapilli and block fall layers, interbedded with cross-bedded surge deposits, and accretionary lapilli-rich, fine ash beds" (McPhie et al. 1990:334). McPhie et al. (1990) propose that it is this phase of the eruption, which lasted no more than a few days, that Hawaiians described to Ellis during his journey through the area in 1823 (see Chapter V).

Based in part on observations of a similar eruptive event that took place at Kīlauea in 1924, geologists developed a description of the processes that led to the eruptive events and deposition of ash materials in the Footprints area. Geologists believe that most explosive eruptions at Kīlauea are caused when water comes in contact with molten rock and converts to steam. In 1924 the lava lake in Halema`uma`u Crater within Kīlauea Caldera dropped below the water table, the walls of the crater collapsed and blocked the opening in which the lava had drained. The steam pressure built up below the blocked opening thereby causing the explosion (Mastin et al. 1999). Swanson (1998) suggests that the caldera floor may have been at or below the water table for nearly 400 years. Thus, this entire period of Hawaiian history could have experienced such explosive events.

McPhie et al. (1990:351) believe that the Keanakāko`i deposits were probably generated by very "deep-seated explosions" (between 500 and 700 m below the ground surface) within Kīlauea and that the rim of the vent from which it erupted

was at least several hundred meters below the rim of the Caldera. Mastin et al. (1999) agrees and states that prior to 1924 Halema`uma`u Crater was so deep that the floor of the crater was below the water table. This allowed ground water to seep in and form a lake. Whenever magma erupted into the lake there was a violent explosion of steam and gases. This explosion fragmented the magma into tiny ash particles and drove fast-moving, very hot ash-laden steam clouds out of the crater. Called a pyroclastic surge, the ash traveled at a speed as great as 100 miles per hour. The explosions also threw out rocks called ejecta from already solidified lava flows inside the volcano.

During the eruption, high dust clouds and particles mixing in the upper atmosphere produced rain. As the raindrops fell through the dust, accretionary lapilli were produced. These small, hardened, rounded balls of ash are still evident in the ash layers today.



Graphic illustrating 1924 eruption (top) and pre-1924 eruption (bottom) at Kīlauea. (Mastin et al. 1999).

In May 1924 a series of explosions took place at Kīlauea. Geologists, comparing the amount of material deposited in 1924 and earlier suggest that the AD 1500 – 1790 explosions were far more violent than the 1924 event, and the amount of ash deposited many times greater (Wentworth 1938:251).

Plume ejected during the 1924 eruption of Kīlauea. A single fatallity resulted from this eruption. A photographer got too close to the site and a large ejecta landed on him. Witnesses tried to save him but they were unable to free his legs. Photo courtesy of National Park Service, Hawai`i Volcanoes National Park.

Although the 1790 explosions were far larger than any in 1924, the large amount of ash that fell in 1790 likely did not cause the death of the warrior party of Keōua. As the story goes, upon making his decision to leave his encampment at the caldera and continue on to Kaʻū, Keōua broke his army up into three groups. Perhaps he felt that the warriors stood a better chance of surviving the impending eruption if they did not travel in such a large group. Keōua was right. Although all of the warriors from the second party perished, most of the warriors in the first party and all of the warriors in the third party survived.

Reports by Native Hawaiians who came upon the dead group suggests that the bodies of the victims were neither burnt nor scarred. Based on these reports as well as geologic information, Swanson and Christiansen (1978) suggest the falling ash was accompanied by searing hot base surges that engulfed the victims. They suggest that the second group was apparently overcome by a sudden and violent pyroclasic surge; the party was engulfed in a stream of hurricane force winds, composed of hot steam and sulfuric gases. The heat of the hot gases and entrapped air probably suffocated the warriors causing their death (Swanson and Christiansen 1978:86). There was probably little ash falling at this time. Thus, the party would not have thought to run away from something that they could not see (Swanson and Christiansen 1978:85).

Flora and Fauna

Despite its active volcanic surroundings plants do thrive in the Kaʻū Desert. The substrate in which plants grow in the Kaʻū Desert is made up of relatively young lava flows interspersed with deeper pockets of ash, and cinder near the summit area. Because the ash and cinder is quite porous, water drains rapidly (Stone and Pratt 1994:126). Vegetation within the Kaʻū Desert is unique from other mid-elevation woodland areas in HAVO. Plant communities in the desert are sparse and highly adapted to dry, at times toxic, conditions (Stone and Pratt 1994:167). These conditions are influenced by substrate found in the area, the rain shadow that blocks moisture normally carried on the prevailing northeasterly tradewinds, and the geologically active surroundings (Stone and Pratt 1994:167).

Plants in the project area consists primarily of scattered native trees like *ʻōhiʻa* (*Metrosideros polymorpha*) and shrubs such as *ʻaʻaliʻi* (*Dodonaea viscosa*), *pūkiawe* (*Styphelia tameiameiae*), *ʻōhelo* (*Vaccinium reticulatum), pohā* (*Physalis peruviana*), and alien taxa including blackberry (*Rubus argutus*).

Alien grasses include the broomsedge (*Andropogon virginicus*) and molasses grass (*Melinis minutiflora*), both of which increase in density as they get closer to the sea and away from the noxious gasses spewed from Halemaʻumaʻu Crater in Kīlauea Caldera (Stone and Pratt 1994:167).

The endemic Hawaiian Goose, or *nēnē* (*Branta sandvicensis*) can be found breeding in the desert area. The young hatchlings do not survive well in this environment because the grasses are not sufficient to feed on. Adjacent ranch lands, however, provide fertile feeding grounds for young *nēnē* (Stone and Pratt 1994:167).

Development of Soils within Kapāpala

The *ahupua'a* of Kapāpala encompasses approximately 99,586 hectares (384 square miles). It is one of the larger *ahupua'a* on the Island of Hawai'i. Kapāpala extends from the seashore to the upper slopes of Mauna Loa (Figure 2). Thus, its residents had access to various resources including rich agricultural lands, as well as forest and marine products.

The distribution of resources within Kapāpala is not even, and this is largely due to geologic variability. The eastern section of Kapāpala (that which now lies entirely within the boundaries of HAVO) is influenced by recent lava flows originating from Kīlauea. Because of the relative youth of these flows the area has poorly formed soils. Soil development in most parts of the desert is minimal and shallow where it does exist. Practicing any kind of agriculture would be extremely challenging in this part of the island.

The western section of Kapāpala, which lies outside of the Park boundary, has been impacted by older Mauna Loa flows. One of the greatest differences between the sections that lie within and outside of the Park has been the influence of the pyroclastic formation called Pāhala Ash west of HAVO's boundary. Pāhala Ash is found in many parts of the Island (Macdonald et al. 1986:49). These deposits probably originated from several different sources. The Pāhala Ash found in Kapāpala, near the town of Pāhala is nearly 15 meters deep. The source for this material is almost certainly from Kīlauea (Macdonald et al. 1986:352).

Because of the extent and depth of the Pāhala Ash, it is possible to engage in both agriculture and ranching activities in lands outside of HAVO. During the precontact period large agricultural fields were cultivated in this area of Kapāpala. Historically, ranching activities have thrived on the rich introduced grasslands. Although the Pāhala Ash almost certainly once extended across the eastern portion of Kapāpala, more recent Kīlauea lava flows would have covered any trace of it. Thus, it is against this active and ever-changing geological background that the cultural activities and events of the precontact and historic periods took place.

Chapter III

CULTURAL HISTORY OF THE PROJECT AREA

In this chapter, background information on the precontact and early historic use of Kapāpala *ahupua`a* is discussed. Journal entries from the first missionaries and explorers who traveled through the area are used to paint a picture of the late precontact to early historic period at Kīlauea. All of this information will be used in the subsequent analysis of site data and feature patterning in the Footprints area.

Early Land Division

The district boundaries of Hawai`i Island are believed to date back to circa A.D. 1475 when there were six districts, of which Ka`ū was one (Tomonari-Tuggle and Slocumb 2000:III -10). Kapāpala *ahupua`a* is one of four large land divisions within the District of Ka`ū. To its east is the *`ili`āina* of Keauhou. To its west is the *ahupua`a* of Kahuku. It is believed that Keauhou was once a subdivision of the larger *ahupua`a* of Kapāpala. Kapāpala, including Keauhou, included the caldera of Kīlauea (Byron 1826:184, footnote as cited in Tomonari-Tuggle and Slocumb 2000:III-10). Thus, the ancient division of Kapāpala (including the *`ili`āina* of Keauhou) was once much larger than it is today.

Why are some *ahupua`a* so large, and others not? It has been suggested that the size of *ahupua`a* is inversely related to the wealth of its resources (Tomonari-Tuggle and Slocumb 2000:III-10). Thus, small *ahupua`a* are generally located in resource rich areas, while larger *ahupua`a* encompass areas that are less abundant in resources. The land within Kapāpala (here including Keauhou) is within the active zones of Mauna Loa and Kīlauea. Thus, many of the soils are not well developed, and much of the land is rather arid. Overall, farming was

probably limited to dryland agriculture utilizing methods of production that were not dependent on deep soils.

There are at least two meanings for Kapāpala. Kapāpala could refer to the pāpala (*Charpentiera)* shrub (Pukui et al 1974:88 as cited in Tomonari-Tuggle and Slocumb 2000:III-10). Kapāpala was also a chief who challenged Pele, the volcano goddess (Westervelt 1963:33 as cited in Tomonari-Tuggle and Slocumb 2000:III-10). Kapāpala thought that he could "ride his surfboard on the waves of her lake of fire." Kapāpala angered Pele by this action. As punishment, she sent waves of fire throwing him off his surfboard and into a lava lake (Westervelt 1963:33 as cited in Tomonari-Tuggle and Slocumb 2000:III-10).

Early Western Contact

Little is known about the use of Kapāpala *ahupua`a* in the precontact period. Early ethnohistoric sources provide some glimpse, however, into the resources available to the residents of this area. The first Europeans recorded to have traveled through Kapāpala were a group of explorers who arrived with Captain George Vancouver in 1794 on the ship *Discovery*. While moored off of Hawai`i Island, Archibald Menzies (Naturalist on board the *Discovery*) ascended Hualālai and then Mauna Loa to the crater Moku`āweoweo.

Descriptions of Mauna Loa and the adjacent lands including the *ahupua`a* of Kapāpala are provided in Menzies' (1920) journal. These descriptions appear 26 years before the arrival of the first missionaries to Hawai`i Island.

Archibald Menzies (Menzies 1920).

Menzies did not travel through the area that is now part of HAVO as Ellis did 29 years later. Therefore he did not experience the Ka`ū Desert. He did, however, briefly mention the western portion of Kapāpala which he described as a "fine plantation" (Menzies 1920:187). From Kapāpala Menzies' group ascended Mauna Loa on the southeast side of the mountain. On their ascent they passed through "groves of trees and clear spots." They walked through "a narrow rugged path without meeting any more cultivated ground after (they) quitted the plantation of Kapāpala" (Menzies 1920:188). Menzies (1920:188-189) describes Kīlauea Volcano, off to their east, from which spewed "smoke and ashes… the air very thick, which at times proved very tormenting to our eyes."

Although Menzies' description is brief, it is intriguing. Was he witnessing the effects of another ongoing ash eruption at Kīlauea? Or, was the smoke

and ash that bothered their eyes remnants from the 1790 eruption being blown around by the winds? Finch (1947:2) suggests that Menzies "merely encountered a dust cloud from the Ka`ū Desert." This cloud must have been quite significant for Menzies to mention it in his journal. We may never know what Menzies was witnessing and will continue to speculate.

William Ellis – Missionary and Explorer

The next written account of Kīlauea does not appear until nearly twenty-nine years after Menzies' visit, when the Reverend William Ellis and his missionary companions walked through the districts of Ka`ū and Puna. Ellis (1963) gives detailed accounts of the geology, fauna, flora, and cultural history of the Kapāpala area in the journal he kept. He is also the first to write about the 1790 explosion and the death of the warrior party of Keōua. Because Ellis' journal is one of the earliest and most thorough written accounts of the Kapāpala area, this report draws heavily from his work.

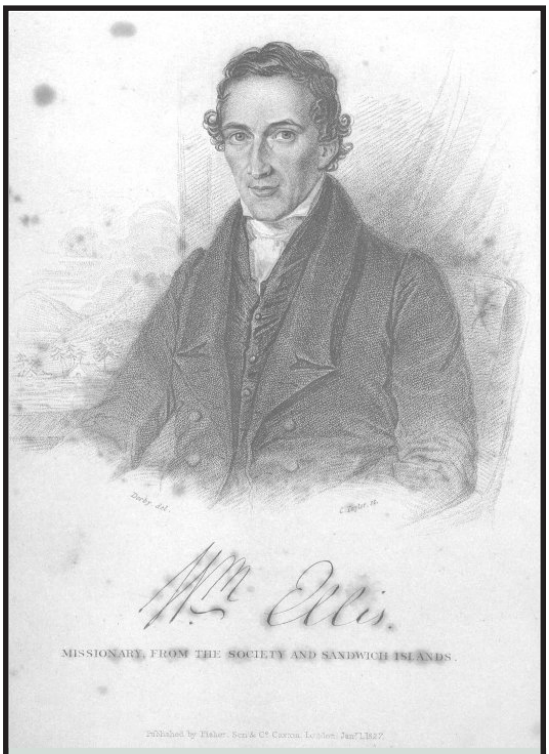


Photo of William Ellis (Fitzpatrick 1986).

William Ellis was a missionary with the London Mission Society. The London Mission Society established missions throughout much of the South Pacific in efforts to "Christianize" the native people. The Society first began its missionary work in the South Pacific in 1796, when they established mission settlements in the Marquesas, the Friendly Isles (Tonga) and the Society Islands (which includes Tahiti) (Ellis 1963:iii). In 1822 a group from the London home office visited its missions in the Society Islands. Rev. Ellis had been living and working as a missionary on the island of Huahine in the Society Islands for six years. Because of his years of experience working with Pacific Islanders Ellis was an asset to the Society in their efforts to establish new settlements. The group persuaded Ellis to leave the Society Islands and go to Hawai`i, where they hoped to extend their work and observations.

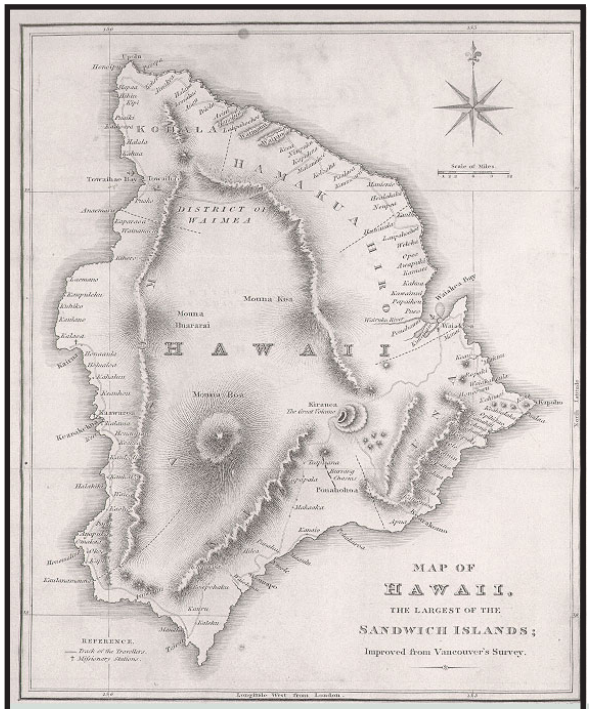
In 1822 Ellis, accompanied by two representatives from the London Society, and two Tahitian chiefs and their wives, arrived in Hawai`i. Ellis' visit to Hawai`i was projected to last only a few weeks (Ellis 1963:iii). The group remained in Hawai`i (on the island of O`ahu) for four months - much longer then first proposed. They found that living in Hawai`i was quite comfortable. They were able to learn and speak the Hawaiian language fairly easily because of their knowledge of Tahitian. The Hawaiians who

worked with the Missionaries were impressed with the group, especially their mastery of the language, and invited them to stay permanently (Ellis 1963:vi). Missionaries were not new to Hawai`i. By the time Ellis arrived in Hawai`i the American Board of Foreign Missions had already established permanent stations on the islands of O`ahu and Kaua`i (Ellis 1963:iv).

Rev. Ellis returned to Huahine at the end of 1822. He packed his family and arrived back in Hawai`i in February 1823 (Ellis 1963:vi). In April of that same year, Ellis and his group received funds to expand their operations beyond O`ahu and throughout the Hawaiian Islands. Before any mission stations could be established, however, the locations for the buildings had to be chosen. Thus, two missionaries were sent to Maui and a group of four missionaries (Ellis, Asa Thurston, Charles Stewart, and Artemas Bishop) and a preacher (Joseph Goodrich) were dispatched to survey all of Hawai`i Island (Ellis 1963:vi). The Island of Hawai`i was chosen for complete survey because the Society wished to establish permanent missionary settlements on what was the "largest, most important and populous island of the group" (Ellis 1963:24).

On July 14, 1823 Ellis reached Kailua, Kona. The next day he met his group and they began their tour around the island. The entire journey took two months, during which they visited many areas across Hawai`i Island (Ellis 1963). In Ellis' (1963:24) words they:

> *"ascended its lofty and majestic mountains, entered its dark caverns, crossed its deep ravines, and traversed its immense fields of rugged lava... stood with wonder on the edge of its ancient craters, walked tremblingly along the brink of its smoking chasms, gazed with admiration on its raging fires, and witnessed, with no ordinary feelings of awe, the varied and sublime phenomena of volcanic action, in all its imposing magnificence and terrific grandeur."*



Map drawn by William Ellis (Fitzpatrick 1986).

Resources in Kapāpala

While on his trip, Ellis recorded in his journal the many features he encountered. It is no surprise that Ellis, in his description of his travels, devoted much attention to the area now located within HAVO. The land must have been both foreign and exciting to view. His first encounter with Kīlauea, its craters, and inhabitants came as the group journeyed south from Kailua through the district of Ka`ū and the *ahupua`a* of Kapāpala.

Flora

Ellis arrived in Kapāpala in the later half of July 1823. His first view of the *ahupua`a* was of the lush western side. As Ellis passed through the *ahupua`a* of Ka`ala`ala into Kapāpala, he noted sweet potato or *`uala* (*Ipomea batatas*), sugar cane (*Saccharum officianrum*), and *kalo* (*Colocasia esculenta*) growing in extensive agricultural field systems. These field systems stretched for some distance through the upper portion of Ka`ala`ala, into Kapāpala. Ellis (1963:148) described these fields as "large" and growing "very luxuriantly." As he walked through the area he noted the "continued succession of plantations, in a high state of cultivation" (Ellis 1963:148).

In addition to food crops, Ellis (1963:149) also observed *māmaki* (*Pipturus spp.*) growing in Kapāpala. Parts of the *māmaki* plant can be used for making cloth, medicine and tea. The bark of the *māmaki* plant is an important source of fiber for making *kapa*, especially on the Island of Hawai`i (Stone and Pratt 1994:251). Once the fibers from the stems and branches are stripped, they can be pounded into a strong, dull-colored, unwashable cloth. It is not known how widely *māmaki* was used to make *kapa.* However, at one point, it was a suitable material for the chiefly class. Don Francisco de Paula Marin (a Spanish adventurer) presented to Kamehameha twenty pieces of *māmaki kapa* in 1814, and in 1822 he accepted forty pieces from Liholiho, the son of Kamehameha (Abbott 1992:50).

The berries and leaves of the *māmaki* plant have medicinal value. The leaves can be collected, dried, and made into a tea when feeling "run-down" (Abbott 1992:102). The berries from the *māmaki* plant are tasteless but can be used to treat mouth infections in children and to dress wounds (Stone and Pratt 1994:251).

There is little doubt that the ancient division of Kapāpala included upland *koa* (*Acacia koa*) groves. In 1825 the botanist Macrae (1922:75) described "sheds used by the natives when cutting trees for canoes" on the north rim of Kīlauea crater near the steam vents. William P. Alexander (1934:129) a Missionary traveling to Kīlauea from the north in 1833 recorded "passing many large trunks of the *koa*, partly hewn into canoes, beside which were erected little huts, the temporary abode of the carpenters" (as cited in Tomonari-Tuggle and Slocumb 2000:III-18).

Fauna

Prior to European contact, the area above the mid-elevation region of Kapāpala was forested. In these upland forests above the Ka`ū Desert hunters could once find native birds whose feathers were used for colorful feathered cloaks. Today many native forest birds are either extinct or extirpated. In the upland region of Kapāpala today, only *`elepaio* (*Chasiempis sandwichensis*), *`i`iwi* (*Vestiaria coccinea*), and *`amakihi* (*Hemignathus virens*) survive. On the slopes of Mauna Loa Hawaiian bird catchers once hunted the Dark-rumped petrel, or *`ua`u*, (*Pterodroma phaeopygia*) and other seabird taxa (Moniz Nakamura 1999). Today, scientists

studying these taxa rarely encounter them. The decline of Hawaiian avifauna is primarily due to introduced disease, alien predators, and exploitation in the precontact and historic periods.

Although the eastern section of Kapāpala (which now lies within the HAVO boundaries) had fewer resources, testimony found in the Boundary Commission strongly suggests that n*ēnē* and *ʻuaʻu* may have nested there as well. The Hawaiian Government established the Board of Commissioners To Quite Land Titles in 1845. This board, commonly known as the Land Commission was set up to investigate, ascertain or reject "all claims of private individuals, whether natives or foreigners, to any landed property acquired anterior to the passage of (the act)" (Chinen 1958:8). Through the commission's work traditional land and resource divisions were identified in the Islands. The Boundary Commission reports (ca. 1865 – 1915) and the land claims provide a wealth of information on resources available in an *ahupuaʻa*.

Bird hunters spent most of their lives in the forests and other areas within an *ahupuaʻa*. Thus, they were the most familiar with the political boundaries and economic resources of the land and often testified before the Commission. Kenoi, a native informant for the Commission, claimed that the boundaries of the areas within and adjacent to Kapāpala were pointed out to him because "in olden times… it was kapu to catch birds on any land but the one you lived on, and if you did so the birds were taken away from you" (Boundary Commission 1873b).

The Boundary Commission testimonies suggest Native Hawaiians who lived in Kaʻū had a unique method for dividing up the *nēnē* and *ʻuaʻu* in Kapāpala. All of the n*ēnē* and ʻu*aʻu* found in Kapāpala were for the sole use of the people who lived in the *ahupuaʻa* of Kaʻālaʻāla. The people of Kapāpala controlled the forest birds that were prized for their feathers. Two testimonials recorded by the Boundary Commission give some explanation for the division of the avifauna:

> *"The geese and uwau on the mountain all belonged to Kahuku and from the aa to Hamakua they all belong to Kaalaala. The oo and mamo all belonged to Kapapala.*
>
> *The land belonged to Kapapala but the geese and uwau all belonged to Kaalaala.*
>
> *I heard that when Nuunu and Kakohi, kaikaina (younger brother) of Liloa (then king of Hawaii) he mau kahuna (several kahuna) were taken on a canoe and carried to Na Elemakule (at the boundary of Kʻaʻālʻaʻāla and Kapāpala) and set up there… They lived where Aua lives at Moeala. Kaunui was their kahu (caretaker), and as he was sick the Kau people carried them over the foot of the mountain into Hamakua (through Kāohe ahupuaʻa), the uwau and geese were their meat, and so the birds became the property of Kaalaala" (Boundary Commission 1873b, Kenoi, BC Book A:439).*
>
> *He (Keaweehu, the one who guided Wilkes to the summit of Mauna Loa in 1842) said the kaikunāne (brother) lived on Kaalaala and*

kaikuahine (sister) lived on Kapapala, and gave her brother right of way across Kapapala to Keawewai and Hamakua, for bird catchers to go and catch uwau and geese on Kaalaala (should be Kapapala) (Wahine, BC Book A:153-154).

Other fauna that could be found in Kapāpala in the precontract period included dogs and pigs. Ellis noted that many of the women in Kapāpala kept dogs as pets. During his stay in Kapāpala, he also met two sisters who kept a curly-tailed pig as a pet. It was the first time Ellis saw a pet pig. Apparently the pig was treated as part of the family, because it even "joined the social circle around the evening hearth" (Ellis 1963:149).

Eyewitness to an Eruption

Ellis first entered what is now park lands some time around July 31, 1823, his third day of travel through Kapāpala. On this day Ellis and two other men from the group investigated columns of smoke seen in the area the day before. They traveled for nearly five miles "over a country fertile and generally cultivated" to a place called "Ponahohoa" (ie. Ponohohoa) (Figure 4). When they reached their destination, they must have been amazed to see the numerous fissures and chasms that had smoke rising from them. The chasms ranged from very small cracks (two inches wide) to large gaps (six feet wide) (Ellis 1963:150).

As the group got closer to the area Ellis noted "a valley, or hollow, about half a mile across, formed by the sinking of the whole surface of ancient lava, to a depth of fifty feet below its original level" (Ellis 1963:150). They descended into the bottom of the valley and noted that "the ground sounded hollow and... towards the centre it was so hot that (we) could not stand more than a minute in the same place" (Ellis 1963:150). Ellis and his party were witnessing the very end of an eruptive event that flowed from what is now known as the Great Crack (Figure 4).

"The Burning Chasms of Ponohohoa." Note the steam rising from an active vent of the 1823 eruption. Bishop Museum image.

Ellis' description of the landscape surrounding Ponohohoa and the Great Crack is interesting. His notes suggest the residents of Kapāpala, and perhaps other nearby *ahupua'a,* made use of even the barren lava to plant their crops by altering the landscape. Ellis (1963:153) describes the lava as "decomposed, frequently a foot in depth, and… mingled with a prolific soil, (that is) fertile in vegetation, and profitable to its proprietors." The description of the surface flow suggests Hawaiians may have been breaking apart the flow and using it as a kind of mulching agent in conjunction with either local or introduced soil. Ellis' description of the soil as "prolific" and the vegetation as "fertile" strongly suggests they were successful in their attempts to cultivate in the area. Unfortunately, Ellis (1963) does not say what kinds of plants they were growing. However, archeological evidence from similar areas across Hawai'i Island suggests sweet potato and gourds were likely grown in these features (e.g. Barrera 1971, Carter 1986, and Ladefoged et. al.1987).

Ellis did not have much hope that this venture in cultivation would continue for long. He believed, from witnessing the volcanic activity in the Ponohohoa area, that it was only the beginning of a longer eruptive event. Ellis predicted the volcano would return to "action after so long a repose… (its) irresistible energies will, probably, at no very remote period, spread desolation over a district now smiling in verdure" (Ellis 1963:153).

Ellis (1963) was partially right in his prediction. Although the eruption he described was ending, almost a century later in 1919 a lava flow covered the area northeast of the 1823 flow (Figure 4). This flow cut across a portion of the Ka'ū Desert likely destroying Footprint features as well as other archeological remains.

The Route to Kīlauea - Following Known Trails

As Ellis and his group left Ponohohoa a small party of Hawaiians from the nearby *ahupua'a* of Kealakomo joined them. The group was returning home to Kealakomo and happened to pass through the house Ellis and the others were staying at. The Kealakomo residents said they would be happy to guide Ellis and his group on to Kīlauea.

There is little doubt that throughout much of Ellis' journey he followed known trail systems developed generations before his time by Native Hawaiians. His reliance on native guides strongly suggests he found his guides useful not only for preventing his party from getting lost, but also for finding the most reasonable and familiar routes.

Ellis (1963:155) mentions several notable features on his journey from Ponohohoa to Kīlauea. His party passed by a habitation cave in Kapuahi and later stayed in a large cave about three or four miles away at Keapuana. On August 1, 1823 the party traveled for several miles through "a most fertile tract of country, covered with bushes, or tall grass and fern, frequently from three to five feet high" (Ellis 1963:157). They also passed by more chasms, some of which were too large to cross over. Their guides, however, were familiar with the area and searched until they found an existing path that led them around the cracks (Ellis 1963:157). Near the chasm, Ellis (1963:158) noted a cavern that had calabashes to collect water from

drips in the interior. It was a common practice for Hawaiians to use lava tubes or caves along transport routes to collect drinking water. They would place calabashes (natural or shaped containers) below natural drips in the caves and the water would collect in the container. Water could either be consumed on the spot or transferred to gourds for use during travel.

Most interesting to the current project are Ellis' (1963) notes concerning sand and glassy volcanic flows. Ellis (1963:158-159) complained about the sand dunes in his journal. It was hard for him to walk through the dunes because he would sink ankle deep into the sand. Ellis also found the Kaʻū Desert to be quite windy. Thus, when the wind kicked up, sand blew into his eyes making it both painful and frustrating to hike (Ellis 1963).

Pockets of sand and dunes can still be found throughout the Footprints area, strongly suggesting Ellis and his group walked either very close to, or across the current project area. Although Ellis does not mention either the footprints or ash layers, it does not mean they were not there. In 1823, when Ellis was crossing the area, the sand may have been much more widespread and deeper then it is today and the footprints may not have been visible.

Ellis (1963) also complained about walking on the smooth *pāhoehoe* lava flows. He wrote that the "obsidian" surface was "almost as slippery as glass" (Ellis 1963:158-159). Although he makes no further observations regarding this material, ethnographic and archeological evidence indicate that these flows were a good source of lithic material from which flakes, knives, and other cutting tools were made. It is likely that the trails used by Ellis and his guides were developed, in part, because it was a rich source for raw lithic material.

Although Ellis was one of the first Europeans to record his experiences at Kīlauea he was not the last. In the decades after his tour, other European and American visitors recorded adventures of their trips to Kīlauea in journals, letters, newspaper articles, and logs. Ellis' (1963) journal, however, is one of the most thorough accounts of early historic Hawaiian activity in Kapāpala.

Popularity of the Volcano and Early Visitors

Between 1823 and 1850 historic records from Hawaiʻi are filled with references to Kīlauea written by missionaries, scientists, and American sailors who visited the volcano. These visitors were primarily interested in one of two things: 1) bringing Christianity to the Hawaiians living in the area; or 2) satisfying a curiosity and interest in volcanology and natural history. Other visitors during this period included royalty (Chiefess Kapiolani), as well as locals (Olson 1941). Table 1 includes a non-exhaustive list of some of these early travelers who visited Kīlauea in the 19th century.

The visitors who traveled through Kapāpala and Kīlauea in the following years left behind a record of the land, its people, and volcanoes. Many wrote about the lava flows and craters. They often described the hot steam baths they enjoyed. The

Table 1. List of European and Royal Visitors to Kīlauea, 1823 - 1865.

Name of Visitor	Date of Visit	Occupation	Purpose for Visit	Lodging	Reference
William Ellis	1823	Missionary	Mission Establishment	Grass Hut	Ellis 1963
Elisha Loomis	1824	Missionary Printer	Exploration	Grass Hut	Olson 1941
Chiefess Kapiolani	1824	Royalty	Religious/Cultural	Kapiolani's Hut	Olson 1941
Capt. Byron (+ "Large" Party)	1825	Ships Captain	Scientific (1st map of Kīlauea)	Kapiolani's Hut	Olson 1941
Charles Stewart (+ 10 officers & 23 natives)	1829	Ships Captain USS Vincennes	Exploration	Grass Hut	Olson 1941
David Douglass (+ 10 natives, guides & packers)	1834	Botanist	Scientific	Grass Hut	Olson 1941
Capts. Chase and Parker	1838	Ships Captain	Exploration	Grass Hut	Olson 1941
Mr. Rees	1839	Assistant Surgeon, R.N. HMS Sparrowhawk	Exploration	Grass Hut	Olson 1941
James Jarvis & J.P. Couthoy	1840	Historian and Conchologist	Exploration	Grass Hut	Olson 1941
Charles Wilkes (+300 natives)	1840 - 1841	Ships Captain	Scientific	Pitched Tent	Olson 1941
Henry Lyman	1844 -1845	Local Born Doctor	Vacation	Grass Hut	Olson 1941
Cochran Forbes	1844	Missionary	Exploration	"House" Erected for Travellers	Olson 1941
Chester S. Lyman	1846	Professor, Yale University	Scientific (mapped Kīlauea)	Three Houses at Location of Later Volcano House	Olson 1941
Henry Lyman	1848	Local Born Doctor	Vacation	"Comfortable" Native House	Olson 1941
Samuel F. DuPont	1848	Captain US Sloop Cyan	Visitor	"Comfortable" Native House	Olson 1941
Lieutenants (2) & Midshipmen	1848	Shipmates of DuPont	Visitors	"Comfortable" Native House	Olson 1941
Mr. Coan	1848	Missionary	Guide	"Comfortable" Native House	Olson 1941
Henry T. Cheever	1850	Minister	Visitor	Grass Hut	Olson 1941
Mr. Goodale	1856		Visitor	Volcano House	Olson 1941
D. (David) Hitchcock	1857		Visitor	Volcano House	Olson 1941
Lucy Wetmore	1860	Missionary Wife	Visitor	Volcano House	Olson 1941
Rufus Anderson	1863	Missionary	Visitor	Volcano House	Olson 1941
William Brigham	1865		Scientific (survey of Kīlauea)	Volcano House	Olson 1941

steam was a by-product of the natural heat produced from the underground lava rising through cracks in the earth's surface.

A distinct change in the kind of visitor to Kīlauea is noted in the late 1840s. Prior to 1845 people visited the area primarily for scientific or exploration purposes. After 1845, a sharp increase in casual and pleasure visits rise. The rise in exploration and travel for visitors to Hawai`i, particularly those from the United States, coincides with a period of reconnaissance and expansion in America between 1835 and 1850. A transportation revolution was occurring in the US with the building of canals, railroads and better wagon trails. It was also a time when the US Government had charged the Army to explore the west and gather information on natural resources. Thus Hawai`i, and in particular Kīlauea, was a curiosity and natural draw to Americans during this period.

Over time, new trails and roads were built, lodging areas were established, scientific interest in studying the volcanoes grew, and tourism increased. All of these changes have helped shape the makeup of the Ka`ū Desert and has altered the use of the land in Kapāpala.

The Volcano House

Volcano House ca. 1861. Photo courtesty of National Park Service, Hawai`i Volcanoes National Park.

While visiting Kīlauea, travelers would stay in lodging on or near the edge of the crater. In the early historic period accommodations were very sparse; temporary shelters, consisting of grass huts or shacks were the normal fare. The earliest of these structures were constructed of "a few green branches of trees, some fern leaves, and rushes" (Ellis 1963). E. Loomis described the hut he stayed at in 1924 as "small… on the northeast end of the crater" (Olson 1941). The hut was "open on the side towards the crater; and not more than 15 feet from the brink" (Olson 1941:14).

These habitation sites were commonly constructed and used by Native Hawaiians traveling through the area or by *kahuna* (Hawaiian priests) of Pele (Olson 1941:12).

When Euro-American visitors arrived at the crater, they could sometimes find existing shelter that required only a little fixing to be usable.

By 1844 more "permanent" lodging aimed at the growing number of visitors to the area began to appear. In 1846, a somewhat reliable accommodation was finally available. Located on the northwest side of the crater, this structure was built by Benjamin Pitman, a Hilo resident. Described as a "larger better grass house" (Olson 1941:23 citing Whitney 1891), Pitman named his lodging the Volcano House. The Volcano House was open to all visitors passing through the area. Apparently, word about this new lodging spread throughout the local community, and at times the house was filled with visitors (Olson 1941:27).

Gaining access to the new guesthouse was not always easy. Because the Volcano House lacked a permanent host, at times visitors intending to use the facility found the doors locked, and they were unable to get in. This inconvenience increased the desire by a growing visitor community for a more permanent facility, able to house a larger number of guests (Hitchcock 1911). The need was soon answered in 1866 when J.C. Richardson and Company built the Volcano House Hotel. Visitors to the crater now had a place to stay that was comfortable, convenient and reliable.

The Growth of Infrastructure – Roads and Trails

With the establishment of the Volcano House Hotel, visitors were formally welcomed to the crater and the floodgates to Kīlauea were flung open. By 1866 other business ventures were also growing, and the infrastructure to accommodate tourists, businessmen and scientists developed as well.

The very earliest visitors such as Ellis and Lord Byron reached Kīlauea on foot. They were usually led by Native Hawaiian guides who had extensive knowledge of the various trail systems in this part of the island. To reach the crater, visitors primarily arrived either from the east (Hilo) or the west (Ka`ū) along the Ka`ū-Volcano trail (Site 22982).

In the early 19th century Hawaiian guides were usually hired to carry the food and clothes of the visitors. At times, they were even hired to carry the people themselves in *mānele* (litters) (Olson 1941:52). Even with all this help, it took nearly two days of brisk walking to cover the 30 miles from Hilo (Olson 1941:52). Over time, as horses became more available, they became the favored mode of travel. This cut the time, but not the discomfort for some travelers.

With the growth of tourism throughout the 19th century more reliable transportation systems were established. By 1894 a new road between Hilo and Volcano was completed which could be utilized by horse drawn stages (Jackson 1972:114). By 1901, a railroad was built to service the area between Hilo and Glenwood (Jackson 1972:114). Today, visitors arriving at Kīlauea from Hilo and Ka`ū can drive to the caldera in less than an hour.

The Peter Lee Road

While many of the improvements to the roads were occurring on the Hilo side of Kīlauea, the Ka`ū side was not ignored, especially by those who had investment interests in the area. In Ka`ū, roads and trails serviced the residents and visitors traveling primarily from the Kona area and other villages along the way. One particular village, which was popular with visitors to the Island of Hawai`i was Punalu`u, a village on the southeast coast. Peter Lee, a local businessman, built a hotel at Punalu`u and many of his guests would travel between his hotel and the Volcano House Hotel which he also helped manage.

Peter Lee was an active entrepreneur in the Volcano area. Born in Norway, he left home at the age of 12, became a cabin boy on a ship, and eventually found his way to Hawai`i (Evans 1923:14). He finally settled down on Hawai`i Island, where he met and married a Hawaiian woman. He made one of his homes in the Volcano area, and got involved in the management of the Volcano House Hotel. He later built the Crater House, and managed the Punalu`u Hotel (Olson 1941). An astute businessman, Lee realized the importance of convenient transportation for his hotel guests. Thus, he was active in building and improving roads, especially those that provided service between Punalu`u and Volcano.

Peter Lee built the first road from Pāhala to the Volcano House. Known as the "Peter Lee Road" (Site 22997) it was completed in 1891 (Olson 1941:46). Nearly 24 miles long, the road was built under Lee's direct supervision (Figure 5). The Peter Lee road was first built to accommodate carriages and later modified for motorized vehicles. This road cuts through the northern part of the project area and was likely responsible for stimulating many of the changes to the area that occurred after its construction. A 1921 USGS map shows a junction in the Peter Lee Road at the 3,363 foot elevation. The north spur of the road leads to a watershed and tanks at Kawikohoni. The maps suggests this spur ends near the Mauna Loa Trail (Figure 5).

Remains of a rusted Ford located on the Peter Lee Road. Photo courtesy of National Park Service, Hawa`i Volcanoes National Park.

By 1927 the Peter Lee Road was replaced by the Ka`ū Road (Site 23034). The Ka`ū Road was funded by the Territory of Hawai`i and built by prisoners. The prisoners were housed at a camp that was located where the current Namakani Paio Camp ground is today. The Ka`ū Road paralleled much of the route of the Peter Lee Road over the Ke`āmoku flow. Near the eastern edge of the Ke`āmoku flow at the 3,564 foot elevation the routes nearly overlap. Today, although the general route of the Ka`ū Road still exists, the surface has been updated and today it is called the Māmalahoa Highway or Highway 11 (Olson 1941:46) (Figure 5).

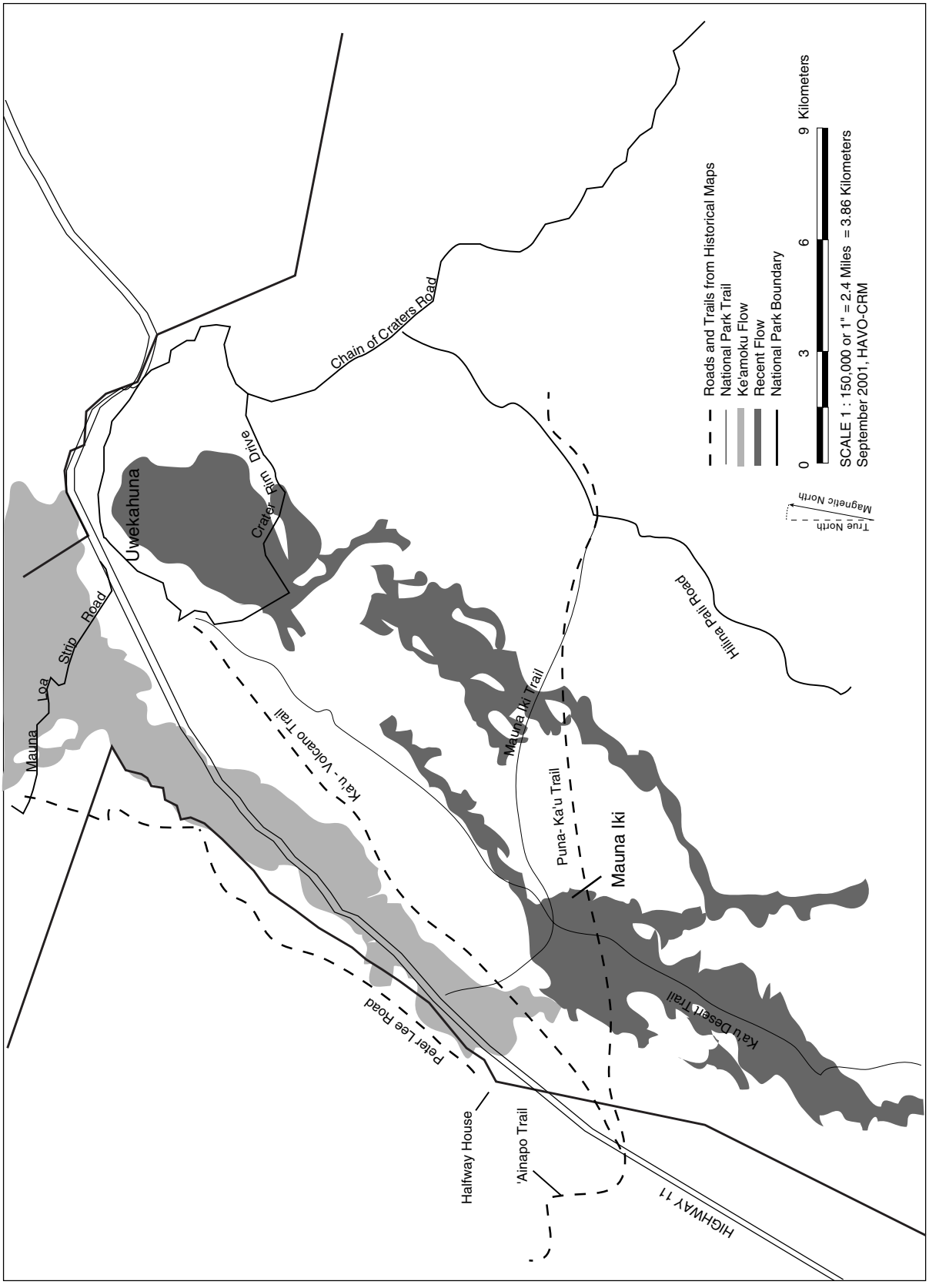


Figure 5. Precontact and early historic roads and trails.

The Ka`ū Half-Way House

Despite the advances in transportation, during the 19th century the journey from Hilo and Pāhala to Volcano was quite long. To make life more comfortable for the traveler, local entrepreneurs built Half-Way Houses. As the name implies, the houses were built essentially "halfway" between the two towns and the Volcano (Olson 1941). The Ka`ū Halfway House was located approximately 13 miles from Kīlauea and was operated in 1886 by J.M. Lee, the brother of Peter Lee (Olson 1941:80) (Figure 5). At the Ka`ū Halfway House visitors could eat lunch, get new horses and mules, or rest overnight. Unlike the Puna Half-Way House which was a grass thatch structure on the Hilo side, the Ka`ū Half-Way House was built of lumber (Olson 1941:80).

By 1895, the Lee brothers no longer ran the Ka`ū Halfway House; it became part of the Kapāpala Ranch (its apparent headquarters). A hermit, Mr. W. Dolloway ran the establishment for the ranch. Not a very friendly man, he loved to tell wild stories and would fix travelers a simple meal from a "makeshift menu" (Olson 1941:81).

Thus, in less than 70 years, the influx of EuroAmerican visitors to Kīlauea transformed the area forever. Once word about this magical area got out the floodgates were flung open and could not be closed. People wanted to see one of the greatest wonders of the world. To accommodate the large numbers of people who were visiting the area, transportation routes and housing was established and improved tremendously over the years. Today, visitors reach Kīlauea primarily by automobile or bus and stay in comfortable hotels, bed and breakfasts and other lodging.

Chapter IV

LAND TENURE - CHANGE COMES TO KAPĀPALA

From the moment Captain Cook returned to Europe from his first voyage to Hawai`i, the islands and her people were no longer isolated from the rest of the world. The mid-19th century saw an explosion of interest in the Hawaiian Islands from foreigners. Traditional cultural, political, economic, and religious principles in Hawai`i were forced to evolve at an even faster pace. The activities occurring in Hawai`i and around the Kīlauea area did not develop in a vacuum; they were influenced by outside forces and events. Outside interest in the project area, in particular the area around Kīlauea Caldera exploded in the mid-19th century and early 20th century.

Construction of more convenient, reliable roadways and other infrastructure fed growing business activities in the Kīlauea area. The rise of big business coincided with a time of political change in the Islands especially in the area of land tenure. The changes occurring in the Kapāpala area reflected these political times. In 1848 the traditional Hawaiian system of shared use gave way to the foreign concept of land ownership. By the mid-19th century foreigners began to claim a larger stake in the future of Hawai`i. In 1893, the overthrow of the Hawaiian monarchy further influenced rapid change in land ownership. This chapter focuses on changes in land tenure in the Kapāpala region. Specifically, this chapter covers the precontact and early historic use of land in the Kapāpala region, the impact of the 1848 *mahele* and 1893 overthrow on land tenure, the rise of business activities in Kapāpala, and the acquisition of portions of Kapāpala by the National Park Service.

Hawaiian Land Use

Prior to European contact, land in Hawai`i was divided amongst the numerous Island chiefs, their warriors, and tenant-commoners. As in most hierarchical societies, land tenure was controlled by those at the top of the power structure and apportioned accordingly. Those who possessed lands had certain rights in what could be gathered from the land and sea as well as what was cultivated (Chinen 1958:5). Land could be taken away at the pleasure of the chief. However, this was not considered a just thing for a ruler to do and therefore rarely occurred (Chinen 1958:5). Chiefly land holdings varied with power shifts. These changes rippled down to the commoners but likely affected the lowest levels less than the upper hierarchy. When Kamehameha I ascended to power in the beginning of the late 18th century into the 19th century he kept the same system, but redistributed land amongst his chiefs as he saw fit (Chinen 1958:6).

Kauikeaouli, c. 1853 (Kamakau 1992).

The native system of land tenure remained basically intact after the death of Kamehameha I and through the assent of his sons Liholiho (Kamehameha II) and later Kauikeaouli (Kamehameha III) in 1824 (Chinen 1958). Kauikeaouli faced many difficulties during his reign and primarily was forced to address the wants and needs of various outside forces who were moving to the islands. Within a period of forty-six years from when Europeans first landed in Hawai`i to the ascent of Kamehameha III, a significant foreign population had settled in the islands. This group included sailors, traders, merchants, and missionaries. Although the newcomers were a disparate group they had one thing in common – the desire to posses lands in fee simple. They continually "challenged the right of the king and the chiefs to dispossess them (of their lands) at will" (Chinen 1958:7).

The *Mahele*

With such a growing, and increasingly politically strong outside force, change in land tenure was forced on the ruling king. The first sign of change came in 1839 when Kauikeaouli enacted the Bill of Rights of 1839 (Chinen 1953:7). This bill was quickly followed in 1840 by the first constitution of the Hawaiian Kingdom, the creation of the Board of Commissions to Quiet Land Titles (Land Commission) in 1845, the *Mahele* of 1848, the Act of July 10, 1850, and the Act of August 5, 1850. Combined, these actions allowed the sale of lands in fee simple to resident aliens and authorized the award of *kuleana* *`aina* (owned land) to native tenants (Chinen 1953:12).

The *Mahele* called for the king to retain all of his private lands which were to become his own individual property. The remaining lands were to be divided equally between the Crown, the chiefs and *konohiki* (headman of an *ahupua`a* under the chief), and the tenants or commoners living on the land. Kamehameha III divided all of the lands he kept for himself into two separate, but unequal parts. When all was concluded, he kept one portion (the larger portion) of land as his personal property. This land became known as "Crown Lands." The rest of the lands he gave to the chiefs and commoners. These were known as "Government Lands" (Chinen 1953:26).

A bulk of the Government Lands that Kauikeauoli gave away came from Hawai`i Island. L. Kame`eleihiwa (1992:238) states that these lands were "the center of his father's birthright. It was as if having decided that government *`Āina* should be set aside for the *maka`āinana*... the gift should represent his father, Kamehameha, the *makua* of the *Lāhui*." One of the pieces that Kauikeauoli did not give away, however, was the *ahupua`a* of Kapāpala (Cahill 1996:128-129).

Sandalwood Trade

It is often speculated that chiefs kept the best lands for themselves; lands that were rich with natural resources. Although this theory remains to be tested, if it is accurate, one reason Kauikeauoli may have kept Kapāpala was because it contained an abundant supply of *`iliahi* or sandalwood (*Santalum species*). Sandalwood was discovered in Hawai`i between 1791 and 1794. An American, Captain Kendrick of the sloop *Lady Washington,* is credited with the discovery of the plant on Kaua`i (Kamakau 1992:204). Ship captains on the trade route to and from Manila (Philippines) and Macao (China) knew that the fragrant wood was a valued item of trade amongst the Chinese. American merchants were eager to profit from Hawai`i's sandalwood supply and encouraged the Kauikeauoli to harvest his supply.

Boundary Commission testimony (Vol. A, No. 1) given in 1873 confirms that Kapāpala was an important *ahupua`a* for collecting sandalwood. The Commission testimony states:

> *When the people used to go after sandalwood the Alii of Kapapala Naihe and Aikanaka took it for Kaahumanu. The Kaalaala people went after sandalwood for their chief but the people of other lands in Kau used to go after sandalwood on Kapapala and take to their chiefs. This was the last gathering of sandalwood for Kamehameha III to pay the debt."*

The Boundary Commission (1873c) for Kapāpala *ahupua`a* goes on to give specific boundary areas involved in sandalwood collection:

> *I went to Keaweehu to Keawewai after sandalwood, and he said it was on Keauhou. We went to Keahoaimakaoloa, then to Makapani a cave. He said part of it was Olaa and part Kau, Kapapala or Keauhou, then to Nahaleowai kauahale, thence to Punaluu a heiau, the sand at Punaluu came from this place. Thence to Kaamaumauloa aa makai of a hill, said hill being at Puuulaula. But*

the aa was covered by the flow of 1852. Keaweehu said that the sandalwood belonged to Kapapala.

The trade in sandalwood began in earnest when Kamehameha I ordered some of his people into the mountains of O`ahu to gather the wood. Discovering that he could use the wood to purchase European goods, the king soon began trading sandalwood for wool, silk, cotton, and other commodities (Kamakau 1992:204). Two years after harvesting began on O`ahu the people from the districts of Kona, Ka`ū, Hāmākua and Kohala began abandoning their fields and other duties to participate in the growing trade. Those who cut sandalwood were called *Kalā`au`ala* (The Fragrant Wood) and *Kekua`iliahi* (The Chopper of Sandalwood) (Desha 2000:464). *Kekua`iliahi* were paid for their labor in European cloth, *kapa* (bark cloth) material, food, and fish (Kamakau 1992:204).

At first the king controlled all of the sandalwood trade. However, after the death of Kamehameha I in 1819, the number of individuals able to profit from the trade expanded. At the investiture of Liholiho the first item discussed by the *Ali`i* (chief) council was the settling of the *Kālai`āina*, the right to sell and cut sandalwood and the monopoly held by the royal family on the trade (Kame`elehiwa 1992:73). Ka`ahumanu, one of the wives of Kamehameha I, already powerful in her own right, agreed with the other chiefs at the council that the sandalwood trade should be shared amongst the chiefs (Kame`elehiwa 1992:74). Thus, each *Ali`i Nui* (paramount chief) was now free to cut and trade as much sandalwood as they pleased from their land and keep all of the profits. The number of people involved in the sandalwood trade increased, and between 1810 and 1825 the trade peaked (Kamakau 1992:204).

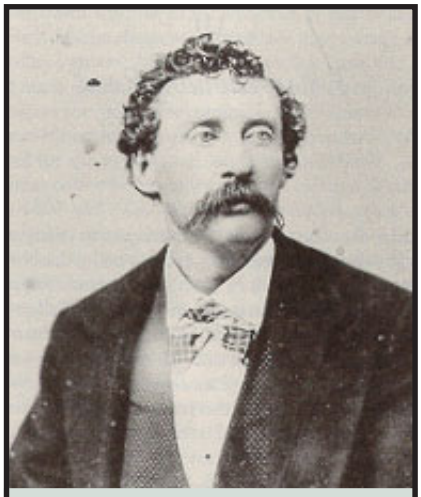
During these years the demand for sandalwood by foreign traders was great, and the demand for foreign goods by the chiefs was immense. Many chiefs were unable to maintain the supply of sandalwood and often bought items on credit. This commonly led to chiefs falling into debt. No matter how much sandalwood was cut, the debt was often never erased (Kame`eleihiwa 1992:88). Tension increased between foreigners and Hawaiians, with foreign ship captains often threatening military reprisal if merchants were not repaid (Kame`eleihiwa 1992:88-89). It was a bad situation for Hawaiians who were suddenly thrust into an economic situation they were not prepared for. In addition, the native forest was ravaged by the harvesting. The Kapāpala lands and its people likely suffered the same fate.

Foreign Influence and Investment

By 1829 the Sandalwood trade was over (Abbott 1992:132 citing Kuykendall 1938:92). Deforestation combined with an overextended credit line by the chiefly class contributed to the decline. In 1859 title to Kapāpala *ahupua`a* transferred to Kamehameha IV upon the death of Kauikeauoli. As the new head of the Hawaiian Monarchy, Kamehameha IV was forced to deal with the influence of foreigners. Other large-scale businesses, however, were springing up in place of the Sandalwood trade. One such venture was cattle ranching.

Ranching

Captain George Vancouver first introduced cattle to the islands in 1793, on his second trip to Hawai`i. Vancouver brought a bull and five cows (all Longhorns) as gifts to Kamehameha I (Cahill 1996:130). A few months later another bull, two cows and two bull calves were delivered to Kamehamea at Kealakekua Bay. The cattle were set free to roam the island. Because there were so few at the time, Kamehameha put a prohibition on killing them for a period of ten years (some say 30) at the suggestion of Vancouver (Cahill 1996:130).



W.H. Reed (Cahill 1996).

Within 67 years the cattle population exploded on the Island of Hawai`i. By 1860 it was estimated that there were over 20,000 head of cattle. Of these, 8,000 were considered domestic (Cahill 1996:130). At this time, Hilo was a growing and bustling town. The residents needed items like butter, cream, meat, wool, and hide. A working cattle and sheep ranch could provide these necessities. Thus, the time was ripe for two Hilo businessmen, W.H. Reed and Charles Richardson to join forces in a new business venture that would forever alter the landscape of the *ahupua`a* of Kapāpala.

Reed and Richardson realized that if they found enough land, they could start a ranch that could take advantage of the growing cattle population and provide items that would be bought by those living in town. The change occurring with Hawaiian land tenure was favorable for these men; it was now possible for foreigners to own and lease land from the Kingdom of Hawai`i. Both men took advantage of this opportunity and sought land in the District of Ka`ū. In 1860 Kamehameha IV leased the entire *ahupua`a* of Kapāpala to Reed and Richardson. The lease was to run for 30 years and the leasees were to pay $300 per year to the crown (Cahill 1996:129). The new business was called Kapāpala Ranch and the partnership formed by Reed and Richardson in 1859 lasted for 13 years.

The land area incorporated as part of the ranch was large. An undated article in the *Hawaiian Gazette* described Kapāpala Ranch as "including two extensive lands known as Kapapala and Keaiwa extending along the shore perhaps ten miles from Punaluu eastward, thence up towards the summit of Mauna Loa, embracing an area of 200,000 acres, more or less… There are no streams of water on the land though numerous springs abound and the pastures are always fresh and green from frequent showers" (Hawaiian Gazette as cited in Cahill 1996:129).

Although the project area did not provide fertile grazing land for the Kapāpala cattle, this land was nonetheless important to the ranch and it would play a role in later negotiations with the Territory of Hawai`i and the US Government during the development of Hawaii National Park.

Reed and Richardson ran the ranch together until 1873. That year, Reed bought out Richardson's share of the ranch and gave one third to his stepson Willie (W.H.) Shipman. Willie and Reed ran the ranch for another three years. In October 1876 Reed sold the ranch to Charles R. Bishop, a businessman and banker for $75,000 (Cahill 1996:141). Two months later, Bishop sold the entire lease to the Hawaiian Agriculture Company for $120,000 – a hefty profit!

Science

The introduction of cattle ranching to the Kapāpala area and adjacent lands brought about large-scale changes to the region. This was not the only activity occurring at the time, however, that would permanently alter the cultural and natural landscape. The influx of visitors who came to view the lava flows of Kīlauea would forever change the area.

From the 1860 through the early 1900's Kīlauea was very active (Macdonald et al. 1986:80). For the visitors who flocked to the crater, Kīlauea provided a spectacular show. For the scientist who desired to study present and past volcanic activity Kīlauea and Mauna Loa were unique. Halema`uma`u, the crater within Kīlauea Caldera, was like nowhere else in the world. Both visitors and scientists could safely and easily view the activity from its vent.

In a 1883-84 report by staff from the U.S. Geological Survey to the Secretary of the Interior, a paper was included on Hawaiian Volcanoes, the first of many volumes on the volcanoes of Hawai`i (see Dana 1890, Brigham 1891 and Hitchcock 1909 as cited in Jackson 1972:40). All of these reports called for a permanent staff in Hawai`i to study both Kīlauea and Mauna Loa.

On a visit around the world in 1909, Dr. Thomas A. Jaggar, a young volcanologist with the Massachusetts Institute of Technology (MIT) visited Kīlauea. During this visit he declared the area to be the best site in the world to study volcanoes. He was able to interest Lorrin Thurston, a missionary descendent and local businessman, and several others in establishing a five-year pilot study of Kīlauea and Mauna Loa. Utilizing a $25,000 donation from the Whitney Trust, Dr. E.S. Shepherd and Dr. F.A. Perret left for Hawai`i to begin their work on the pilot study. The tasks of Shepherd and Perret included weekly volcano reports that were published in Thurston's newspaper, *The Honolulu Advertiser* (Jackson 1972:41).

Back at MIT after his whirlwind tour, Jaggar's interest in Hawai`i continued to grow. While at MIT he worked to find additional funds to provide for continuous and permanent observation of the volcanoes of Hawai`i. In 1911 the Hawaiian Volcanoes Research Association (HVRA) was formed and negotiated with MIT to bring Jaggar to Hawai`i. Thus, with the monetary support of the Whitney Trust and the HVRA, Jaggar moved to Hawai`i on January 17, 1912 to establish an Observatory on the rim of Kīlauea crater. The new Observatory would eventually replace a hut that served as Dr. Perret's office and lab. The Observatory was constructed "below the road directly opposite the Volcano House" (Jackson 1972).

Jaggar spent 28 years of his career in Hawai`i. From 1912 to 1940 he was the director of the Hawaiian Volcano Observatory (HVO) which he worked to found. During his long stint as the director of HVO Jaggar was involved in numerous groundbreaking projects related to volcanology. He was instrumental in the establishment of Hawaii National Park as well as the discovery and description of many natural and cultural features in the area. Jaggar held his post as Director until he retired in 1940. As a research fellow at the University of Hawai`i, he continued his research until his death on January 17, 1953 (41 years to the day after he arrived at Kīlauea) (Jackson 1972:42).

Eruption of Mauna Iki and the Discovery of the Footprints

Between 1907 and 1924 Halema`uma`u was nearly continuously active (Macdonald et al. 1986:82). In 1919 lava drained out of Halema`uma`u into fissures in the southwest rift zone. An eruption, nine miles away from the Caldera, on that rift zone built Mauna Iki, a small shield volcano (Figure 4) (Macdonald et al. 1986:82). Although the eruption area was only three miles from the then Hilo-Kona road, to get to Mauna Iki to study the eruption, Jaggar's then assistant, Ruy H. Finch and his crew had to walk nearly twelve miles through the desert (Apple 1954:132). A shorter route was available, but if the crew chose to access this route they had to walk over the very rough Ke`āmoku *`a`ā* flow. While walking through this shorter route Finch and his crew discovered human footprints preserved in the hardened desert ash.

Deep footprint impression in hardened desert ash. Photo National Park Service, Hawai`i Volcanoes National Park.

Finch was the first person to record the existence of the prints (Apple 1954:132 citing personal communication with R. Finch July, 1954). The geologists immediately recognized that the prints were a unique resource. After they were discovered, a "crude trail was marked through the jagged Ke`āmoku flow, and many people visited the area" (Apple 1954:132-133). Soon, this portion of the Ka`ū Desert which was not part of Hawaii National Park, became known as "Footprints" or the "Footprints area" (Apple 1954:132).

Establishment of the National Park Service

By the 1870s there was a growing trend in America towards an increase in tourism to scenic and health-enhancing areas (Sellars 1997:16). Between 1872 (establishment of Yellowstone) and 1916, (establishment of the National Park Service) the priority

within the new federal parks was for the use and enjoyment of recreational tourism. Thus, across the continental United States, the creation of parks was undertaken to enhance the development of resorts near favored health spots or scenic areas. Hawai`i did not escape the influence of this national movement; the trend in Hawai`i, and specifically in the Volcano area, was to follow that of the United States.

In 1916, the United States Congress established the National Park Service. The Service was formed to "promote and regulate the use of the national parks… which purpose is to conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations" (NPS Organic Act, 16 U.S.C.1). Prior to the creation of the Service, several large tracts of land across the United States had already been set aside for special use and protection (Apple 1954:1; Sellars 1997:12). Yellowstone, for example, was established in 1872 as the nations first "national park," yet it was managed for 44 years before the agency which was to manage all national parks was even created. Yellowstone thus established a precedent for preserving large land areas for "non-consumptive use" where "unrestricted free enterprise and exploitation of natural resources (was) prohibited" (Sellars 1997:10).

Although Congress was slow to set aside more areas as national parks, by the turn of the century, Congress developed three large parks (Sequoia, Yosemite and Mount Rainier) and the small General Grant National Park. These parks joined Yellowstone as part of the national recreation areas set aside for use by America's growing populace (Sellars 1997:11). With the creation of these parks, Congress acknowledged that the nations populace enjoyed visiting these areas; they were quickly becoming tourist attractions, and were an important part of the expansion of the west (Sellars 1997). This recognition had wide ranging consequences for existing and future National Parks which began to make accommodations for tourists including the "design, construction, and long-range maintenance of park roads, trails, buildings, and other facilities" (Sellars 1997:10).

Between 1872 and 1916 "management of the parks for public use and enjoyment was the overriding concern" (Sellars 1997:16). By the end of the nineteenth century, however, the need to protect wilderness areas became more popular. It was recognized that special attention needed to be paid to the natural wonders that existed across the United States. Congress, however, had not yet defined "national parks as being solely large natural areas" (Sellars 1997:13). This lack of clarity would pit two groups against one another – those who saw parks as places for public recreation and tourism, and those who saw the natural resources as essential for logging, mining and other commercial activities.

Following the establishment of the Park Service a growing conservation community voiced concern that parks be left "unimpaired." This idea was not quickly or clearly spelled out in the beginning of the Service's existence. Thus, resources were either ignored, left alone (especially wildlife), or manipulated to levels deemed appropriate. Despite the manipulation and intrusion that occurred early on in the parks system, "the national park idea embraced the concept of nurturing and

protecting nature" while at the same time being viewed as "scenic pleasure grounds" (Sellars 1997:27).

In 1906, at the urging of archeologists, Congress began to also pay attention to historical and archeological sites. During this same year, Mesa Verde was established to preserve "impressive archaeological features" and the Antiquities Act was passed. The Antiquities Act made it possible to create national monuments, which were to include "areas of importance in history, prehistory, or science", and it made it illegal to take "antiquities" from federal lands (Sellars 1997:13).

Establishment of Hawaii National Park

In the background of this national movement was the increasing popularity of the Kīlauea area on Hawai`i Island. Although Hawai`i was not yet a state (it became a state in 1959), it was a popular destination for adventurers, scientists, entrepreneurs, and tourists. The earliest Euro-American interest in the Kīlauea region came from naturalists, adventurers and scientists seeking to understand and explain the geologically active area. Later visitors were primarily tourists interested in seeing the spectacular volcanic activity and enjoying the natural steam baths.

The popularity of Kīlauea eventually spurred local American businessmen to lobby Congress in the early 1900s for the establishment of a National Park in Hawai`i. In 1911 and 1915 bills were introduced in Congress to acquire Kīlauea and in particular the active lava lake in Halema`uma`u. Mauna Loa was also included as part of the proposal for a new park, but it was considered a secondary piece (Apple 1954:20). In December 1915, Jaggar, a leading force in the creation of Hawaii National Park, revised the 1911 and 1915 bills. In his revised bill, Jaggar requested funds for a National Park and included specific boundaries and provisions, which proved to be more to the liking of Congress. Jaggar's bill for a National Park in Hawai`i passed into law on August 1, 1916.

Hawai`i National Park, Ka`ū Entrance Sign. Photo National Park Service, Hawai`i Volcanoes National Park.

The newly formed Hawaii National Park included the following land areas on Hawai`i Island: 1) the Kīlauea Section (35,865 acres); 2) the Mauna Loa Section (17,920 acres); and 3) a strip of land to connect the two aforementioned sections (Figure 6). Hawaii National Park also included Haleakala on the Island of Maui which became a National Park in its own right on August 21, 1961. All of the lands that were held in private or municipal ownership within the park bounds were not affected by the Act (Apple 1954:28).

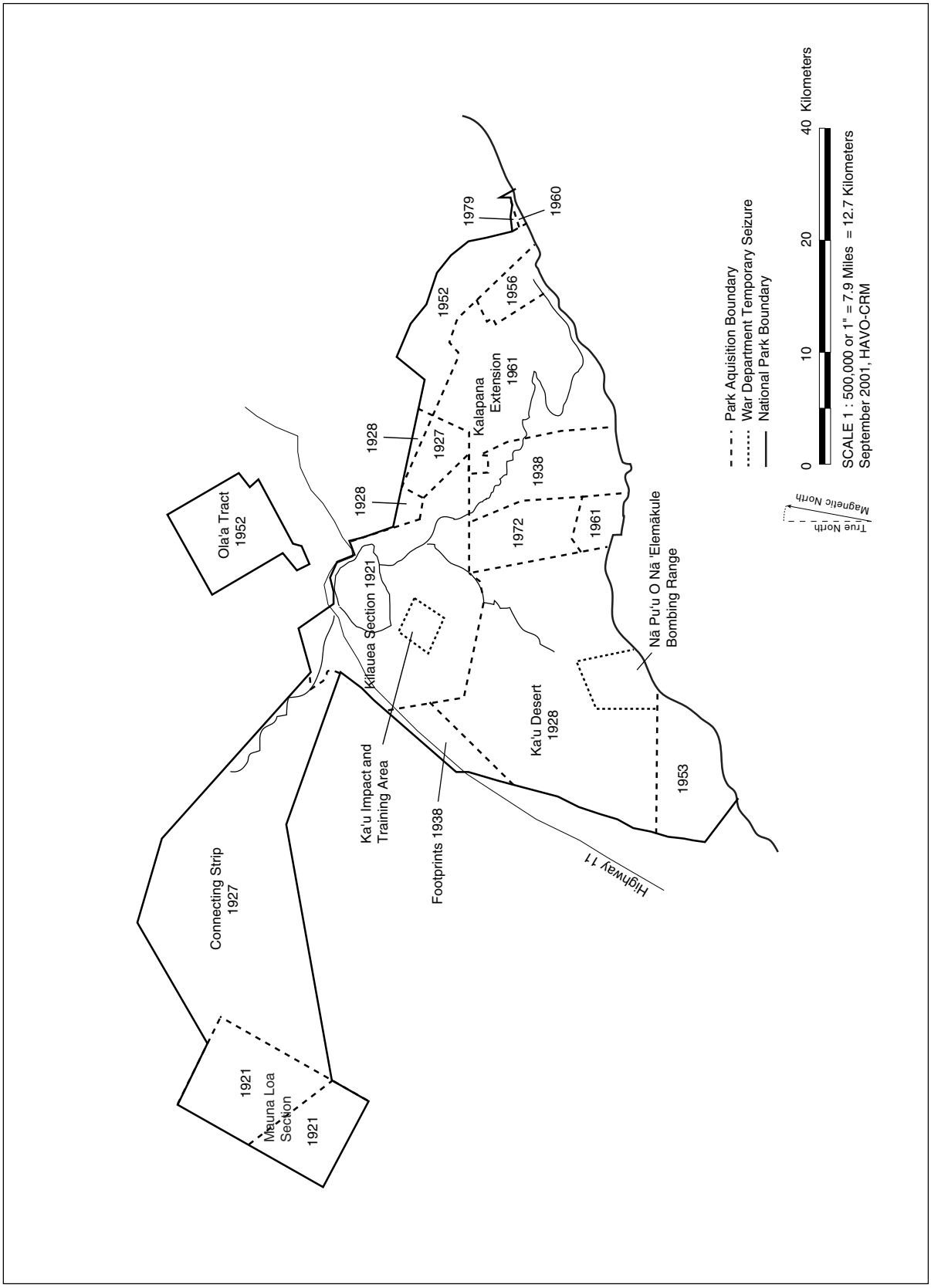


Figure 6. Land parcels added or removed from Hawai'i Volcanoes.

The Ka`ū Desert Piece

The parcels of land that encompass the project area were not part of the original 1916 legislation that established Hawaii National Park. The Park Service considered this land area for inclusion as two separate parcels, henceforth referred to as the Ka`ū Desert piece and Footprints. Prior to its inclusion in the park, the Territory of Hawaii "owned" the Ka`ū Desert lands and the Footprints area. This land came to be part of the territorial government lands after the overthrow of the Hawaiian monarchy in 1893, when all the Crown Lands, or lands held by the monarchy, were ceded to the new government.

Acquisition of the Ka`ū Desert area became a goal of the Park Service after a visit to Hawaii National Park by Director Mather in 1919 and later a visit by his assistant, Horace Albright, in 1920. These two men were excited to support the inclusion of this land as part of the new park after viewing the eruption of Mauna Iki and learning about the Footprints that Finch found in the desert. They recommended that the Ka`ū Desert be included as part of Hawaii National Park. The Desert shared a common border with the Park and would extend the boundaries of the Park to the seacoast on the southwest side (Apple 1954:95-96). Because it was government lands, then Hawaii Governor McCarthy issued "Executive Order (EO) number 81 on October 29, 1920" (Apple 1954:96). This EO set aside approximately 43,400 acres of land in the *ahupua`a* of Kapāpala, District of Ka`ū (Figure 6) (Apple 1954:96). A bill (H.R. 8960) was drafted for Congress to amend the existing boundaries of Hawaii National Park. The bill passed and was signed into law on May 1, 1922 (Apple 1954:96-97). A deed (#3866) transferred the land from the Territory of Hawaii to the United States on June 28, 1928, nearly six years after Congress passed the legislation.

The Footprints Parcel

In addition to the Ka`ū Desert, the Park Service also was interested in acquiring the smaller Footprints section and include it as part of the growing Hawaii National Park. Acquisition of the land would not be simple. The Territory of Hawaii owned the land but the Hawaii Agriculture Company owned the lease to the Footprints area as well as portions of land already within the boundary of the park. In 1920, the Territory of Hawaii opened competitive bids for the lease of land near the newly developed Hawaii National Park. On April 16, 1929, the Territory awarded General Lease 1920, a 21 year lease to the Hawaiian Agricultural Company, operators of Kapāpala Ranch, for 50,535 acres primarily west of the Park (Apple 1954:119). As previously stated, part of the land leased from the Territory of Hawaii fell within the Park. Bradford Sumner, the manager of Kapāpala Ranch, stated that the land within the park (in particular the land along connecting strip) was worth "at least two and a half times that part outside the Park" (Apple 1954:120). Thus, he continued with his plans to graze cattle in the Park (Apple 1954:120).

Between 1932 and 1938, the Park entered into negotiations to acquire the Footprints section of land from the Territory of Hawaii that was part of General Lease 1920 with C. Brewer and Company (factors for Kapāpala Ranch). The Ranch was actively grazing cattle in portions of the Footprints parcel that could support grasslands. The original discussions between C. Brewer and the Park included enough land in the area to house a Ranger patrol cabin or entrance station as well as a corral (Apple 1954:133 citing File 901-01.2, H.N.P.) On March 19, 1935 a survey of a 5,730 acre area was completed. Included in the surveyed parcel was an existing corral with a concrete water tank for cattle, and a pipeline that supplied water from Kapāpala Ranch (Apple 1954:134-135). The intent of the Service was also to build the cabin or entrance station near the Ka`ū Half Way House (Apple 1954:135) (Figure 5).

Hawaii National Park's Superintendent Leavitt urged the governor of Hawai`i to support the desires of the park to remove the Footprints area from Kapāpala Ranches General Lease. He stated that if the land were to come under Federal (Park) jurisdiction the Park would preserve historical value of the area. The Park Service would also be able to acquire money to maintain existing and new trails in the area as well as to improve the portion of the Hilo-Kona road that passed through the proposed addition (Apple 1954:134). The bill for the acquisition of the Footprints area was combined with a bill for the Kalapana extension (Figure 6). Hawai`i's delegate to Congress submitted both bills in 1936. The Footprints bill was signed into law on June 20, 1938, nearly two years after it was introduced and six years after the first serious discussions for its acquisition occurred.

Within a year after Congress passed the Footprints bill, C. Brewer Company requested that Land Commissioner Whitehouse readjust the boundary of the Footprints area to exclude a corral (known as the Peter Lee corral) used by Kapāpala ranch (Apple 1954:136). C. Brewer argued that should the corral remain in the newly acquired piece of Park land, it would adversely affect the ranch as nearly 500 head of cattle were often kept there and trees near the corral provided shade for the animals unlike most areas in the desert (Apple 1954:137).

Maps of the area made in 1907 and 1920 identify a cattle pen (1907 map) and a Halfway house (1907 and 1920) southwest of the Park's boundary. A corral (Site 21230) was identified in Park land during the current project. It is likely that Site 21230 is an alternate corral used by the ranch. Site 21230 lies just inside of the Park boundary, at the base of the Ke`āmoku flow. It does not fit the description of a corral with associated concrete water tank and pipeline as described above.

Historic documents suggest that C. Brewer and Company did not carry through on their request to the Land Commissioner to readjust the Park's boundary. Instead, they decided not to inform the Park Service that the corral was in Park land (Apple 1954:137 citing File 194, Surveyor). Apple (1954:137) suggests that if the Park Service knew that the ranch continued to graze on land that was formerly part of General Lease 1920 "the area covered by the lease might be further reduced." In 1942 C. Brewer gave up all of its cattle grazing rights in the Footprints area. Thus, by 1942 Hawaii National Park had added yet another significant piece of land to its borders.

The CCC

In 1940 the interpretive value of the Footprints area was enhanced when two groups, Hui O Pele and the Civilian Conservation Corps (CCC) pooled money and manpower to construct an interpretive shelter alongside the trail. Charles C. Moore organized Hui O Pele in 1922. Moore was a well-known engineer from San Francisco. He was very impressed with Kīlauea, and before he left Hawai`i he established a society for those who have "stood on the brink of what is without a doubt the most fearsome spot on earth accessible to man" (Jackson 1972:181 citing Hilo Tribune Herald, August 1951). The goal of the society was to monetarily support park projects that would benefit the visitor and contribute to their "comfort or pleasure" while visiting the volcano. The shelter at Footprints was a perfect project for Hui O Pele to be involved in.

The Footprints shelter was also a good project for the CCC. The Kīlauea CCC camp was established on January 24, 1934 in Hawaii National Park (Hilo Tribune Herald, Oct. 31, 1933). The young men who worked for the CCC participated in numerous improvement projects throughout the island, and in particular, at Hawaii National Park. CCC project B-19, construction of the "Footprints museum" began in 1940.

Construction of the Footprints shelter by the CCC. Photo National Park Service, Hawai`i Volcanoes National Park.

The structure consisted of "several waterproof cases to preserve the historic footprints in the Kau Desert" and water tanks for visitor use because there was no other water sources available in the area (Jackson 1972:146).

Today, water is no longer available, the tanks and glass covering of the interpretive cases have been removed, and the surrounding metal pipe railings are rusted and in disrepair. In addition to these changes, some of the footprint impressions in the interpretive shelter have been worn or disturbed from years of visitor use and the footprints are barely visible.

World War II

Newspaper headline as appeared in the Honolulu Star Bulletin the day the Japanese imperial Government launched a surprise attack on the Territory of Hawai`i and the United States on December 7, 1941. HWRD Image #153.


Honolulu Star-Bulletin 1st EXTRA

WAR!

SAN FRANCISCO, Dec. 7.- President Roosevelt announced this morning that Japanese planes had attacked Manila and Pearl Harbor.

OAHU BOMBED BY JAPANESE PLANES

SIX KNOWN DEAD, 21 INJURED, AT EMERGENCY HOSPITAL

Attack Made On Island's Defense Areas

Hundreds See City Bombed

Names of Dead and Injured

Schools Closed

Editorial

The addition of the Footprints parcel to Hawaii National Park unfortunately coincided with a turbulent period in the world. Europe was slowly being engulfed in war and Japan was exerting its power over its neighbors.

The outbreak of the Second World War had far-reaching effects on Hawai`i. The bombing of Pearl Harbor on December 7, 1941 thrust the islands into a world of horror, tragedy and uncertainty. Prior to December 7, however, Hawai`i was already playing a vital role in the training and defense of the United States. Hawaii National Park did not escape the impact of military training activities. With much of the world at war in the late 1930's and the United States on the brink of involvement, the US military was actively looking for more areas for training and Hawaii National Park was one of those areas considered.

Nā Pu`u O Nā `Elemākule Bombing Range

In 1938, the Army Air Corps needed a bombing range for training. They decided that the Ka`ū coast of Hawaii National Park met all of their training needs and thus was the most suitable place to establish such a range (Jackson 1972) (Figure 6). The area under consideration had only been added to the park ten years earlier. If such a training range were established in the park, the public would no longer be able to use that section of the Park because of the danger associated with the bombing and subsequent unexploded ordnance left behind.

The Superintendent of Hawaii National Park, Mr. Wingate, did not forcefully object to the use of this area by the military when he met with the Army in November 1938. Wingate did, however, outline two conditions for the use of the land. First, he said, no permanent structures were to be built in the area. And second, he requested that the Army make every effort to locate another site for the bombing range that would suite their needs (Jackson 1972).

Superintendent Wingate's request fell on deaf ears. The Army had decided the Ka`ū piece was what they wanted. By the time the Park Service and the Army held their November meeting, the Army had already applied for use of nine square miles in the area. Wingate made one last attempt to lessen the impact to the Park. He suggested that the Army use no more than six square miles and only after they had looked at all other suitable places and gave good reason for wanting the Ka`ū piece. When this request also got no response from the Army Wingate tried to negotiate a land swap. He requested that the withdrawal of the Ka`ū lands only occur after the

Territory of Hawaii agreed to transfer the lands in the Kalapana area of Hawai`i Island to the Park. This land area came to be known as the Kalapana Extension (Jackson 1972 citing File 601-04 (April 19, 1939)) (Figure 6).

The mood outside of the park reflected Wingate's stance. Many people seemed resigned to the fact that the US Government had a greater mission in national security than the defense of the natural resources. In light of the introduction of the bill to remove the Ka`ū coastal piece for training exercises, in 1940 Richard W. Westwood wrote in the magazine Nature:

> *"With all the terrific destruction going on in the world today, the still small voice of conservation is going to have a more and more difficult time making itself heard"* (cited in Jackson 1972).

Groups such as the Audubon Society, the Isaak Walton League, and other conservation groups protested the bill as well. They all felt that even if the nation was close to war removal of park land for military purposes would set a dangerous precedent (Jackson 1972:91). However, many were reluctantly resigned to the fact that protection of the parks lands were beyond their control. On May 23, 1940 the Isaak Walton League wrote to the Secretary of the Interior, Ickes:

> *"While in principal, of course, we are opposed to any withdrawl from national parks, we hesitate to oppose this particular bill as we do not want to be in the position of opposing any needed national defense measures"* (Jackson 1972:99 citing from file 601-04, H.N.P.).

In the Spring of 1940, over moderate protests, Senator Sheppard introduced a bill requesting nine square miles (5,760 acres) plus a number of park roads, trails and the Hilina Pali cliffs be removed from Hawaii National Park for use by the Army. The area was to be known as the Nā Pu`u P Nā `Elemākule Bombing Range (Figure 6) (Jackson 1972). On July 16, 1940 withdrawal of the area went into effect but only after some revisions. In its final form, bills H.R. 9171 and S. 3676 decreased the area of withdrawal to just over four and a half square miles (2,880 acres) (Jackson 1972:98). In addition, the Commanding Officer of the Hawaiian Department, General Herron, agreed that if the Army either did not use, or abandoned the area, the land would revert to its previous owner (the Park Service) (Jackson 1972:91).

The military held on to the Ka`ū parcel for ten years. During this period, the Army did not use the land at all. The Navy, however, did use the area for a bombing range in 1943 (Jackson 1972:99-100). Use of the area by the Navy did not sit well with the Park Service. The agreement with the War Department was that the area was supposed to be used by the Army, not the Navy. The exercises by the Navy caused a lot of trouble for the Park. Most significantly, the Navy was not confining its bombing activities to the designated bombing range. On March 25, 1945, for example, a plane strafed the area around `Āpua point and slightly injured two fishermen.

Although complaints were made to the Army about the training abuses, the Navy was responsible for the damage. The Army Commander, Mr. Muller, sent a memo to the Navy requesting they stop all non-compliant training activities. The requests for

a halt to the flagrant activities did not go far enough, however, for the Park Service; the Service requested a complete return of the land. In December 1945 the Army relinquished two acres at ʻĀpua Point but the ʻElemākule range was not returned. In the spring of 1946 Acting Superintendent Baldwin again resurrected the issue of land return. He cited several reasons the Army should give back the area to the NPS. First, Baldwin pointed out that the Army was not using the land that had been set aside for their use and therefore it should revert back to the NPS and not the Navy. Secondly, he complained that the NPS was routinely denied access to the area to do goat drives, and when they were allowed in they were shot at (Jackson 1972).

In response to these repeated requests, in April 1948 the Army said they had no more objections to legislation authorizing the removal of the Kaʻū area from its list of active training sites. The Navy, however had no plans to stop practicing there. In fact, on September 30, 1948 the ʻElemākule range was again used for bombing – this time with no prior warning to the NPS. The Service asked the Air Force why the area was being used again. The Army Air Commanding Officer at Hickam said the Army was not responsible for this action, but that the Navy had posted a newspaper notice of possible use.

Following this incident, General Travis, in a memo dated Oct. 5, 1948, finally put an end to all military use of the ʻElemākule range. In his memo, he stated that there would be no more bombing in the area as there were other useful sites available for military training. Within a year, the Army began clearing and restoring the Park areas of unexploded ordnance (it is not known if they specifically cleared the bombing range itself). In May 1950, the Secretaries of War and Interior revoked the order of withdrawal. On June 14, 1950 ʻElemākule range was officially returned to the Park Service (Jackson 1972:93).

Kaʻū Desert Impact and Training Area

In addition to the ʻElemākule bombing range, other parts of the Kaʻū desert were also used for military training after the outbreak of World War II. Known informally as the Kaʻū Desert Impact and Training Area, the Army, without formal NPS or Congressional authorization, used a large area primarily for maneuver training (Figure 6). Park officials protested the unauthorized use of Hawaii National Park for two years. On December 7, 1941, after the bombing of Pearl Harbor by the Imperial Government of Japan, Hawaiʻi Territorial governor Mr. Poindexter, declared martial law in Hawaiʻi. After the declaration of martial law it was almost futile to forbid the Army from using the Park for training.

The Army demarcated a specific area on a map where maneuvers and troops would be confined in Hawaii National Park. Explicit training assignments were given to ensure safety and compliance by the military. However, the Army failed to stay within these boundaries and many problems arose as a result of the military's unfettered use of Park property. Flagrant safety violations by the military topped some of the concerns of Park officials. The military set trip wires across patrol and public trails, without park knowledge, endangering hikers. Army troops also failed

to clear boulders from roads that were important evacuation routes during volcanic eruptions (Jackson 1972:95). In April 1943 Superintendent Wingate protested these unnecessary hazards and harassment set up by the Army (Jackson 1972:95).

Martial law formally ended on October 24, 1944. In 1944 Superintendent Wingate made a strong case for the removal of troops from the Park. Despite the end of marital law and continued requests for a termination to military training on National Park land, it was not until January 1945 that the Army finally stopped using the Ka`ū Desert Impact and Training Area for training and maneuvering of light and heavy weapons (Jackson 1972).

The impact of the military on Hawaii National Park did not disappear with the removal of troops from its boundaries. Warning signs were kept up for months, and many areas were damaged beyond repair. Koa groves had been blasted, Nēnē nesting sites were gone, and in the desert, intensive use had broken the crust of the volcanic ash (Jackson 1972).

Feeling the pressure from the Park Service, in April 1946 the Army restored some of the damage done outside of the desert area. Between June and November 1949 a team from Schofield Barracks, Hawai`i cleared the Kīlauea and Ka`ū sections of unexploded ordnance (Jackson 1972). Despite the work by the Army ordnance team, in January 1955 the Superintendent noted in his annual report that duds were still being found (Jackson 1972:97). Even today, the remains of World War II era activities are still being discovered in the Ka`ū Desert.

World War II UXO. Photo National Park Service, Hawai`i Volcanoes National Park.

Although the assault by the military on the Ka`ū Desert tapered off significantly after World War II, in March 1957 a new request was made by the Navy to use the area. The Navy wanted to create a 30,000-acre jet bombing range in the Park's Ka`ū lands. They were strongly discouraged from this venture, and no further requests were made (Jackson 1972). At the end of its use by the military, the Footprints area was again accessible to the public. The interpretive trail to the Footprints area was reopened for public use (Apple 1954:132-133).

Chapter V

THE STORY OF KEŌUA AND KEONEHELELEI

Many historical events helped shape Kapāpala and the Ka`ū District. In the precontact period a major trail system linking Ka`ū to Kīlauea, Hilo, Ka`ū, and Puna ran through this area. Hundreds, perhaps thousands of Hawaiians passed through this area as they conducted their daily business. In the early historic period missionaries, explorers, businessmen, scientists, and soldiers also traveled through here, altering the desert landscape as they went through. Perhaps the one event that has left a lasting impression and has been the focus of Park interpretation programs is the 1790 ash eruption of Kīlauea and the death of Hawaiian warriors who were unfortunate enough to be caught in the fallout.

The story of the destruction of a portion of the army of Keōua first appeared in writing in the journal of William Ellis. In 1857, the event was recorded by F. Lyman as "Keonehelelei" (the falling sands) in his "List of Dates" compiled as part of a census exercise conducted by the Hawaiian Government. In 1920, the story of the desert tragedy grew. It was this year that Ray Finch discovered human footprints embedded in hardened ash of the Ka`ū Desert.

Soon after they were found, the creation of the prints was linked to the fallen army of Keōuakū`ahu`ula (Keōua), a Hawaiian chief from Ka`ū who was traveling back to his home district from Hilo. The story of Chief Keōua has been recounted in numerous articles and books with slight variations as time has gone by. In this chapter, the story is summarized and a systematic analysis of published accounts of the event is undertaken. The goal of the analysis is to identify the origin of the story, note changes to these accounts over time, and discuss when the tragic event was linked to the fossilized prints found in the Desert.

Tragedy Befalls a Chief's Army

Many versions of the story of the *Ali`i* Keōua and the time of Keonehelelei can be found in the literature. Although each version generally provides the same basic information, the early accounts by writers such as Kamakau, Ellis and Desha provide more details that relate to individuals and place names directly connected to the event. This summary of the event attempts to provide as much of this detailed information as possible. The information was taken primarily from the works of Ellis (1963), Desha (2000), Dibble (1909) and Kamakau (1992).

As the story goes:

In 1782, Kalani`ōpu`u, *Ali`i Nui* of Hawai`i, died. In accordance with his wishes, his son, Kīwala`ō became heir of Hawai`i Island. Kamehameha, the nephew of Kalani`ōpu`u, had hoped to be named his successor. When he was not, Kamehameha became upset and launched a campaign to overthrow his cousin Kīwala`ō. In July 1782, Kamehameha defeated Kīwala`ō at the Battle of Moku`ōhai. Unbeknownst to Kamehameha, some of the family members of Kīwala`ō escaped the battle. Keōua, the half-brother of Kīwala`ō, was one of the warriors who survived. Keōua returned to his home district of Ka`ū. Keawemauhili, the uncle of Keōua, was able to escape as well and he returned to his home district of Hilo.

For some time, these three leaders kept to themselves not wanting to accept one or the other as paramount chief. Keawemauhili finally decided that he was going to accept Kamehameha as his *Ali`i nui* and sent his own sons to assist Kamehameha in his efforts to gain control of the islands. This decision enraged Keōua who marched through Kohala, Waimea and Hāmākua killing some of the warriors of Kamehameha and pillaging his property (Desha 2000:269-270) (Figure 7). Finally, at a place between Pauk`a`ā and Wainaku Keōua attacked Keawemauhili. Most accounts credit Keōua for killing his uncle at `Alae, just north of Hilo (cf. Kamakau 1992). Desha (2000), however, states that Keawemauhili was killed at this place by a spear from his own warrior named Mo`o. After he was struck on his side Keawemauhili is said to have uttered *"Hu`ihu`i wale kā ho`i Kāu lā`au I ka `ao`ao e Mo`o "* (your spear only tingles in the side, O Mo`o) (Desha 2000:270).

Hearing about these battles Kamehameha returned to Hawai`i Island, landing at Kawaihae. Upon arrival he learned that Keōua was in Waimea. Spies from the Army of Keōua, meanwhile, saw the arrival of Kamehameha and reported the event to him. Keōua retreated towards Hāmākua, predicting that a battle there would be easier to win. Hiding in ambush at Mahiki, Keōua launched a surprise attack against Kamehameha as they passed through the thick forest. The battle was not decisive, and after much fighting both armies retreated, with Keōua heading back to his home district of Ka`ū.

The route to Ka`ū that Keōua and his troops chose was by way of Ōla`ā and the Lua o Pele (Kīlauea Caldera). Keōua and his army started their march to Ka`ū and on the first night camped on Kīlauea near a *heiau* (shrine) dedicated to Pele, the fire goddess. This was a period of volcanic activity at Kīlauea Caldera. Fearing they had

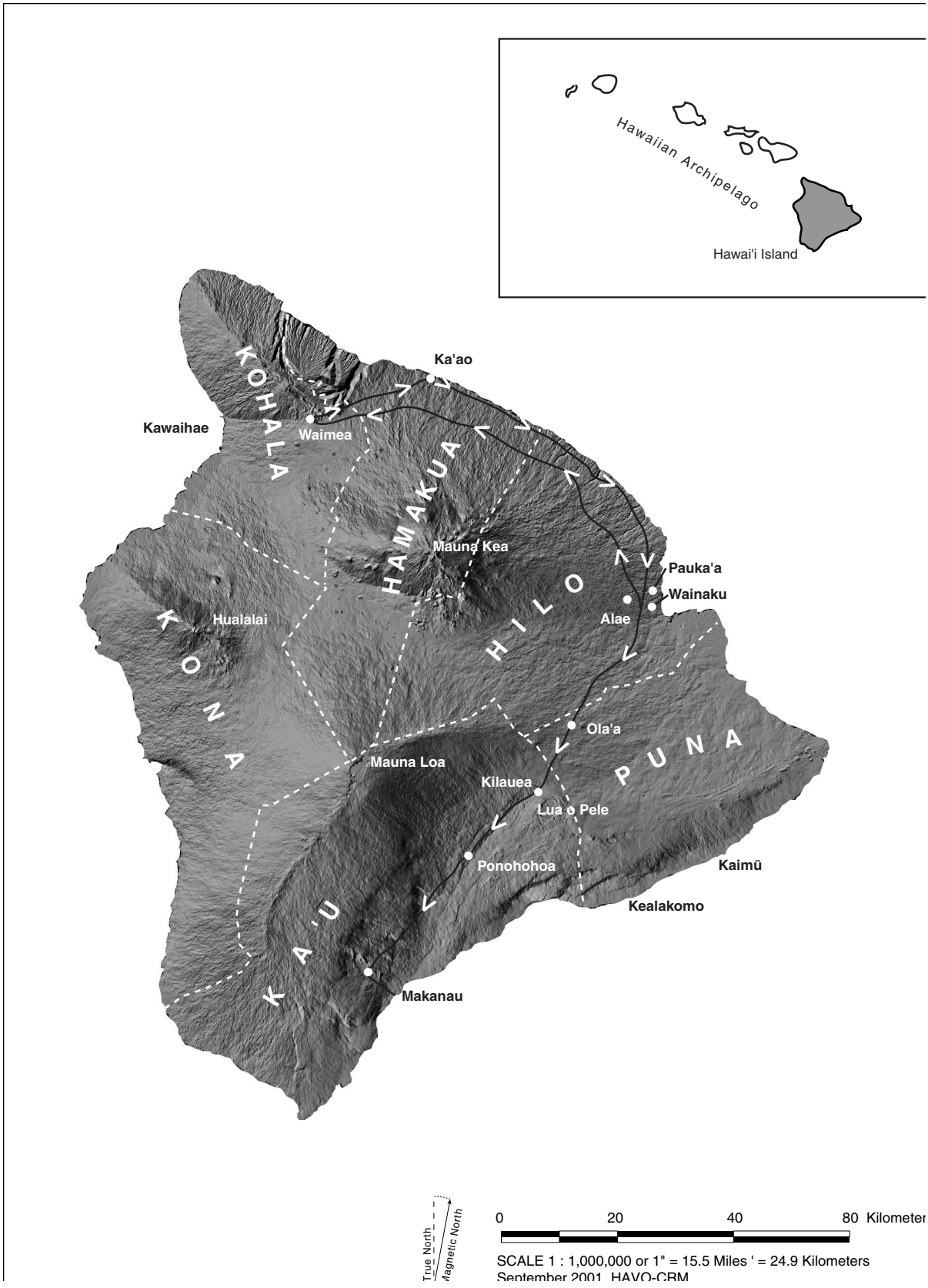


Figure 7. Map showing route taken by Keōua during and after the 1790 battles.

somehow angered Pele, Keōua decided to remain there for several days to bestow offerings in an attempt to appease her. Upon leaving Kīlauea summit, Keōua split his army into three different companies. These groups left the crater at different intervals.

The first company had not gone far when the earth started to tremble violently. Gasses and superheated steam exploded out of the Caldera. Then, a huge, dense cloud of ash, sand and cinders was ejected out of the crater and rained down for miles around. Unable to escape, all of the individuals in the second party died. One lone pig is said to have survived.

Not far behind, the rear-company by chance survived the catastrophe because they were not in the path of the gaseous fumes. Picking themselves up, they continued on their journey determined to get to Ka`ū. They were startled when they came upon members of the second company lying down across the desert floor. To their surprise, the second company was not resting but in fact lay dead. Discovering this, it is believed that the rear-company choose to move on, not staying to mourn the deaths of their fellow compatriots.

Depiction of the death of the army of Keōua. Image HAVO archives.

The ash, which settled across the desert floor, provided a unique medium in which footprints have been fossilized. It has been suggested that the footprints are what remains of the fallen warriors of Keōua. However, recent archeological research in the area indicates that the history the Ka`ū desert may be much more complex, and the prints are likely from the warriors as well as local Hawaiians traveling through the area performing common daily functions.

Historical Accounts

The popular story of the destruction of the Army of Keōua links two separate and possibly unrelated events in Hawaiian history. The first event is the eruption and death of the Army. The second is the timing and the formation of the "fossilized" footprints. The remainder of this report examines many of the earliest written accounts of these events. This section traces changes in the interpretation of the footprints site and the story of the destruction of the Army of Keōua.

Since 1823, those traveling through the area have made many references to the catastrophic events that are believed to have led to the creation of the prints. Some elements of the account have changed little over the years as the stories were passed from person to person. Others parts of the story, however, have varied over time, and have significantly changed the interpretation of the Footprints area.

Despite the number of written accounts of the Keōua story and the explosive eruption of Kīlauea, all of the earliest documented information comes from ethnographic sources and are contained in the work of five men – William Ellis, Andrew Bloxam, David Douglas, Sheldon Dibble, and Samuel Kamakau. These men recorded their information directly from Native Hawaiians either living in the area, who were somehow directly involved in the event, or knew of someone who was. All of these versions span the period between 1823 and 1867. After 1867 most accounts of the story of Keōua quote Ellis, Dibble, or Kamakau. With extensive "borrowing" from these three early sources, the story of Keōua expanded over time and was eventually linked to the fossilized prints found in the desert in 1920. An analysis of these accounts, and key aspects of the story follows:

Source of Information

The first written documentation linking the destruction of a part of the army of Keōua to a volcanic event is found in Ellis' (1963) journal. While on the Kīlauea leg of his tour, Ellis (1963) spoke with his Kealakomo guides about the goddess Pele. In describing her powers his guides spoke of an eruption which caused the death of a part of the army of Keōua. Ellis (1963:174) writes:

> *"Pele… was 'huhu roa,' exceedingly angry, and soon after sun-set, repeatedly shook the earth with the most violent heaving motion, sent up a column of dense black smoke, followed by the most brilliant flames.*
>
> *A violent percussion was afterwards felt, streams of bright red lava were spouted up, and immense rocks in a state of ignition thrown to a great height in the air. A volley of smaller stones, thrown with much greater velocity and force, instantly followed the larger ones, and struck some of them.*
>
> *Many of Keoua's people were killed by the falling fragments of rocks, and many were actually buried beneath the overwhelming mass of ashes and lava."*

When Ellis reached Kaimū (Figure 6) other Hawaiians from that area repeated the story again to him. The same story was accounted to Ellis twice, independently, thus giving strength to its validity. Ellis' guides and the Kaimū residents may have chosen this particular story to impress upon the white missionaries the power of their gods and goddesses. The story, however, has since gained much greater meaning. Various authors have retold the story in several written accounts since then.

Following Ellis, four individuals collected first person accounts of the story of Keōua and the explosive eruption of Kīlauea. The first of this group was Andrew Bloxam, the Naturalist aboard the ship "Blonde" which sailed from England to the Hawaiian Islands between 1824 and 1825. Bloxam's account appears in the Diary of Andrew Bloxam

(1925). On their island journey through Hawai'i Bloxam and other members of his crew visited the Kīlauea area. There, he described the surrounding volcanic landscape and very briefly mentions a spot where:

> "...a number of natives who had formed an encampment in the reign of Tereoboo (the king when Capt. Cook was killed) were overwhelmed by the sudden ejection of an immense quantity of ashes, several escaped by a timely flight, but most of them perished" (Bloxam 1925).

A third account of the destruction of a portion of the army of Keōua appears in 1834. David Douglas, a botanist, included the story in the Journal of the Royal Geographical Society of London.

The fourth reference found in the literature comes from Sheldon Dibble (1909), an instructor at the Mission Seminary in Lahaina, Maui. As a teacher Dibble strongly believed that native people should be aware of their own history. Thus, in 1836 he started a program to collect facts on Hawaiian History. To accomplish this task, he put together a group of 10 of his best Hawaiian seminary students. He called this group his "class of inquiry." Dibble devised a list of questions concerning Hawaiian history and gave a question to each member of his class. He instructed each student to go "individually and separately to the oldest and most knowing of the chiefs and people, and gain all the information that they could on the question given out" (Dibble 1909). At the end of the research period, each student would read his report to the class. The class would critique the information gathered, reconcile discrepancies, and make corrections to the text. Dibble compiled all of the information his class gathered, edited it, and produced his History of the Sandwich Islands (1909). In his words, the information concerning the death of the army of Keōua were told by "the lips of those who were part of the company and present in the scene" (Dibble 1909:52).

The last reference containing a first person account of the destruction of the army of Keōua is found in the early Hawaiian Language newspaper *Ka Nupepa Ku'ako'a* on April 27, 1867. Samuel Kamakau, a Hawaiian historian who wrote about the history of his people for 34 years, wrote the article. His first publications appear in the Hawaiian language newspapers in 1842. Throughout his life, Kamakau wrote over 300 articles explaining aspects of Hawaiian history, life, politics, and religion (Kamakau 1992:iii). Kamakau got his information from a witness to the event named Mona (Kamakau 1992).

Date of the Event

In addition to containing the first written account of the destruction of the army of Keōua, Ellis' (1963) journal also contains the first reference to a dated event. In the published account of Ellis' (1963) journal the year 1790 is referenced as the date the army of Keōua was destroyed. This reference is likely to have been added in after Ellis left Kīlauea.

It is not clear whether Ellis included this date in his original manuscript, or the editor added it in later editions. After Ellis returned to England in 1824 he rewrote the journal into a personal narrative, added a number of his own observations and published five editions in London between 1825 and 1828 (Ellis 1963:iv). "A number of these editions differ more or less from each other" (Ellis 1963:iv), and thus in 1917 the Advertiser reprinted the journal including many of the differences found in all five.

Following Ellis, the date 1790 appears in several other accounts and today is the date most people, including the Park Service accept as the date Keōua and his army passed through Kīlauea. A few variations on this dated event are found in the literature. The first appears in the journal of David Douglas, written in 1834. Douglas dates the event to 1787 and is the only one to mention this date. At least three other references (Dana 1849, Brigham 1909, and Jaggar 1932 citing Brigham 1909) refer to the event as having taken place in 1789. It is interesting to note that Dibble (1909) who is cited by numerous authors including Dana (1849) and Brigham (1909) does not mention a specific date for the eruptive event.

Where did the date 1790 come from? The origin of this dated event is still questionable. The date 1790 coincides with the arrival in Hawai`i of John Young, an English boatswain who was accidentally left stranded in Hawai`i by his fellow sailors. Young became a favored advisor to Kamehameha I and had a residence in the Kawaihae area. Young may have mentioned an eruption to Ellis when he reached North Kohala. Apparently, in November of that same year people living in Kawaihae, the northwest part of Hawai`i Island, saw an eruption from Kīlauea Volcano. Thrum (cited in Jaggar 1921) translating Kamakau's *Moolelo* writes:

> "the sand and stones sprang up and became a pillar, standing up higher than the mountains of Mauna Loa and Mauna Kea. Those who lived at Kawaihae shore (northwest coast of Hawai`i) saw this wonderful fire pillar standing in the sky, and at the top of this pillar a flame of fire was flashing (*lapalap*, a flashing of lightening)."

Jaggar (1921:118) calculated the height of the 1790 ash explosion using the distance from Kawaihae (109 miles northwest of Kīlauea), the known height of Mauna Loa in 1921 (8,100 feet), the estimated depth of Kīlauea at that time, and the height of the fume jet over Mauna Loa in 1916. Jaggar (1921) estimates the height of the explosion to be at least 30,000 feet.

It is possible that Young was the first to link the date 1790 to the eruption and death of part of the army of Keōua. At the time of Ellis' visit, Native Hawaiians did not yet have the experience of European calendar dating. Thus, the date 1790 would not have come from their lips.

A second, early source for the 1790 date comes from Frederick Lyman's 1857 List of Dates. As previously stated, Lyman, a tax assessor, compiled a list of important events in Hawaiian history to associate the birth dates and ages of Hawaiians who were being taxed. Most Hawaiians at this time could associate births and deaths in relative terms, with famous "occurrences." *Haole* (foreigners) would apply a date to these events based on several pieces of evidence collected from their native informants.

Thus, Lyman's List of Dates reflects the year 1790 as the time of Keonehelelei, "the falling sands" further solidifying the date 1790 as the year in which the army of Keōua was caught in the eruption.

How Many Died, How Did They Die and Where Are the Bodies?

It is widely accepted that a portion of the army of Keōua was killed during an explosive eruption of Kīlauea some time in the late 18th century. How they were killed, however, has long been debated. Several suggestions have been made regarding the cause of the death of the warriors. These include death by suffocation due to ash (cf. Dibble 1909, Dana 1849, Brigham 1909, Westervelt 1963, and Desha 2000) and poisonous gas (cf. Dibble 1909, Dana 1849, Brigham 1909, Westervelt 1963, Macdonald et. al.1986). Still others like Ellis (1963) and Douglas (1834) suggest lava, stones, ash and other volcanic material was the cause of most of the deaths. Explanation based on native accounts suggest Pele was angry with Keōua. The reasons for her anger range from a dislike of Keōua in favor of Kamehameha, anger over improper offerings and disregard for protocol while at the crater as well as displeasure that stemmed from Hi`iaka, the sister of Pele.

The most interesting and variable explanation comes from Jaggar. In five articles that address the issue of cause of death Jaggar provides a different explanation. In his 1921 Paradise of the Pacific article he cites hurricane force winds, asphyxiation and burning as the possible causes. In a May 1924 HVO Monthly Bulletin Jaggar states that ash suffocation and scorching heat were the cause. Later, in the March 1930 in The Volcano Letter Jaggar writes that he believes ash and lava buried the warriors. Jaggar was probably closest to the more true cause of the death of the warriors in his 1921 article.

Today, geologists have developed the most probable hypothesis. As discussed briefly in Chapter 2, geologists believe that a large amount of falling ash likely did not cause the death of the passing party (Swanson and Christanson 1973). Reports by natives on the conditions of the bodies of those killed by the 1790 event, in addition to geologic indicators, strongly suggest the 1790 ash explosion was preceded by a magmatic phase (Wentworth 1938:252). Swanson and Christianson (1973:86) suggest that a "hot base surge, composed primarily of superheated steam… (travelling at) hurricane velocity" was the cause of death. The hurricane velocity of the winds prevented the people from running away and while they huddled together, probably in an attempt to not be blown away, "hot gases seared their lungs" (Swanson and Christianson 1973:86).

The warriors did have some warning that the crater was increasingly unstable. The earthquakes that preceded the eruption caused the group to halt their march and camp near the crater for three nights. This action suggests they were trying to wait out the eruptive event. Their presence in the area for several days suggests that eruptions were either so familiar they had little fear of them, or their purpose for traveling through the area was of higher priority than their personal safety. Geologic evidence suggests the former may be a more accurate depiction of the situation.

Swanson et al. (1998) suggests that the Caldera floor may have been at or below the water table for a period of nearly 300 years. Thus, for several centuries, Hawaiians living in the area could have been exposed to these kinds of explosive events thereby becoming more accustomed them. If they or others had traveled through the area on numerous previous occasions and passed through unharmed, they would have nothing out of the ordinary to fear from the 1790 eruption.

Most accounts of the event agree that three groups traveled with the warrior party. Disagreements arise amongst the authors, however, on the number of warriors killed and the fate of the bodies. Neither aspect of the story has been firmly established. The amounts range from a vague "all of the center party" and "some of the forward party" (cf. Dibble 1909, Brigham 1909, Westervelt 1963) to a huge number of 5,405 (Douglas 1834). The more commonly cited number is about 80 killed (cf. Ellis 1963, Jaggar 1930 and 1932, Doer 1931, Finch 1947) but 400 also appears in at least two references. Jaggar (1921) citing Thrum (Bishop. Museum Bulletin V, Part 2, pg. 474) suggests that perhaps there were 400 total in the war party of which 80 were killed.

We may never know how many warriors were killed or the fate of their bodies. Some (Douglas 1834) state the dead were thrown into Kīlauea. Others (cf. Dibble 1909, Brigham 1909, Westervelt 1963, Jaggar 1921 and 1932) state that the dead were never buried and they were left "bleaching in the sun and rain for many years" (Dibble 1909). Brigham (1909) citing Dibble (1909) goes as far to say he actually saw thigh bones, apparently from the warrior party in the desert. It is difficult to imagine that the bodies of the deceased warriors were left where they were. However, we can not be sure what may have happened to the victims.

Reference to Footprint Features and Keōua

In the very early accounts of the Ka`ū Desert written by missionaries, scholars, and adventurers, no mention of the existence of the footprints are made. The suggestion that the prints were made by the warriors of Keōua first appears in print in a 1921 publication by Jaggar. Jaggar (1921) knew the story of Keōua and was the first to link the archaeological evidence with the explosion. Thus, Jaggar appears to be the sole individual responsible for developing the origin story of the Footprints. Scholars and lay-people quickly adopted his explanation for the origin of the footprint impressions. Today, it is the primary interpretive story accepted by the Park Service.

Closeup view of imprint of toes hardened in desert ash. Photo National Park Service, Hawai`i Volcanoes National Park.

We know from the ethnohistoric record that Keōua was on his way back to Ka`ū from Hilo some time during a large explosive eruption of Kīlauea. Thanks to geologists at HVO we now have a better understanding of the cause of

death as well as the process of the eruption and formation of the ash. However, several issues regarding the history of the Footprints area are unresolved. These issues concern the events that surrounded the creation of the footprint features, the extent and distribution of the footprint impressions, and the discovery of other precontract and historic structures. Specifically, these questions remain unanswered: 1) why did Keōua choose this route? Was it an arbitrary decision to cross through the crater area and just bad luck that they got caught in this horrible situation? Or had people been through this area before?; 2) does the area identified within the National Register boundary encompass all of the footprint features? Are there other features in the desert that may add to the story of precontact and early historic use of the area? Evidence from the archeological record can help answer some of these questions. The archeological record is explored in the subsequent chapters.

Chapter VI

PREVIOUS RESEARCH

The footprint impressions in the Kaʻū Desert have been studied since their discovery in 1920. It was not until 1998, however, that intensive archeological research using modern methods were undertaken. This recent work in the Footprints area is the direct result of funding secured by the Park Service. Prior to 1990, most of the "survey" projects conducted in the area were limited in scope, focusing solely on the footprint impressions. Previous research projects are discussed in detail in this chapter.

A Brief Summary

In the 82 years since the impressions of human footprints were first identified in the Kaʻū Desert, and the 212 years since the phreatic eruption of Kīlauea, the story of the Footprints area has remained relatively unchanged. Archeologically, the area is distinguished for the ancient footprint features that spread across the desert. Historically, the footprint features have been linked solely to the army of Keōua; no other individuals were believed to have contributed to the creation of these features.

When Footprints was nominated to the National Register in 1974 the focus of the nomination was on the footprints themselves, as these were the only known historic properties in that area. No surveys were done to identify any other precontract or historic features that may have contributed to the National Register property. Also, because no systematic survey was done at the time of nomination, the extent of the footprint features was not well known and therefore was not captured in the nomination form. This fact is apparent when one compares the boundary designation of the National Register parcel to the footprints that have been identified outside of the National Register boundary in the last 27 years (Figure 8).

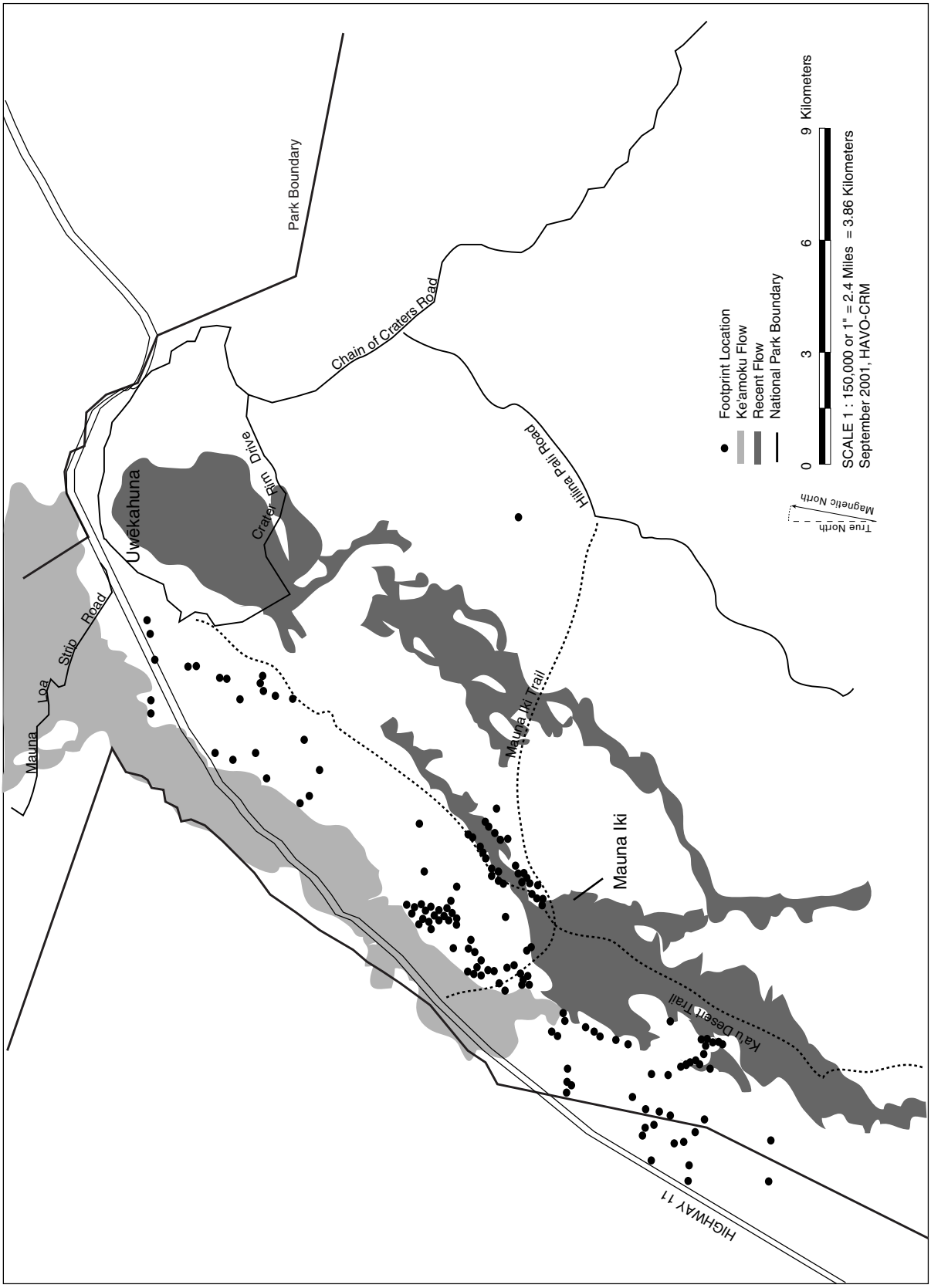


Figure 8. Locations of footprints identified.

Early Discoveries and Descriptions

As discussed in Chapter IV, in 1919 lava from Halema`uma`u drained out of the crater and erupted in an area of the Ka`ū Desert. The eruption built a hill called Mauna Iki (Figure 4) (Apple 1954:132; Macdonald et al. 1986). Ruy Finch, a scientist with HVO was studying the Mauna Iki eruption when in 1920 he discovered the fossilized human prints during one of his field visits to the area.

The fossilized footprints were first found "west of the head of the flow of 1920 at the edge of the National Park" (Jaggar 1930:1). Following their discovery, Jaggar became very interested in the prints and their formation. He visited the Ka`ū Desert on several occasions and wrote profusely about the subject (see Jaggar 1921, 1924, 1925, 1930, 1932). In addition to the prints found by Finch, Jaggar found two more groups of prints between 1920 and 1925. The first group is located about a mile and three-quarters west of Uwēkahuna and the second approximately two miles west of Uwēkahuna (Apple 1973) (Figure 3). In a 1932 Paradise of the Pacific article Jaggar makes the first suggestion that other ancient features once existed in the desert. Jaggar (1932) wrote, "stone shelters used by the native wayfarers were overflowed by the lava of 1920 on the East Side of Mauna Iki." Despite this tantalizing bit of information it took nearly 66 years before these features were mentioned again.

It is interesting to note that R. Finch, the man who discovered the prints, did not begin writing about the fossilized prints until nearly 30 years after he found them. This task was left to Jaggar. The first accounts by Finch are found in two belated articles written in 1942 and 1947. Other early accounts of the area include one by then Park Naturalist John E. Doerr in 1931. Doerr (1931:54) identified prints from "the Kau road (nine miles south of the park headquarters) to the Mauna Iki lava flow of 1920." Doerr's (1931:55) inventory was limited to a few sketch drawings of at least two long line of prints and a notation on the size and direction the prints headed.

In 1973 Russ Apple prepared National Register nomination forms for the Footprints area. Included in his nomination packet was a recommendation for the size and location for the new National Register parcel (Apple 1974). Apple's nomination form includes a discussion of the discovery of the prints, a review of field records noting locations of prints, as well as the story of Keōua. Unfortunately, no systematic survey was conducted in the 1970s to verify the extent of the footprint features or other related historic properties in the area. Thus, Apple's nomination includes only footprint features found within a 4,284-acre-rectangular area in the Desert (Figure 2).

Broad Coverage Projects

Between 1974, when the Footprints area was included on the National Register, and 1990, there were no attempts to systematically record archeological and historic features in the desert. Since 1990, two volunteer projects and one professional survey were completed in the Footprints area. These surveys emphasized broad coverage; the spatial area inventoried was large. Despite their wide reach, however,

methodology was often not clearly described and many features were neither systematically recorded nor classified, leaving a question as to the true area covered by the surveys. Data provided by these surveys do not sufficiently addresses issues regarding site formation and function. These projects are reviewed below.

Osborne 1991

In the summer of 1991 Cheryl and Nick Osborne of New Zealand volunteered with HAVO Resources Management to do a survey of the Footprints area. The Osborne's first interviewed HAVO personnel regarding the nature and known distribution of the footprint features. They then followed up these interviews with ground survey. Field forms have been located in the CRM files but it does not appear that a report or summary of their work was produced at the conclusion of the project.

Field notes found in the HAVO CRM files from the Osborne project span the period from June 7, 1991 to July 19, 1991. The couple visited 31 different "site" locations. All of the data collected for each "site" was recorded on a descriptive form. Data they collected includes: the total number of prints observed, the minimum number of individuals represented, the length and width of the right and left impressions, the length of the stride (if more than one impression was identified), the angle of the print (direction the individual was heading) and the ash layer the print was found in. Together, Cheryl and Nick Osborne identified 205.5 footprints representing a minimum of 89 individuals.

Miller 1991-1992

Less than a year after Cherly and Nick Osborne worked in the Ka`ū Desert, Al Miller volunteered at HAVO for five months locating and recording footprint features. Miller's goal was to further address the nature and distribution of the footprint features. To reach his goal, Miller conducted a survey and recorded the locations of the footprint impressions he came across. Working alone, Miller field checked 27 square miles, a very large area in the desert (approximately 17,279 acres) between December 1, 1991 and May 29, 1992 (Miller 1992 unpublished ms. on file HAVO CRM) (Figure 3).

Miller's field notes and draft report do not describe his survey methodology. If he used standard systematic transects and identified all of the footprint features located within the entire 17,279 acres this was quite an accomplishment. However, because this is such a large area, it is questionable whether systematic transects were used and whether 100% survey coverage was completed.

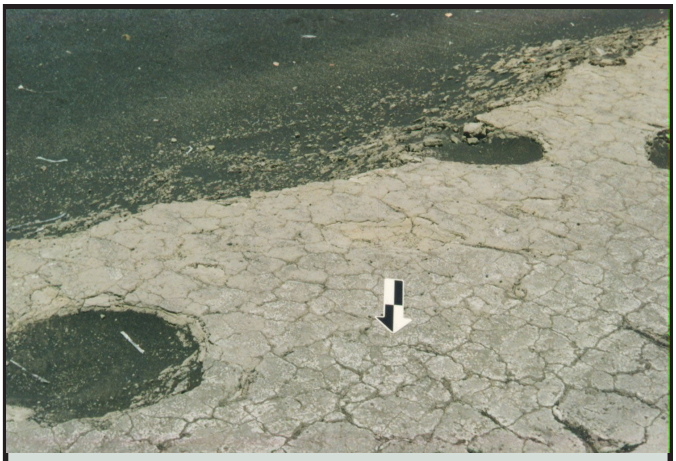
Despite the questions about the methodology he used, Miller collected some very useful data such as the number of prints he found, the angle of the prints, their relative location (no GPS positions were obtained), the angle of the print and the kind of print (human versus animal).

All of the data Miller collected for each "site" was recorded in tabular form (Appendix I). There are some discrepancies between the tabular data and the manuscript provided by Miller. For example, in his manuscript Miller (1992 unpubl. ms.) documents 176 recorded sites. His table, however accounts for only 136 locales that are assigned location numbers from 1 through 136. Data collected by Miller includes the layer the footprints were found in, the minimum number of prints, the direction the prints were heading, the percent of prints facing each direction and the percent of the print that was exposed. His data has been transferred into a digitized tabular form (Appendix I). Miller (1992 unpubl ms.) states that he identified 2,700 footprints, and 10 horseshoe prints. His data sheets, however, account for only 1,773 footprints from a minimum of 447 individuals (Appendix I).

Original maps produced by Miller were found in the HAVO CRM office. Utilizing the tabular data provided by Miller and the points he plotted on a USGS map, a GIS shape file was created (Figure 8). Because Miller recorded not only the number and location of prints, but the direction or angle the prints were facing, it was possible to graphically portray this information as well. Miller's data provide a very good representation of the gross distribution of prints across the desert. From this map, site boundaries, direction, and distribution of the footprint features within HAVO can be identified.

ARPA Incidents 1994

Two incidents of vandalism to the Footprints site have been documented. The damage assessment reports are on file in the HAVO CRM office. Both assessment reports are dated October 17, 1995. The Criminal Incident Reports (CIR) concerning these cases on file are #940663 (dated July 5, 1994) and #940880 (dated October 1, 1994). Howard Hoshide, HAVO Wildlife Biologist reported the damaged footprints, to then HAVO Cultural Resource Manager Ms. Jan Keswick on July 5, 1994. Hoshide reported at that time noticing the prints had been disturbed several months prior to his verbal report. Rita Pregana, HAVO Law Enforcement Officer investigated Area 1 on July 5, 1994 and later she investigated Area 2 on September 30, 1994.



Photograph of ARPA violation in Area 2. Photo National Park Service, Hawai'i Volcanoes National Park.

Area 1

CIR #940663 documents damage that occurred to three footprint impressions located in the Footprints Shelter display case and to at least three prints in the immediate vicinity outside of the shelter. All of the prints were removed, likely dug out with a

shovel or some kind of a similar tool. Large circular gaps (voids) were identified where footprint impressions once were located. Just to the east of the prints that were once located in the display case was a boot print. Investigator J. Judd took a cast of the boot print. There were no suspects at the time of the investigation. Damage was believed to have occurred some time between October 31, 1993 (the time of the last backcountry patrol of the area) and July 8, 1994.

Area 2

CIR #940880 was documented during a follow-up report to #940663. On September 30, 1994 while checking on previous damage in the area R. Pregana noted a third area of damage approximately 325 feet north of the Footprints shelter. The area in question involved at least 13 footprint impressions. Unlike the damage reported in CIR #940663, the damage to these prints appeared to be cumulative; prints were not physically removed but were the result of negative natural and cultural processes over time. It was suspected that damage may have been caused directly by people putting their feet into the impressions or by people making rubbings or castings of the prints. Other footprints in the area did not exhibit erosion to the extent the 13 reported in CIR #940880 did.

Wulzen 1998

In the late 1990's the Park Service significantly increased protection efforts in the Footprints area. The NPS realized that limited survey projects (primarily conducted by volunteers) were complete for the area. In addition, the National Register boundary for the site was arbitrary, and site erosion and damage was increasing with time. Thus, the Park service determined that a more systematic reconnaissance survey of the Footprints was needed. In 1998 professional archeologists from the Park Service began to take a closer look at the Footprints area.

Between August and December 1998 an intensive reconnaissance project was conducted in the Footprints area by staff employed by HAVO through RCUH (see Wulzen unpublished ms1999). The goal of the project was to formally document features in the National Register boundary. The field survey was led by W. Wulzen, B.A.

Survey Methodology

Unlike previous surveys Wulzen (unpubl. ms.1999) did describe his field survey methodology. Wulzen (unpubl. ms. 1999) states that survey was done by two to three persons via transects which were spaced "with a few exceptions" between 30 to 80 meters apart. He justified such wide spacing due to the "high visibility on the open desert." He goes on to state that "occasionally closer spacing was adopted in the few thickly vegetated areas" (Wulzen unpub. ms 1999:13).

The methodology employed in 1998 is somewhat problematic. Although it is not unusual to expand the usually accepted 10-meter-transect spacing for archaeological surveys, it is hard to justify anything over 30 meters in the kind of terrain found in the Ka`ū Desert. Footprints are primarily preserved in low spots across the undulating *pāhoehoe* and *`a`ā* flows and some structures are built into small crevices in the *pāhoehoe* and *`a`ā*. With such wide spacing between individuals, many low areas that could potentially contain footprint features could have been missed during the 1998 project, and many of the smaller structures may have been overlooked.

The total area surveyed by Wulzen (unpub. ms. 1999) is not clear. In his report, Wulzen provided a GIS map identifying the area surveyed. A copy of this GIS layer could not be relocated in the HAVO CRM computers. Using a crude method of digitizing, the author was able to reproduce his survey map. The overall project area represented by the reproduced map totaled 33,369 acres (52 $mi^{2)}$. Wulzen, however, estimated the 1998 survey covered only 12,340 acres (19 mi^2).

Not all of the 12,340 acres received 100% survey coverage. Wulzen (unpub. ms. 1999:13) states "some areas… were only sampled . The *pāhoehoe* flats between the Ke`āmoku flows and the Southwest Rift Zone are an example of complete coverage, while the majority of the Ke`āmoku flows were only sampled." Of the area receiving complete coverage this author determined the sections adjacent to Hilina Pali Road were well outside of the Footprints area and were beyond the scope of the original project description.

Wulzen (unpub. ms. 1999) did not clearly define his reasons for selecting his survey boundary areas. The boundaries identified on his map (Wulzen unpubl. ms.1999) appear to be along major park trail systems and roads. Did the 1998 crew choose these areas because they were easily accessible to the field crew? Or, did they choose these areas because they wanted to identify impacts of visitors on archaeological features? Although the latter explanation is reasonable, no discussion of the impact of visitors on sites is provided in the draft report. Volunteers who worked with Wulzen on the 1998 project suggest that trails and roads were chosen as easily accessible routes. Therefore, the crew was more likely to identify features along these access routes than features that may exist elsewhere in the desert (T. Houston 2001 pers. comm.).

Discovery of Architectural Structure, Trails, and Other Features

One of the key differences between the 1998 survey and previous projects in the area was the discovery and documentation of archeological structures, trails, and historic artifacts. As previously discussed in this chapter, Jaggar (1932) is the first to mention the existence of precontact Hawaiian structures in the Ka`ū Desert. No further investigations of these sites was undertaken and they seem to have been forgotten. They were "rediscovered" and inventoried in 1998 by Wulzen's field crew. Wulzen (unpubl. ms.1999) identified 235 archeological features in the project area

during his survey (Figure 9). Universal Transmercator (UTM) points were collected for each feature using a Trimble ProXR Geographic Positioning System (GPS). The 1998 crew also assigned a temporary field number and typological classification to each feature and collected minimal descriptive documentation. The crew did not make scaled sketch maps and did not systematically record other essential field data, however, such as site function, size, and condition because they did not use feature forms. Thus, although the 1998 crew identified the locations of the features, without further fieldwork there was little information available to assess their function or significance.

Conclusion

Many of the features recorded between 1991 and 1998 are either found outside of the 4,284 acres placed on the National Register, or are within the nomination boundaries but were not included or identified during the nomination. Because none of the architectural and trail features were recognized prior to 1998 they were not included as part of the National Register nomination and therefore were not evaluated for significance.

Prior to 1998, interpretation of the Footprints area was based solely on the "fossilized" human foot impressions found in the Ka`ū Desert. No associated archeological features such as house structures, resource procurement areas or trails had been identified in the desert that suggested other kinds of activities had taken place in the desert. Archeologists did not recognize the brief reference made by Jaggar in 1932 to shelters in the area. The discoveries made during the 1998 survey opened many new possibilities for interpreting the area.

Figure 9. Map of features identified in 1998 and 2000 (confidential - 36 CFR 79).

Chapter VII

SUMMARY OF 2000-2001 SURVEY AND TESTING

Despite the methodological problems associated with a decade of survey during the 1990s, all of the volunteer and program supported projects have expanded our knowledge of the Footprints area. These projects have proven that: 1) footprint features extend beyond the National Register boundary area; 2) several kinds of prints belonging to both humans and animals exist; and 3) researchers have identified the existence of features other than the fossilized impressions suggesting a greater degree of activity once occurred in the Ka`ū Desert. Several questions, however, regarding site function and interpretation remained after the HAVO CRM program entered the 21st century.

In 2000, additional funding was received for further work in the Footprints area. The goal of the 2000 survey was to synthesize available information and collect any additional data needed to begin to address functional issues. This chapter summarizes the fieldwork carried out in the Ka`ū Desert in 2000-2001. It describes field methods, defines the types of sites recorded, and discusses the character of the historic resources in the Footprints area. Incorporating previously collected data (in particular the 1998 survey) this chapter addresses site function and significance. Finally this chapter suggests that the story of the Ka`ū Desert is much more complex than the version that has been popularly related over the last century and proposes a new hypothesis for events that occurred in the area.

Field Methods

Between June 1 and September 13, 2000 and July 10 and August 2, 2001, a total of 36 field days (approximately 1,152 personnel hours) was expended on the Footprints 2000-

2001 survey. The original purpose of the project was to gather enough data to complete the 1998 survey report for an area where features had been insufficiently documented and survey methods were inconsistent. Although the 1998 project documented numerous features in the Footprints area, it was not possible to assess site function or significance due to a lack of data. Thus, with limited funding left, archeologists from HAVO decided to go back to the desert in the summer of 2000 to collect as much data as possible to asses site significance, function, and association.

Survey and Detailed Mapping

The original method devised for the 2000-2001 survey was to field check all of the features located in 1998. The goal was to gather as much data as necessary to formally record the features identified, evaluate the sites for significance, and asses the potential for future field projects. As the 2000-2001 inventory proceeded, it became apparent that many features, some adjacent to others that had been recorded in 1998, had not been identified. This situation was especially apparent along the eastern edge of the Ke`āmoku lava flow. Because of time and budget constraints, the survey methodology was altered to focus on a limited area along the eastern edge of the Ke`āmoku flow. The field crew intensively surveyed a 20 m along the easter edge of the Ke`āmoku flow. The flow boundary was chosen as the area of concentration because most of the sites appeared to cluster in this area. The survey consisted of three-person transect survey. The field crew collected a GPS point for all of the new and previously identified features.

Mapping techniques utilized in the 2000-2001 inventory project consisted of detailed planimetric sketches of all archeological features. The technique consisted of a three-step mapping method. First, the interior and exterior of archeological structures were mapped with a Trimble TSC1 GPS unit as a line feature. The data was then taken back to the office, downloaded into Pathfinder ver. 2.10 and corrected with base station files to obtain the most accurate location data available.

Once the data was corrected, it was then downloaded as a shape file into ArcView ver. 3.2. The result is an outline, or sketch of the archeological site that can be projected, to scale, and is georeferenced to real-world points. The next step involved detailed mapping. A preliminary sketch map was printed to scale on graph paper and taken back to the field for detailed mapping. In the field, rocks, artifacts, vegetation, and other feature components were added. Because the outline of the site is printed to scale, much time is saved in the mapping process. In addition, using GPS and tape and compass increases accuracy. The result is a highly detailed and accurate planimeteric map that is relatively easy to produce.

The field team mapped all of the features identified in 2000-2001 at a 1:50 metric scale. The field maps were then scanned and the image was registered into ArcView. Symbols representing artifacts and other features were added in ArcView. The resulting TIFF, or image file, was displayed in a GIS system according to its geographically referenced location. The TIFF files for this project were used as multiple image layers. For projects where time allowed for detailed mapping of all

architectural features, the images were digitized into one large shape (.shp) file and the data used on a regional scale for spatial and temporal evaluation.

In addition to feature mapping, data on structure size, construction materials, type of construction, surface cultural remains, soil deposition, vegetation, and other general characteristics related to the feature and the environment were documented on feature forms. Interpretation of formal and functional type was also made.

All features were photographed using a color digital camera. This procedure aided in the descriptive and functional interpretation of the features after the field phase of the project was completed. Archeological technicians also took color slides of select features for archival purposes as well as presentation aides. Following analysis of the mapping data, the principal investigator changed some of the structural designations assigned in the field. These changes were made to maintain consistency in feature recording, and ultimately allow for a more accurate analysis of feature distribution.

Feature and Site Numbering

The 1998 survey crew identified sites in the field by assigning a temporary number (T-#) to each architectural structure or feature on the landscape. A GPS point was collected for each feature, and pink flagging was wrapped around a rock with the temporary number either on top of, within, or next to most structures. At times it was difficult to verify features. Due to severe weathering, much of the flagging was unreadable by the summer of 2000. In addition, structure type designations were inconsistently applied to features identified during the 1998 survey.

Because of problems reading the flagging and inconsistent feature type designations, new temporary numbers were assigned to all of the features located in 2000-2001 including those identified in 1998. For those features identified during the 1998 survey and relocated during the 2000-2001 survey, additional field data was collected. For those features identified during the 1998 survey, but not relocated during the 2000 survey, the descriptive documentation provided by Wulzen (unpubl. ms. 1999) is referenced in Appendix II.

Once the 2000-2001 field survey was completed, an overlay of the 2000-2001 data was compared to the 1998 survey data and duplicate feature locations were identified. Wherever possible, features identified in 1998 and 2000-2001 are correlated. However, if there was a conflict, the author accepted the 2000-2001 feature designations.

Assignment of site boundaries was based on spatial clustering of features on the landscape. For the purpose of this report individual architectural features are defined as structural components of the larger site. In some cases no clear indication of feature clustering was apparent. Thus, larger site boundaries were established to include several disparate features. Because caves are managed as separate units

at HAVO the author assigned them separate site numbers, but overhangs were generally incorporated into the larger site complexes. Trails and associated rock piles and mounds were determined to be functionally associated and thus were assigned to the same site number. Segments of associated trail systems were lumped together and are viewed as discontinuous pieces of a larger site. Historic roads and their associated mounds and rock piles were also assigned site numbers as a group. Footprint impressions identified since 1990 were consolidated under the original state site number (50-10-61-5505) assigned on the Footprints National Register form because the nomination included only the Footprint impressions.

Future systematic survey work in the Footprints area will likely identify additional sites and structures that may be associated with the current site boundaries. It is recommended that the site boundaries be amended to include new associated features once they are identified. Other features that are functionally but not spatially associated with sites identified in the current project should be assigned new site numbers.

Features Not Located

Due to time and budget constraints, 188 features identified during the 1998 survey and determined to be within the project area could not be relocated in 2000-2001. The data provided by Wulzen (unpubl. ms. 1999) has, however, been incorporated in the Site Description section found in Appendix II. Although the data collected during the 1998 and 2000-2001 surveys are uneven, an attempt was made to incorporate as much information into one report as possible while noting areas of deficiencies in the data. All of the detailed site and feature data can be found in Appendix II.

Footprint impressions identified since 1991 were not relocated, and a survey for new prints outside of random test areas was not conducted, because the sand is continually shifting. Due to the ever-changing nature of the resource it was felt that footprint data collected to date needed to be synthesized before more effort was put into locating additional features. A brief synthesis of the footprint data available to date is available in Appendix I.

Summary of Survey Results

In his 1999 unpublished report, Wulzen documents 704 newly discovered features and 73 isolated artifacts. A review of the digital image files, however, found data for only 382 features. Of these 382 features 136 were determined to be outside of the project area or modern and are therefore not considered in this report. Thus, 246 features identified by the 1998 crew are located in the project area. Of these 246 features, 189 were not relocated by the 2000-2001 survey crew. The 2000-2001 crew gave the relocated features new temporary field numbers based on the 2000-2001 field survey numbering system. In addition to the relocated features, the 2000-2001 field crew identified 270 new features. In total, the 1998 and 2000-2001 field crew recorded 55 new sites consisting of 516 features (Table 6; Appendix II).

The features recorded from between 1998 and 2001 included walls, "C", "U" and "L"-shaped structures, trails, mounds, rock piles, enclosures, terraces, petroglyphs, caves, quarry areas, overhang-shelters, historic roads and corals. A GPS point of all artifacts was taken but artifacts were not collected during this phase of the survey.

Appendix II provides detailed information and evaluation of each site and feature identified during the 1998 and 2000-2001 survey projects. This appendix also contains a summary of the sites and component structures, with data on formal structure types and size of sites and structures. Correlation between the 1998 and 2000-2001 survey feature designations and numbers are made only where inconsistencies in the data from the two projects lead to confusion.

Combined, the 1998 and 2000 field crews conducted test excavations in three structures. The 1998 field crew excavated a single test unit (TU-1) in Site 23026, Feature 98-42). This unit was 100 cm^2 in plan view. The 2000 crew excavated two test units. The first test unit (TU-1) was a 100cm^2 in plan view and was excavated in Site 22974, Feature 98-562. Test Unit 2 (TU-2) was 100 x 50 cm and located in Site 22973, Feature 00-1 (cf. Feature 98-81).

Definition of Structure Types

Sites and features are categorized by formal characteristics based on Tomonari-Tuggle (1994) and Ladefoged et al. (1987). These categories attempt to separate formal types from functional interpretations. Functional interpretations are made for many of the features, however, in the absence of further evidence from subsurface testing they are not conclusive.

Several criteria are considered when developing functional interpretations for sites. They are: configuration and construction of surface features, location and density of features, the presence or absence of elements that may contribute to the interpretation (e.g. coral, waterworn stones, uprights, midden), and comparability with similar structures in similar environments. **Habitation** structures are either single features or complexes used for residential purposes including shelter and food processing. **Resource Procurement** refers to features related to the collection of material used for making tools such as volcanic glass or basalt quarry areas. And, resource procurement refers to features used to enhance and collect ground-nesting seabirds such as the excavated pits related to petrel nesting. **Markers** are features constructed and used to identify areas of importance such as trails, resource areas or habitation complexes. Markers include rock piles and mounds, commonly called *ahu* by Hawaiian archeologists. **Transportation** refers to features used for transit or movement across the landscape. These features usually include roads and trails.

All of the formal structures defined for the Footprints project are based on surface configuration and construction. Results from the three test excavations did not provide support for these conclusions (see below).

Mounds - free standing structures constructed of piled rock. Mounds have convex surfaces and well-defined, vertical or nearly so sides. Generally mounds are circular, oval or elongated. Mounds are generally defined as serving agricultural purposes or as boundary or trail markers. There are 67 mounds located in the project area.

Mound located on the Ke`moku flow. Photo National Park Service, Hawai`i Volcanoes National Park.

Rock Piles – unlike mounds, rock piles are loosely constructed piles of cobbles and/or boulders. They are not well-defined and are irregular in shape in both plan view and profile. Rock piles, when associated with soil areas are generally the remains of clearing for agriculture. As isolated structures, they may be poorly defined and may have no function. Rock piles are often constructed by Park staff and visitors to define Park trails and for other symbolic reasons, and thus may add to the problems with interpretation. The 1998 and 2000-2001 crews identified 11 rock piles in the project area.

Walls are generally low, linear structures. Most of the walls are constructed of loosely stacked, cobble to boulder-sized basalt. Walls range in height. Some may be relatively low while others have considerable height. Many extend off (perpendicular to) a lava flow or another feature. Walls can serve as physical boundaries to define or separate specific areas. They can also serve as soil or water retention features. Walls are typically twice as long as they are wide. Eighty-seven walls occur in the project area.

C-shape adjacent to the Ke`amoku flow. Photo HAVO CRM.

C-shaped, L-shaped and U-shaped structures are walls that form a "C," "L" or "U" shape. C-shapes are roughly circular but are not completely enclosed. U-shaped structures have a longer length to width ratio (at least 2:1). All three structures may incorporate the natural lava flow as part of its construction (usually as a third side). U-shaped structures usually consist of two parallel walls that are adjacent, or connected to a flow. U-shaped structures differ from walls in that they form a relatively close enclosed area. It is also possible to have L-shaped structures which can be defined as having two walls set at right angles to one another. All of these features likely functioned as habitation areas. There are 119 C-shapes, 23 U-shapes and nine L-shapes in the project area.

Lithic Workshops are areas where fine-grained basalt material has been intentionally removed (quarried) and altered for possible use as a tool. Evidence of quarrying would be scarring of the natural surface or removal of pieces of surface rock. Evidence of alteration of the material for tool use would be the discovery of lithic

reduction materials, or debitage, including flakes and cores. There are eight lithic workshops in the project area.

Enclosures are features that, unlike C-shapes and U-shapes, are defined by an enclosing wall. The plan view of enclosures can be circular, oval, rectangular or square. The interior surface areas of the features located on the Keʻāmoku *ʻaʻā* flow is generally cleared and level. No midden or artifacts were found in the structures, but their construction suggests they served a residential function. The use of these features may have been transient or may have involved non-depositional activities, or may have been part of ranching activities (cattle, goat or sheep pens). The project area contains 60 enclosures, two of which are historic corrals.

Volcanic Glass Quarries are areas where volcanic glass, also known as chill glass, was collected. Two types of lithic raw materials were used to produce stone tools in the precontract period, volcanic glass and dense fine-grained basalt. Volcanic glass can be found on certain *pāhoehoe* lava flows. When the conditions are right, lava cools and forms a glassy surface. This surface varies in thickness from a thin rind to several centimeters. The quality of the glass also varies. Good quality glass is not only thick, but clear. Poorer quality glass may have only a thin, dull rind. Many of the quarries, where the flow was broken up and the glass removed in chunks are the latter kind of flow. Volcanic glass was used to make cutting tools. There are 28 volcanic glass quarries in the project area.

Closeup of excavated volcanic glass. Note shiny black surface where glass has not been removed versus the vesicular area where glassey surface no longer remains. Photo National Park Service, Hawai'i Volcanoes National Park.

Modified Overhangs are any naturally formed crevice (predominately occurring in *ʻaʻā* flows). Overhangs, unlike caves, have limited interior development. Many overhangs have been modified to accommodate at least one or two individuals. Usually, modifications consist of a cleared interior floor and/or paving and constructed exterior walls. The depth of overhangs is generally short, thus within overhangs there is no dark-zone. There are 38 modified overhangs.

Lava Tube Caves are large cavities that are formed when rivers of *pāhoehoe* lava flows crust over and "develop more or less continuous roofs, and thenceforth the lava stream flows within a tunnel of its own making" (MacDonald et al. 1986). Unlike overhangs, caves have a dark zone and occur in *pāhoehoe* flows. Many caves have been modified to accommodate a few individuals or groups of individuals. Usually, modifications consist of a cleared interior floor, constructed interior and exterior walls, the building of hearths and sleeping platforms. There are 12 caves in the project area.

Cupboards are small cavities that are formed either naturally in lava flows or are constructed. A cupboard is generally used as a cache to store items for safekeeping. There are three cupboards in the project area.

Worn and Constructed Trails are linear features found across the *ʻaʻā* or *pāhoehoe* surfaces. Worn trails refer to paths where the surface of the *pāhoehoe* flows are worn down from continual travel across the area by humans or animals on foot or on horseback. Constructed trails usually occur across *ʻaʻā* lava flows. The *ʻaʻā* clinkers and boulders are modified in such a way as to create smoother paths across the flow. In some areas flat or waterworn stepping-stones may be placed to aid the hiker. Three trails consisting of four segments were found on the *pāhoehoe* flows in the project area and across the Keʻāmoku *ʻaʻā* lava flow.

Petroglyph also called "rock art." Areas pecked or chiseled into the natural lava flow surface. Petroglyphs generally represent anthropomorphic (humanlike) figures, animals, or symbols or historic lettering. At least three petroglyphs, primarily historic lettering was found in the project area.

Terraces are distinguished from platforms by having between one and three sides raised and potentially faced. The surface of a paved terrace is smooth and level. Terraces are not freestanding as a platform or wall would be. There are 28 terraces in the project area.

Distribution of Roads, Trails, and Associated Mounds and Rock Piles

Two historic roads and three trails (consisting of four segments) were identified in the Footprints project area. Portions of the Peter Lee Road (Site 22997) and the Kaʻū Road (Site 23034) were located in the northwest corner of the Footprints Historic District boundary. These roads were identified by Wulzen (unpub. ms. 1999). No descriptive information was provided in the 1999 draft report. In 2001, a 1907 and 1927 map of the Kīlauea area was scanned and the location of the roads and trails were digitized into ArcView. The field data match the digitized data nearly perfectly. By 1927 the Kaʻū Road replaced the Peter Lee Road as the main route from Kaʻū to Hilo. The roads overlap inside the HAVO boundary across the Kīlauea flows. At least four mounds are associated with the roads in the area of overlap. These mounds may be distinguishing one route from the other. Once the Keʻāmoku flow is intersected on the east, the roads diverge, with the Kaʻū road taking a more southerly route. The 1927 map was interesting. It indicated that the Peter Lee Road forked just at the HAVO boundary. One segment runs northeast through HAVO while the other runs north outside of HAVO and then crosses into the park again through the Mauna Loa Connecting Strip. The section associated with the Connecting Strip is not commonly known and has not been identified in the field.

The four trails that were identified in the Footprints project area include the Kaʻū Volcano Trail (Site 22982), the Old Puna Kaʻū Trail (Site 23021), the Keʻāmoku Cross Trail (Site 23033) and the Halfway House Trail (Site 23032). The Kaʻū Volcano Trail is the longest trail identified in the project area and consists of two parallel segments. Both segments follow a northeast/southwest direction. The trail segments lie parallel

to and east of the Ke`āmoku flow. Although the 1998 crew collected data on the trail, data collection ended at the HAVO boundary. The 1907 and 1927 historic maps suggest this trail continues in a southerly direction and links up with the lower portion of the `Ainapō Trail and the Old Puna Ka`ū Trail (Figure 18). Thus, in an area near the edge of the Park's western boundary is the start of a major transportation network that links the Ka`ū District to Kīlauea, Hilo, the upland resources of Mauna Loa and the mid-elevation communities.

Just southwest of the National Register boundary but north of the `Ainapō/Puna Ka`ū junction is the Halfway House Trail. This trail is nearly perpendicular to the Ka`ū Volcano Trail and lies in a east/west direction. Comparing the location of the Ka`u Halfway House digitized from the 1927 map to its present location this trail leads directly to the house.

Approximately 4,000 m northeast of the Halfway House Trail is a second trail that cuts across the Ke`āmoku flow in an east/west direction. We have named this trail the Ke`āmoku Cross Trail because it crosses over the Ke`āmoku flow. The trail was cleverly constructed to cross the shortest segment of the flow thus minimizing the amount of effort needed to build it and the distance to cross over the Ke`āmoku flow.

All of the trails were likely used during the historic period. Along the Ka`ū Volcano trail historic glass, ceramic and horseshoes were found. Only the Halfway House Trail, however, is believed to be a historic trail. Mounds and rock piles are prominently found in association with the Ka`ū Volcano Trail, the Puna Ka`ū Trail and the Ke`āmoku Cross Trail. Known as "*ahu*" these structures were often used by Hawaiians to mark routes and important areas thus making them more visible on the landscape. All of the mounds and rock piles were incorporated under the site number of the trail they are associated with.

Structure Distribution and General Characteristics

The current project suggests that surface structures are extensive along the eastern edge of the Ke`āmoku flow and followed much the same pattern as the trail systems. Structures appear to cluster in the recessed areas at the base of the flow and along the upper edge on top of the *`a`ā* lava flow. Some sections of the flow have larger clusters of features than other sections. At least 24 large clusters of features (greater than 10 structures) occur along the flow edge (Figures 10 - 13).

In some areas along the Ke`āmoku flow features are virtually continuous along the edge of the flow. Features that occur away from the Ke`āmoku flow generally are associated with trail systems. This may be a factor of survey methodology, however, and more features may exist east of the trails on the open *pāhoehoe.*

Of the features identified in the Ka`u Desert, C-shapes (24%), L-shapes (2%), and U-shapes (5%) constitute 31% of the structures found in the Footprints area. Other common features include mounds (13%), walls (17%), and enclosures (11%). Modified overhangs (8%), volcanic glass quarries (6%), and terraces (6%) make up lesser categories of structure types.

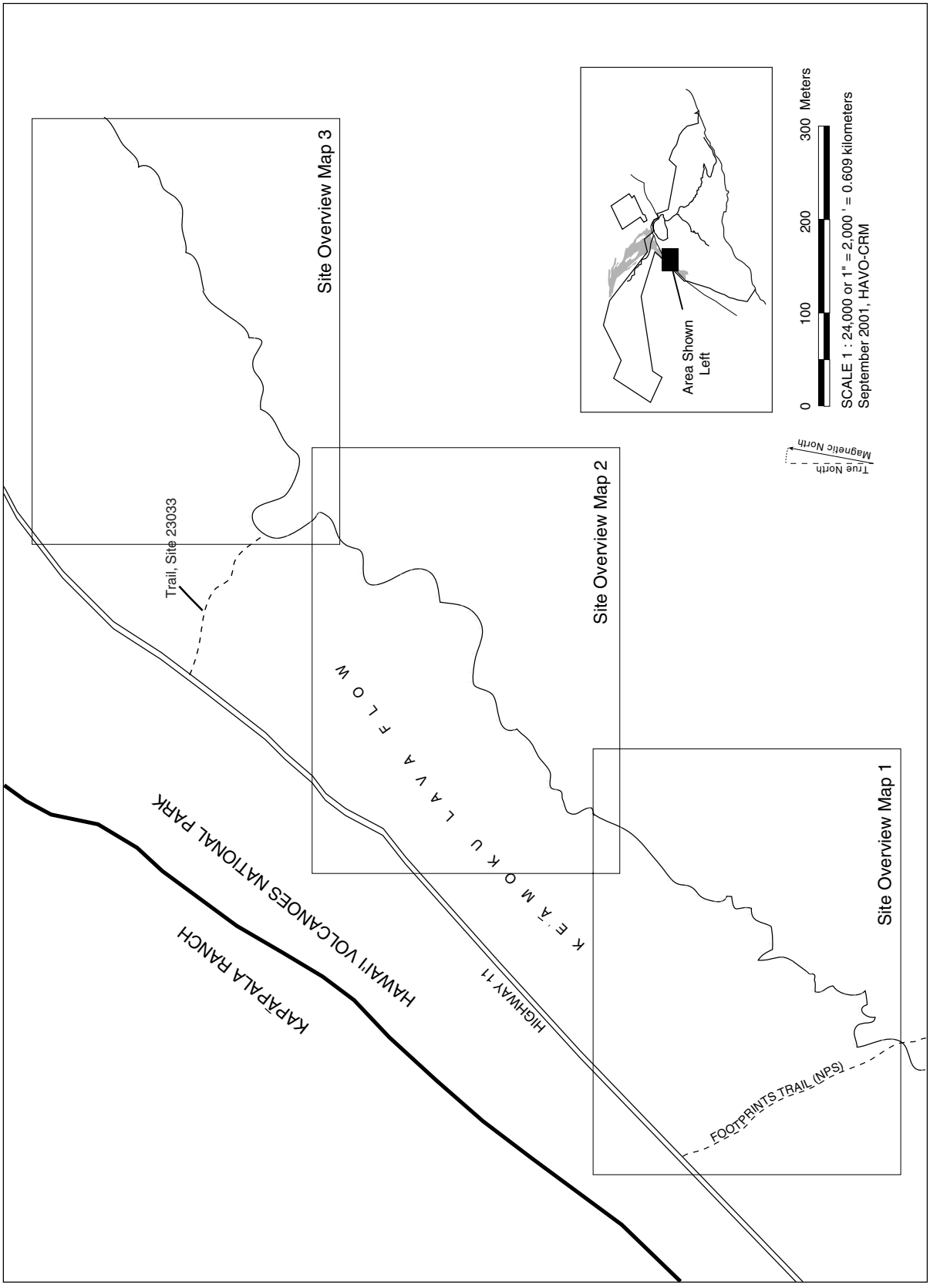


Figure 10. Selected survey area maps for 2000 - 2001 project.

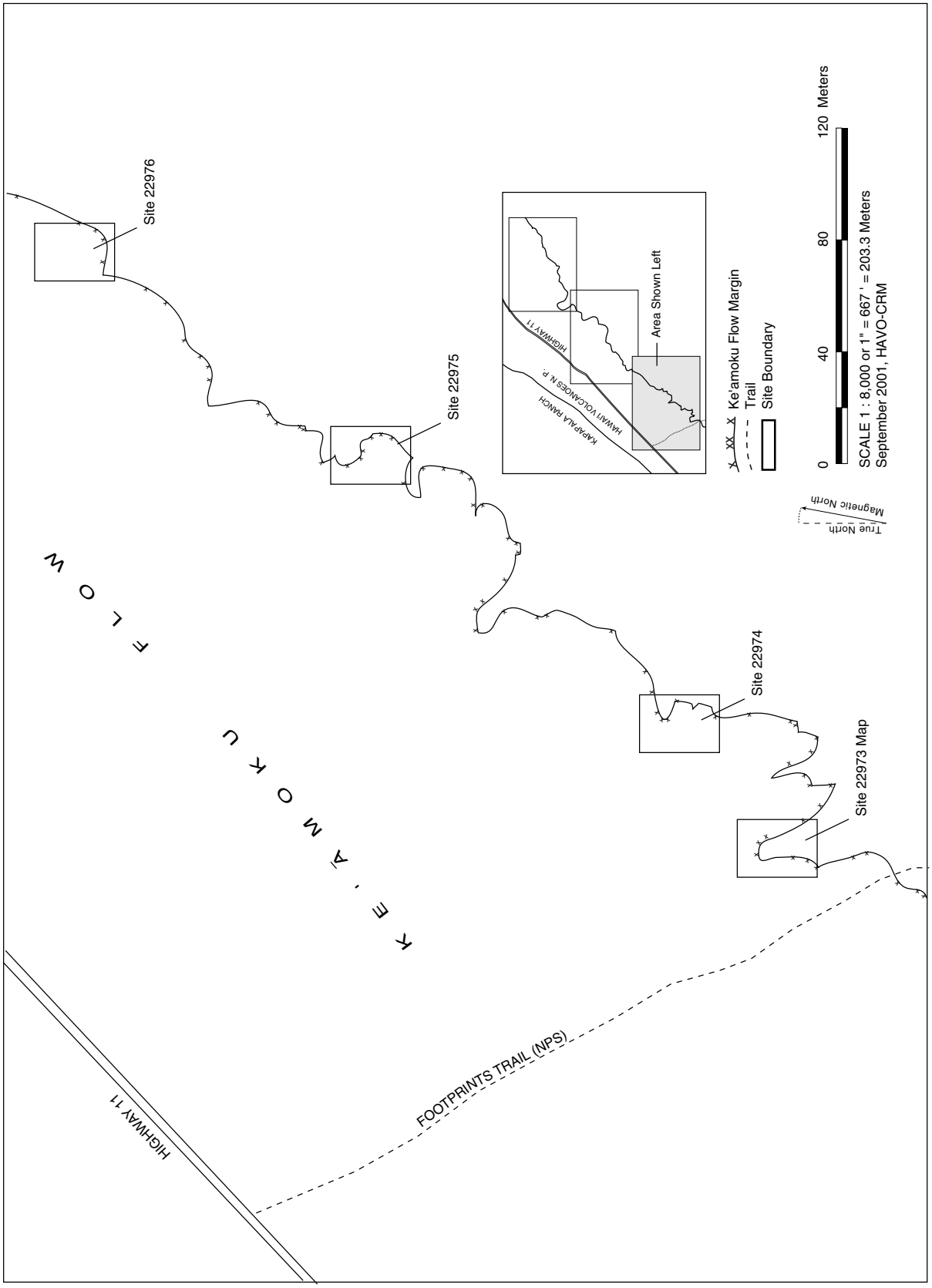


Figure 11. Site Overview Map 1.

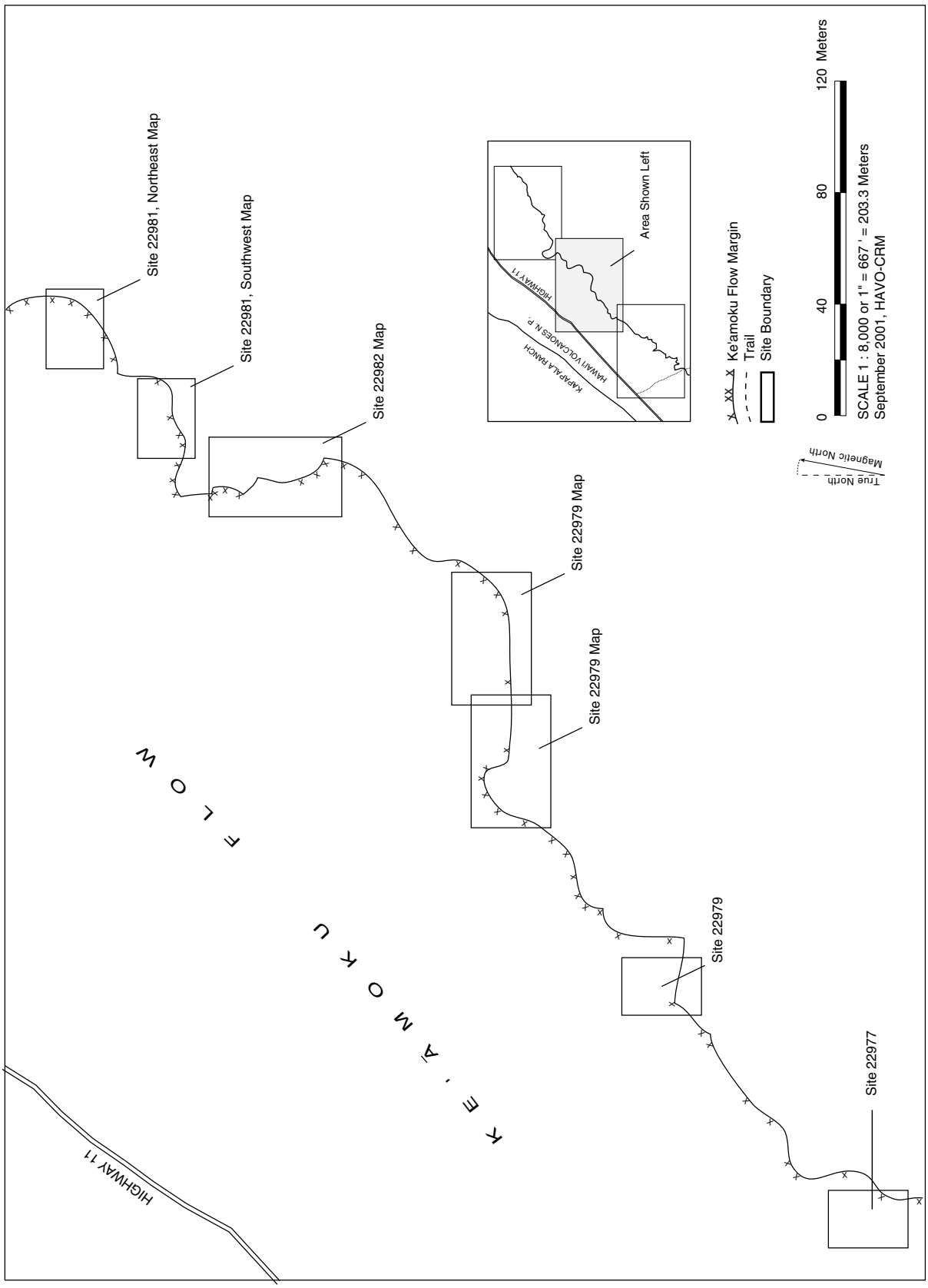


Figure 12. Site Overview Map 2.

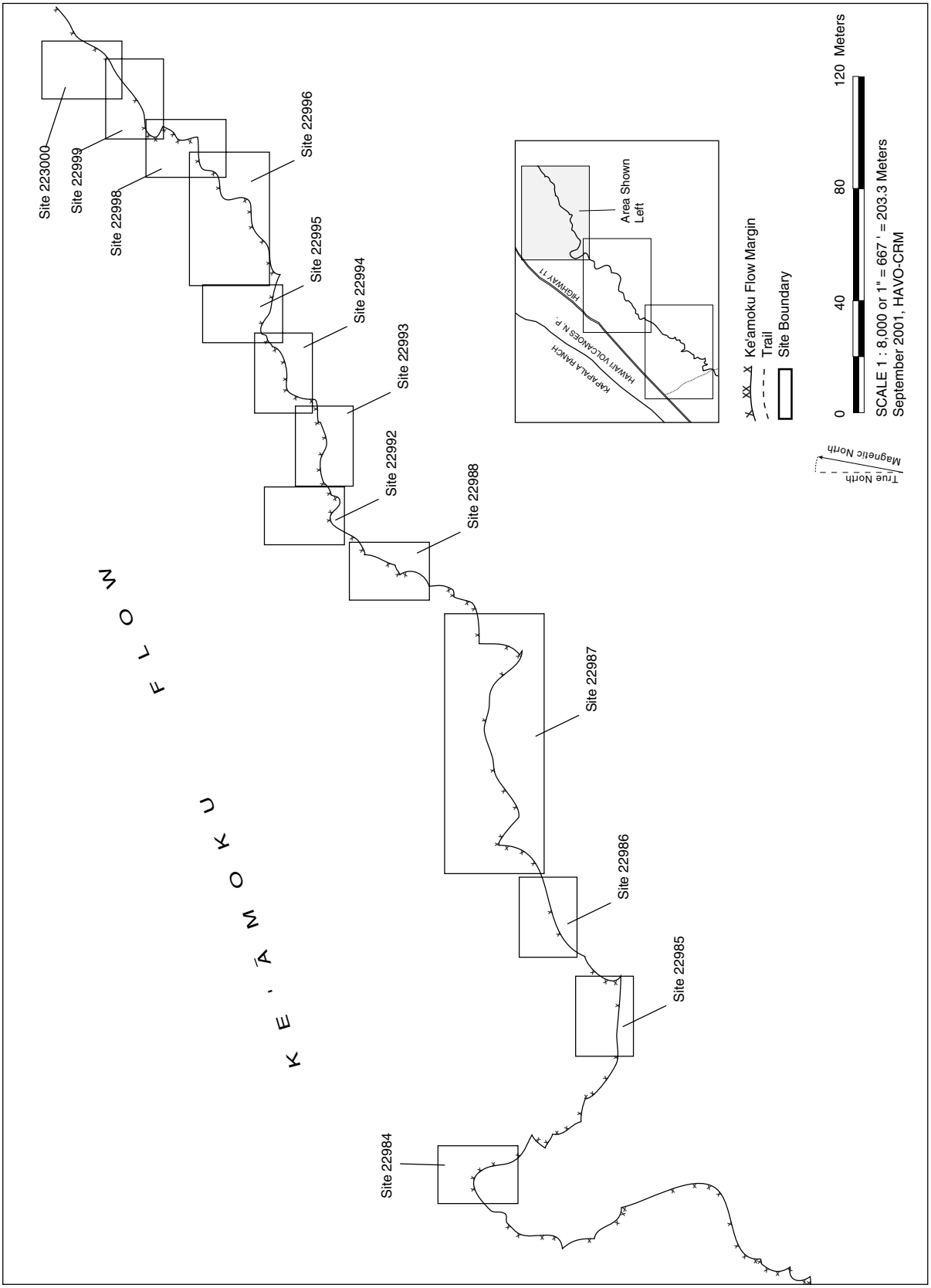


Figure 13. Site Overview Map 3.

Volcanic Glass Quarries and Lithic Workshops

Two sites contain lithic workshops in the project area. The first is Site 23007 which is located within close proximity to Crater Rim Road and Kīlauea Crater. This site consists of several features spread across a 600 m area. The features consist of a lithic block ejected from Kīlauea during its explosive eruptive phase. The blocks are fine-grained basalt material suitable for making stone tools such as Hawaiian adze. Archeologists have found numerous workshops north of Kīlauea Crater with associated adze preforms and flakes (Moniz Nakamura in prep).

Two additional lithic workshops (Site 23000 and 23022) identified in the project area are scattered across the landscape. These sites are remnants of flake reduction of dense black basalt. These features are not associated with the ejected lithic blocks and are likely remnants of "testing" of local materials rather than repeated use.

The volcanic glass quarries identified in the project area cluster at the south head of the Keʻāmoku lava flow and between the base of the flow and the Keʻāmoku Cross Trail (Figure 18). Thus, these features although numerous (28 total) are found in a relatively small area, just over two miles (3,742 m) across the landscape. Sample size and feature distribution may be skewed due to survey methodology. However, many of the quarries are found in close proximity to the Kaʻū Volcano Trail (Site 22982) thus suggesting Hawaiians were purposefully gathering this material as they traveled through the area along known trail routes.

Structures Used for Habitation

A large majority of the non footprint features identified during the 1998 and 2000-2001 projects are features related to habitation. These features include natural sheltered areas such as caves and modified overhangs as well as constructed shelters such as "c," "u," and L-shaped structures, enclosures, platforms, walls and terraces. The natural shelter areas are usually modified with the addition of walls that likely served as wind breaks and cleared level floor areas for comfortable seating. No surface midden or hearths were noted in the overhangs. However, ʻŌhiʻa Cave (Site 23006) does contain at least one hearth and a lithic work area (see Appendix II).

Like the modified natural shelters, the constructed structures also lacked surface midden and apparent hearth features. Almost all of the structures were built on or near the base of the Keʻāmoku flow as part of their construction. Many of these structures are located within recessed areas of the Keʻāmoku *ʻaʻā* lava flow. These inlets represent areas where the lava has flowed in such a way as to create a natural area protected from the prevailing, and at times strong, winds. The Keʻāmoku flow also provided most of the building material for the structures. Hawaiians utilized loose cobbles and boulders from the Keʻāmoku flow to create structure walls.

Some structures located on the undulating *pāhoehoe* are built up against the Keʻāmoku flow edge. Thus, the builders incorporated a natural feature as part of

the construction. This methodology for building habitation sites maximized the natural resources available as well as cut the time and energy needed to build the structures. None of the structures showed evidence of cultural deposits. Most of the C-shapes and enclosures show evidence of ash buildup in the interior of the feature and may contain some subsurface cultural remains.

The structures are likely temporary, used as people were traversing through the desert on their way to and from Ka`ū and Hilo. The temporary nature of these features is indicated by the almost complete lack of midden and traditional artifacts and hearths. The construction style of these shelters (small, single room non-complex) suggests they were likely quickly and rather easily built. The structures thus reflect an overall low intensity (in duration), transient use of the area. The vast number of shelters and their association with trails that cross the project area suggests a consistent number of people traversed the area over a long period of time.

Few traditional artifacts were found in the desert. These generally consisted of probable volcanic glass flakes and one possible adze blank. Upon further examination it was determined that the adze blank is likely natural rather than cultural. Archeologists occasionally identified historic artifacts including bottle glass and horseshoes on the surface of the flows. The crew obtained a GPS point for each artifact, some of them were photographed, but none were collected.

The Ke`amoku flow is younger than the adjacent pāhoehoe flow whose source is Kīlauea, and is believed to be between 600 and 750 years old. Thus, the features and trails identified during this survey are at least 200 years old but not older than 650 years. Therefore, Hawaiians may have been traveling through this area between 1300 and 1750 A.D.

A significant number of the structures were found on or along the Ke`āmoku lava flow. This initial survey suggests more features may be found on this flow if the main body of the flow is surveyed more intensively. Additional features including trails, mounds, rock piles, habitation structures, and quarries may still exist on the p4o *pāhoehoe* flow if they were not all covered by the 1920 eruption. In 1932, Jaggar wrote that "stone structures used by the native wayfarers were overflowed by the lava of 1920 on the east side of Mauna Iki." Due to the nature of the 1998 and 2000-2001 surveys, it is likely that further surveys in the Footprints area would identify additional structures on both the Ke`āmoku flow and the adjacent p4o *pāhoehoe* flow.

Results of Test Excavations

Archeologists excavated three structures in the Footprints area between 1998 and 2001. Excavation units ranged from 50 x 100 cm to 100 x 100 cm in area. The primary purpose of testing was to identify the function of the structure and to determine site age through either direct (radiocarbon) or indirect methods (relative construction to ash and lava flows).

In 1998, a single test unit was excavated in Site 23026, Feature 98-42. This unit was 100 x 100 cm in area. In 2000, two test units were excavated. The first test unit (TU-1) was a 100 cm^2 unit in plan view and was excavated in Site 22974, 98-562. Test Unit 2 (TU-2) was 100 x 50 cm in area and located in Site 22973, Feature 1 (cf. Feature 98-81).

All excavations were dug with trowels by natural layers, with 5 cm arbitrary levels used for increased control. Where soil was present, it was screened through ¼-inch mesh screen (except bulk samples). Where appropriate, excavators sketched profiles and plan views. All excavations were backfilled at the end of the testing portion of the project.

The content and characteristics of the matrix encountered in each natural layer from each test unit is summarized below. None of the excavations contained cultural deposits. Archeologists recovered charcoal only from Site 23026, Feature 98-42.

Site 23026, Feature 98-42

Warren Wulzen, Jim Kauahikaua, Laura Carter Schuster, and Don Swanson excavated this feature in 1998. Wulzen (unpubl. ms. 1999) described feature 98-42 as a 400 x 450 x 21 cm enclosure. A single 100 cm^2 test unit was placed over two upright stones in the southwest corner of the structure (Figure 14). Excavation of the south half of the unit proceeded first. Five natural layers were identified (Table 2 and Figure 15). No midden or subsurface features such as a hearth was identified to confirm the function of the structure as temporary habitation. However, within Layer III a basalt shim was identified under the upright stone. This shim was likely placed there to stabilize the upright.

At least five charcoal samples were collected from Layer III. Two of these samples were submitted for radiocarbon analysis (Table 3). The samples were processed at the USGS lab in Reston Virginia and determined by AMS techniques at Lawerence

Table 2. Stratigraphic Layers and Excavation Levels in TU-1, Site 23026.

LAYER	DEPTH (cmbd)	DESCRIPTION OF MATRIX
I	30 to 43	Loose lithic debris, gravel size, very dark brown
II	43 to 45	Silty clay; dark brown. Upper several millimeters are gray, accretionary lapilli-bearing ash
III	45 to 47	Sandy ash, orange surface
IV	47 to 49	Hard, sandy ash; dark yellowish brown
V	49 to 57	Loose, poorly vesicular pumice 1-2 cm diameter, with scattered lithic clasts to 2 cm diameter; brown to black

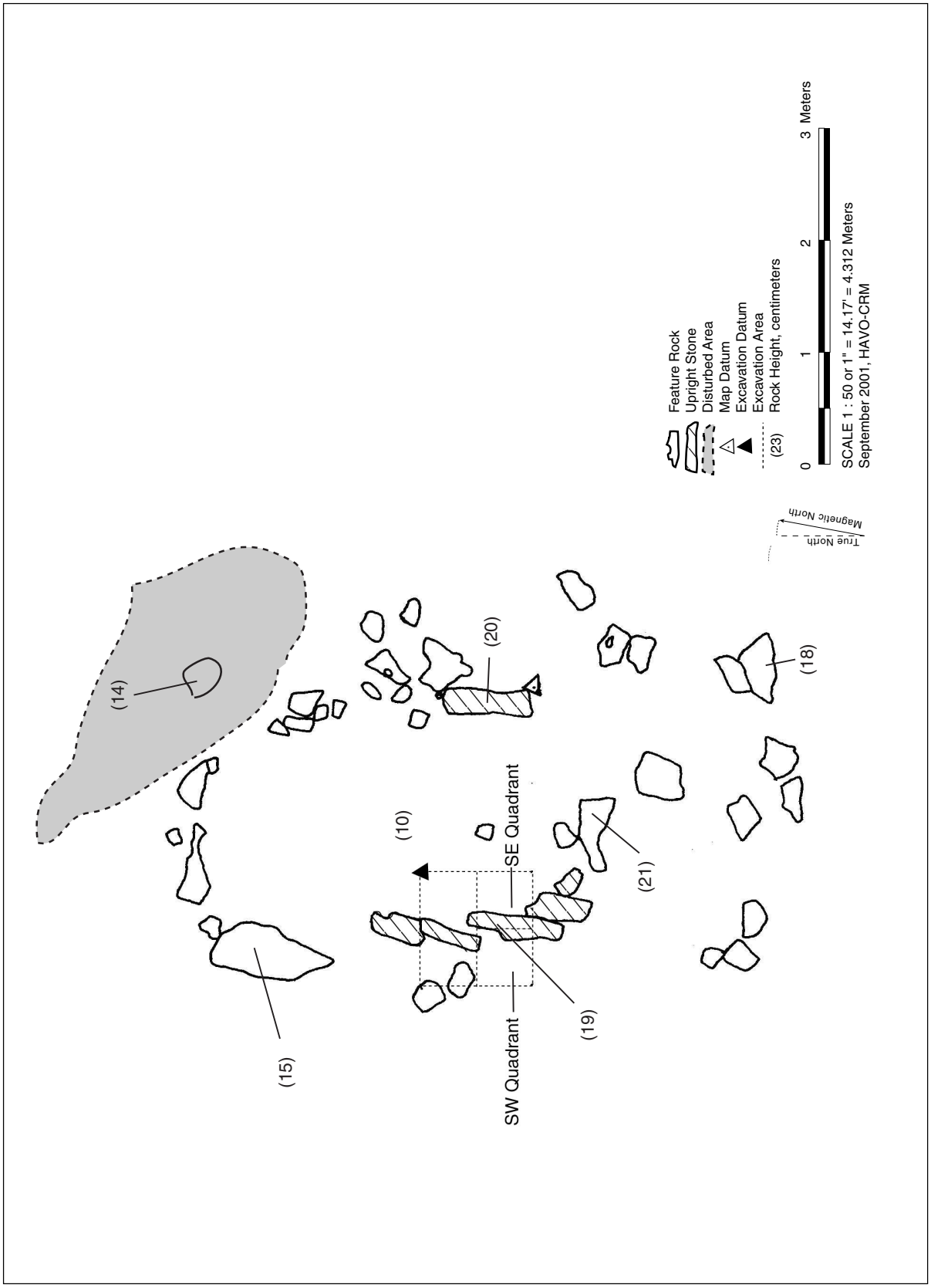


Figure 14. Planview of Feature 98-42, Site 23026.

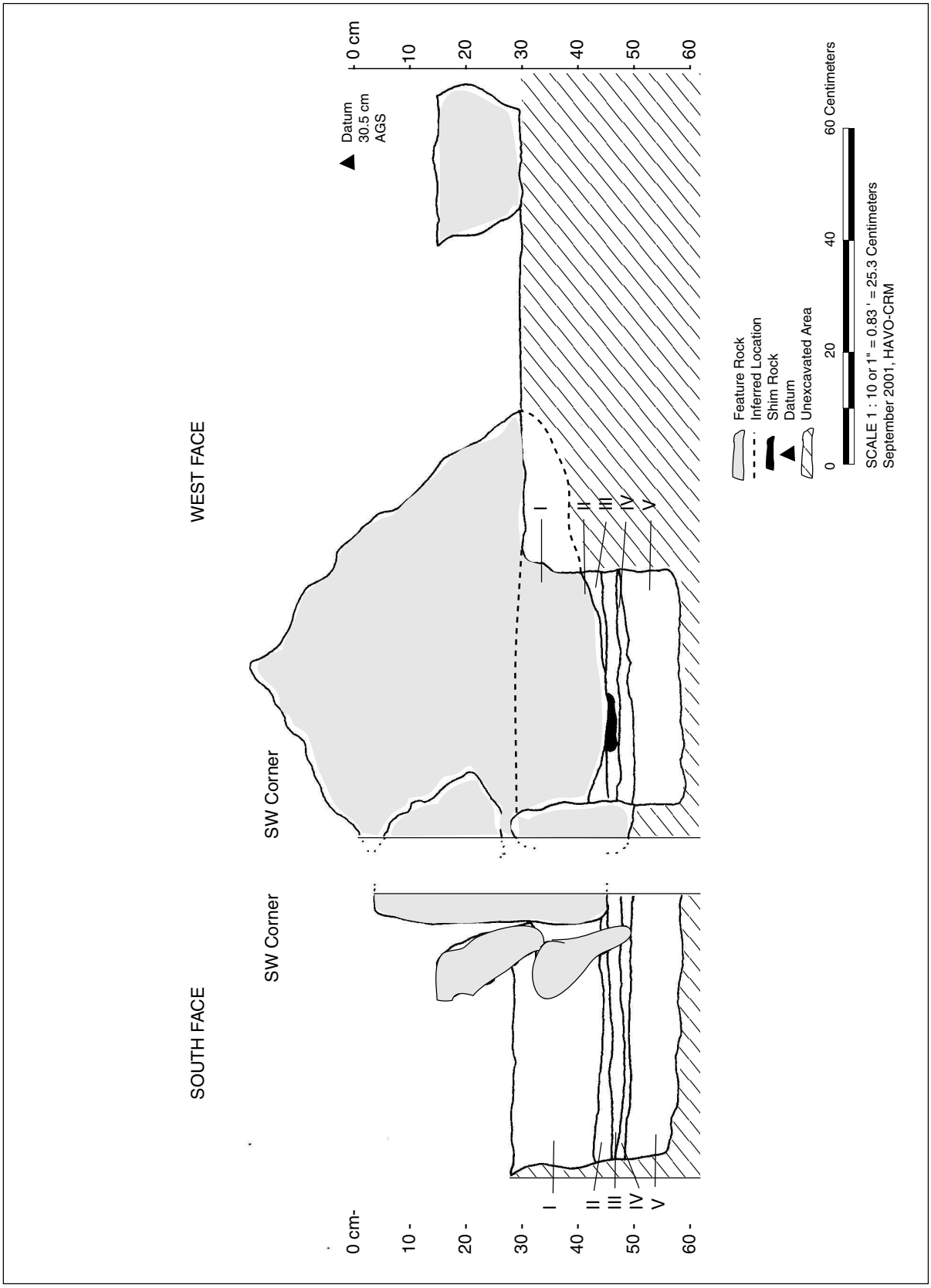


Figure 15. Profile of excavation of feature 98-42, Site 23026.

Livermore laboratory (data provided by D. Swanson, USGS). Although the charcoal samples were not identified to species prior to submission, the pieces submitted were small and suggested that only small bushes, such as *pūkiawe* were burned (Swanson pers.comm., Nov. 12, 1998 e-mail correspondence). The AD calendar ages were calculated using the program CALIB version 4.3.

Site 23026, Feature 98-42 prior to excavation. Photo National Park Service, Hawai`i Volcanoes National Park.

Excavation results suggest that the feature was built during a break in the explosive Keanakāko`i eruption of Kīlauea. The shim and upright stones were built on top of at least one ash layer (Layer IV) and within a second (Layer III). The results of the radiocarbon analysis support this interpretation. The analysis suggests that Feature 98-42 was constructed between A.D. 1642 and 1790, after the Keanakāko`i eruption began.

Table 3. Radiocarbon Data from Site 23026.

SITE/FEATURE	LAYER	LAB. NO.	MATERIAL	^{14}C AGE YRS. BP	CAL AD RANGE (2σ)^2	p value
23026/98-42	III	WW 2251	charcoal	190 ± 50	1642 –1712 1716 – 1887 1911 - 1950	0.242 0.605 0.152
23026/98-42	III	WW 2252	charcoal	160 ± 40	1662 - 1711 1717 - 1886 1911 - 1950	0.181 0.648 0.170

Site 22974, Feature 98-562

A single test unit (TU-1) was excavated in this site in 2000. The feature tested is a volcanic glass quarry site. A natural layer, approximately 3-4 cm thick, of fair to poor volcanic glass material is found in Feature 98-562. Quarrying of this material is evident by excavated basalt and volcanic glass cobbles stacked in a somewhat organized fashion in the area. The flat *pāhoehoe* surface surrounding the excavated and stacked materials exhibits clear evidence of volcanic glass that has been removed. Volcanic glass was utilized by precontact Hawaiians as cutting tools. This material can be shaped into extremely sharp knives and blades that were used to butcher animals and fine woodwork.

M. Durst and W. Costa excavated this feature in 2000 with initial contributions by a group of local intermediate and junior high school students. The excavated unit was 100 cm^2. It was placed partially over an area devoid of surface rock larger than small angular pebbles, and a concentration of angular cobbles and small boulders that exhibit facing. The rock mound and unit was 3 m south of a *pāhoehoe* tumulus that exhibits a thin layer of volcanic glass on the surface. Sediment has collected to the north and the west of the feature. Angular blocky and tabular stones are strewn across the immediate area. The facing is evident along the western edge of the mound and extends beyond the limits of the test unit.

TU-1 Feature 98-562. Photo courtesy of National Park Service, Hawai'i Volcanoes National Park.

Two natural layers were identified during excavation (Table 4, Figure 16). No midden or subsurface features were identified. No rock or stone fragments exhibited characteristics of flint knapping debitage were identified thus suggesting quarried materials were removed and reworked elsewhere. No charcoal was identified or collected.

Table 4. Stratigraphic Layers and Excavation Levels in TU-1, Site 22974.

LAYER	DEPTH (cmbd)	DESCRIPTION OF MATRIX
1a	17 - 20	7.5 YR 5/6 to 7.5YR 4/6. Dry hard medium grained sand. Lapilli bearing layer
1b	12 – 14.5	10 YR 3/3 dark brown to 10 YR 3/4dark yellow brown fine silt
2		2.5 YR 3/3 dark olive brown fine to medium grains to 2.5 YR 2.5/1 black medium grains
Lens 1		10 YR 3/3 hard cemented medium grains with lapilli.

Excavation results suggest that the area was quarried both before the explosive Keanakāko'i eruption of Kīlauea and after. Quarried rock was found on the natural p4o flow surface, below all of the ash layers, as well as nearby on the surface of the final ash layer that was deposited. Much of the sediment represented by Layer I/b has been reworked and redeposited likely by wind and water. Reworking is evident in the profile by three dark sand lenses (10 YR 2/1) that have been deposited within Layer I/b (Figure 16). The three lenses interspersed within Layer 1/b represent only a fraction of the microstratigraphic lenses throughout the unit. These lenses clearly are the result of fluvial forces in the area.

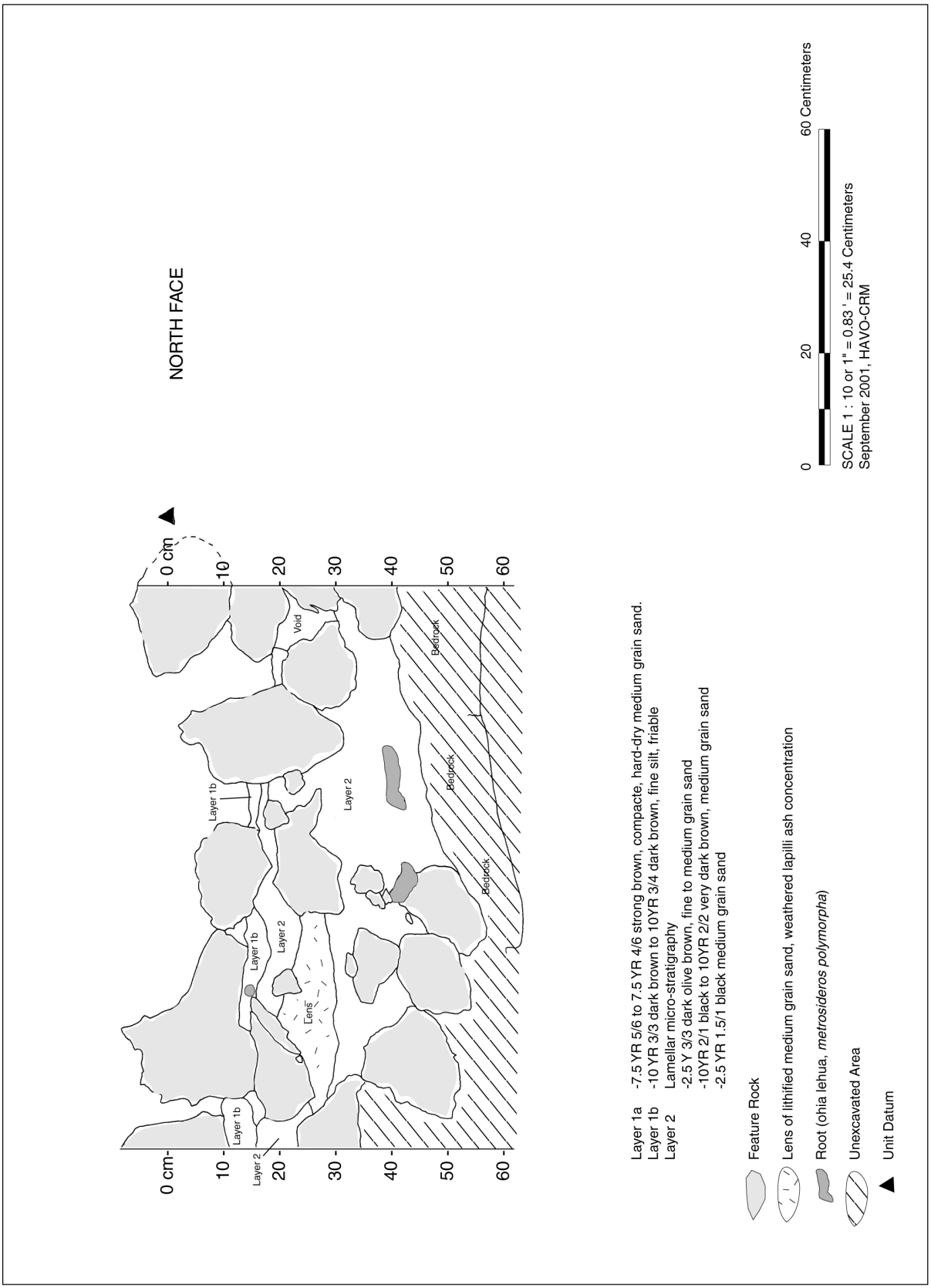


Figure 16. Profile of excavation at Site 22974.

Site 22973, Feature 1

A second test unit (TU-2) was excavated in 2000. This unit was 100 x 50 cm. This feature is a C-shaped structure that is 2.0 m x 2.5 m and 46 cm high. The structure was likely used as a temporary shelter utilized by precontact Hawaiians traveling along the ancient trail systems in the area. No surface or subsurface artifacts were recovered.

This feature was excavated in 2000 by the author, M. Durst and W. Costa with initial contributions by a group of local intermediate and junior high school students. The excavation unit was placed across the northeast end of the feature including a portion of the structure wall within the unit. The test unit was positioned to straddle either side of the feature wall so feature construction could be identified. Initially 100 cm^2 was going to be excavated. However, it was later decided that only the southern half would be removed so that the integrity of the structure could be preserved and construction sequence more fully noted in the profile.

The stratigraphy of this site is fairly complex yet highly instructive of the formation of the site (Table 5). The surface of the feature is composed of a thin, hard, rocky 1790 ash lens (Layer 1a) that is probably a representation of a big explosion (D. Swanson pers. comm. 2000). Layer lb represents an erosional layer that has removed and replaced much of Layer 1a in the northern half of the unit. Layer 1b represents a second ash event that has been repeatedly reworked by wind and water over time. (Figure 17). This layer has numerous microstratigraphic layers within it suggesting that wind and water had a predominant role in its deposition. The deposit is well sorted and may have taken decades of reworking. Layer 1a is only evident in the north wall, and is what remains of the original lapilli bearing layer that has not been subject to disturbance by wind and water. Layer 1a is more consolidated than Layer 1b and likely capped any further reworking of Layer 1b in the area that it is conserved. Layer 2a is comprised of gravelly pebble-sized matrix which sits on top of the p4o *pāhoehoe* flow. Within this layer there are glass chips or "flakes" that have exfoliated from the *pāhoehoe* surface.

Table 5. Description of Stratigraphic Layers and Levels in TU-1, Site 22974.

LAYER	DEPTH (cmbd)	DESCRIPTION OF MATRIX
1/a	18 - 19	2.5 Y 5/6 light olive brown fine sand; compact, slightly hard plates.
1/b	19 – 55	Fine to medium grain 10 YR 2/1 black sand. Irregularly shaped in profile
1/c	55 – 57	10 YR 2/1 to 10 YR 2/2 black sand to very dark brown fine sand
2	55 – 68	10 YR 3/3 dark brown to 10 YR 3 /4 dark yellow brown fine silt

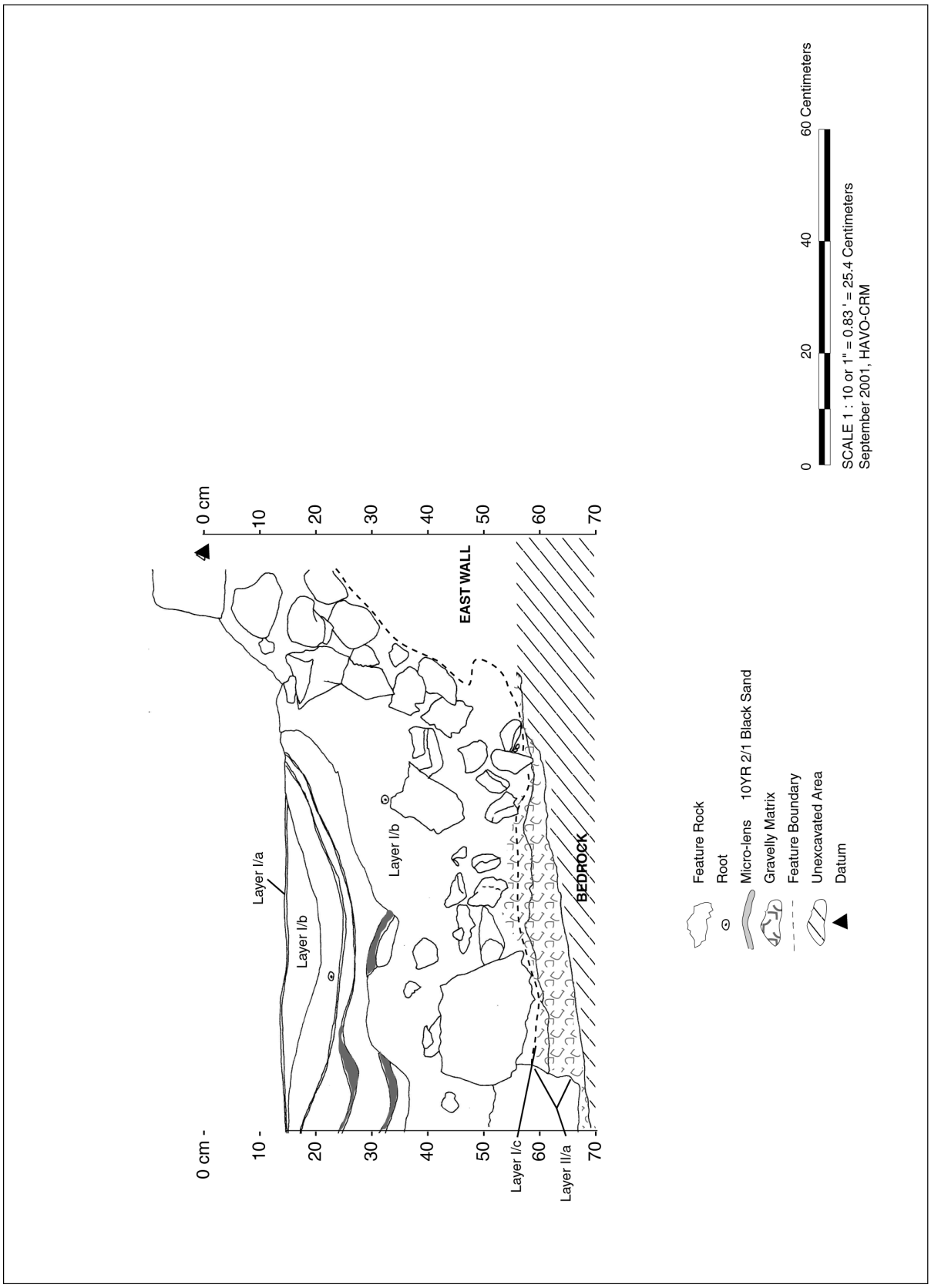


Figure 17. Profile of excavation at Site 22973.

No midden, subsurface features, or charcoal were identified. Excavation results suggest that the feature was constructed before the explosive Keanakāko'i eruption of Kīlauea as the base rocks used to construct the C-shape lies on the p4o *pāhoehoe* surface, below all of the ash layers.

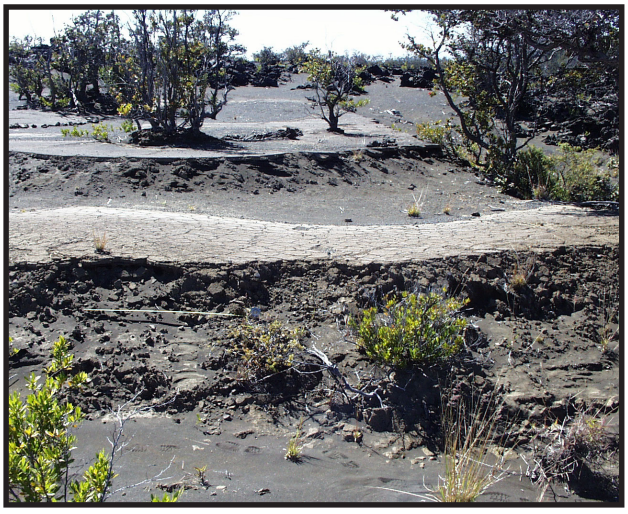
Footprints Distribution and General Characteristics

> "In the spring of 1920... Mr. R.H. Finch discovered the prints... In current exploration of the desert these ancient trails have been photographed and knowledge of them is increasing... it is still doubtful whether the main trail passes Kīlauea on the north or the south side. The lapilli and coarser beds near the crater are not suitable for preserving impressions. Footprints have been found about a mile Northeast of Mauna Iki along what seem to be two different routes. There is no possibility of these footprints being modern" (Jaggar 1932).

In the 1998 draft survey report (Wulzen unpubl. ms. 1999) Wulzen reported identifying 79 footprint impression localities. He estimated that these localities represented 898 prints, or 125 minimum number of individuals (MNI) (Wulzen unpub. ms. 1999). Wulzen also reviewed the data provided by Miller (unpub. ms.1992) and digitized Miller's data into a GIS layer. The 1992 project report suggested that Miller found 162 footprint locations. Within these locations Miller (unpubl. ms.1992) reported that he recorded 2,648 footprints representing a minimum of 598 individuals (Miller 1992). A review of Miller's field forms in 2000, however, accounted for only 1,773 footprints (441 MNI). A review of the CRM digital files did not turn up the Wulzen (unpub. ms. 1999) footprint files. Figure 8 thus represents the prints identified only by Miller (unpub. ms.1992). From Miller's survey we have an idea of the gross distribution of prints across the desert.

Jaggar was not only the first to write about the prints, he was also the first to note that there are two footprint bearing ash layers in the desert; each separated by 90

Two different ash bearing layers. Note the older (lower) layer in the foreground, and the younder (upper) layer in the background. These layers have not been firmly dated, and it is not known how many days, weeks, or months may have lapsed between the deposition of the two layers. Photo courtesy of National Park Service, Hawai'i Volcanoes National Park.



cm of dune sand. Jaggar (1921) was the first to suggest that the lower ash layer contains less footprints and all of the prints point away from the caldera. He surmised that these must be the prints of the army of Keōua leaving the area. The upper ash layer, he surmised, was probably deposited several days or weeks later and contains many footprints going both towards and away from the caldera. This, he suggested, is from the army again, when they returned to retrieve the bodies of their fellow warriors.

Additional data gathered from the area may help narrow the time frame for the creation of the prints. The HAVO museum collection contains a footprint impression removed at some point from the Ka`ū Desert. This impression was later returned to the Park as part of the Peter Lee Collection donated by Gilbert and Bernice Lee. The donation was accepted by then Park Superintendant, David Ames on August 18, 1982 and later accessioned into the permanent collection (catalog number HAVO 796). Upon brief inspection by the author, it was noted that a piece of charcoal was imbedded in the footprint. Radiocarbon analysis of this piece of charcoal suggests the footprints were formed between A.D. 1522 and A.D. 1811. Thus, this data correlates with other radiocarbon data collected from the area.

At this point, based solely on the footprint impressions, we cannot completely discount the hypothesis posed by Jaggar. However, we do know that the prints are not all concentrated in one general area of the desert (Figure 8). If the prints were only from the army of Keōua, then we would expect all of the prints to be heading in the same general direction, in the same general area. To test Jaggar's (1921) hypothesis, a random survey of twenty acres across the desert was conducted. The goal of the survey was to identify footprint impressions and to note their occurrence. Of the twenty locations randomly selected by ArcView, footprints were identified in six locations. At least three of these locations do not occur in the general vicinity where other footprints had been identified, and the prints point away from and towards the crater as well as east to west.

Today we know that more than just footprint features occur in the desert. The architectural structures, trail systems, and wide distribution of footprint impressions strongly suggest people other than the warriors of Keōua may have formed many of the footprints.

Summary – The Nature of Historic Resources in the Footprints Area

A majority of the archeological features identified during the 1998 and 2000-2001 surveys were found along the edge of the Ke`āmoku lava flow. The Ke`āmoku flow is very distinctive, and Hawaiians likely used it for three purposes. First, it provided a visual boundary on the western side of the desert to navigate from; second, the *`a`ā* provided available material to construct temporary habitation shelters and mounds; and finally, the inlet areas of the flow provided protection against the tradewinds that sweep through the desert.

Structures

A high-density cluster of features is especially predominate in the recessed areas of the flow. These inlets represent areas where the lava has flowed in such a way as to create a natural area protected from the prevailing, and at times strong, desert winds. Many of the structures are also constructed in such a way that the highest side is the east wall of the structure. This construction method was likely adopted as a means to block the prevailing easterly winds.

From the Ke`āmoku flow, inhabitants of the area obtained building material for the structures. Loose *`a`ā* cobbles and boulders are utilized to create structure walls. Some structures located on the undulating *pāhoehoe* are built up against or into the Ke`āmoku flow edge, thus incorporating a natural feature as part of the construction. Building the structures in this way maximized the natural resources available as well as cut the time and energy needed to build them.

Excavations at three archeological features indicate that the structures and quarry areas were built or utilized both before the Keanakāko`i eruption as well as in the intermediate period between the deposit of the two major ash layers. No midden or subsurface features were identified during the excavations thus strongly supporting the idea that the structures found in the Ka`ū Desert had limited, short-term, but perhaps repeated use.

Trails and Roads

Trail systems and historic roads were also identified during the survey. At least four major trail systems converge south of the Ke`āmoku flow thus suggesting a major transportation network existed in this area in the precontact and historic periods. A string of mounds running parallel with the Ke`āmoku flow marked the direction and route travelers took to get to and from Kīlauea. The trails that cross the p4o *pāhoehoe* flow are evident as well-worn paths on the surface of the "p4o" *pāhoehoe* flow. Trails that cross the Ke`āmoku *`a`ā* flow appear as vaguely cleared paths with flat paving stones in some areas. Historic documents confirm that these trails were well known and consistently used. In Ellis'(1963) journal account of his travel through this part of the desert, he tells of an event when his native guides were unable, for a moment, to find the trail route. Ellis expressed his admiration for the guides who were able to identify features on the landscape that indicated the correct routes to take.

Precontact Hawaiians had extensive trail systems throughout the islands. These trails were well established by the time Europeans arrived. The trails were a necessity for linking the residents of an *ahupua`a* or district with both the upland and lowland resources. Trails that cut across *ahupua`a* and district boundaries were also important for maintaining communication and the social fabric of Hawaiian life. Thus, coastal, mountain, mid-elevation and *mauka-makai* (mountain to the sea) trails abound.

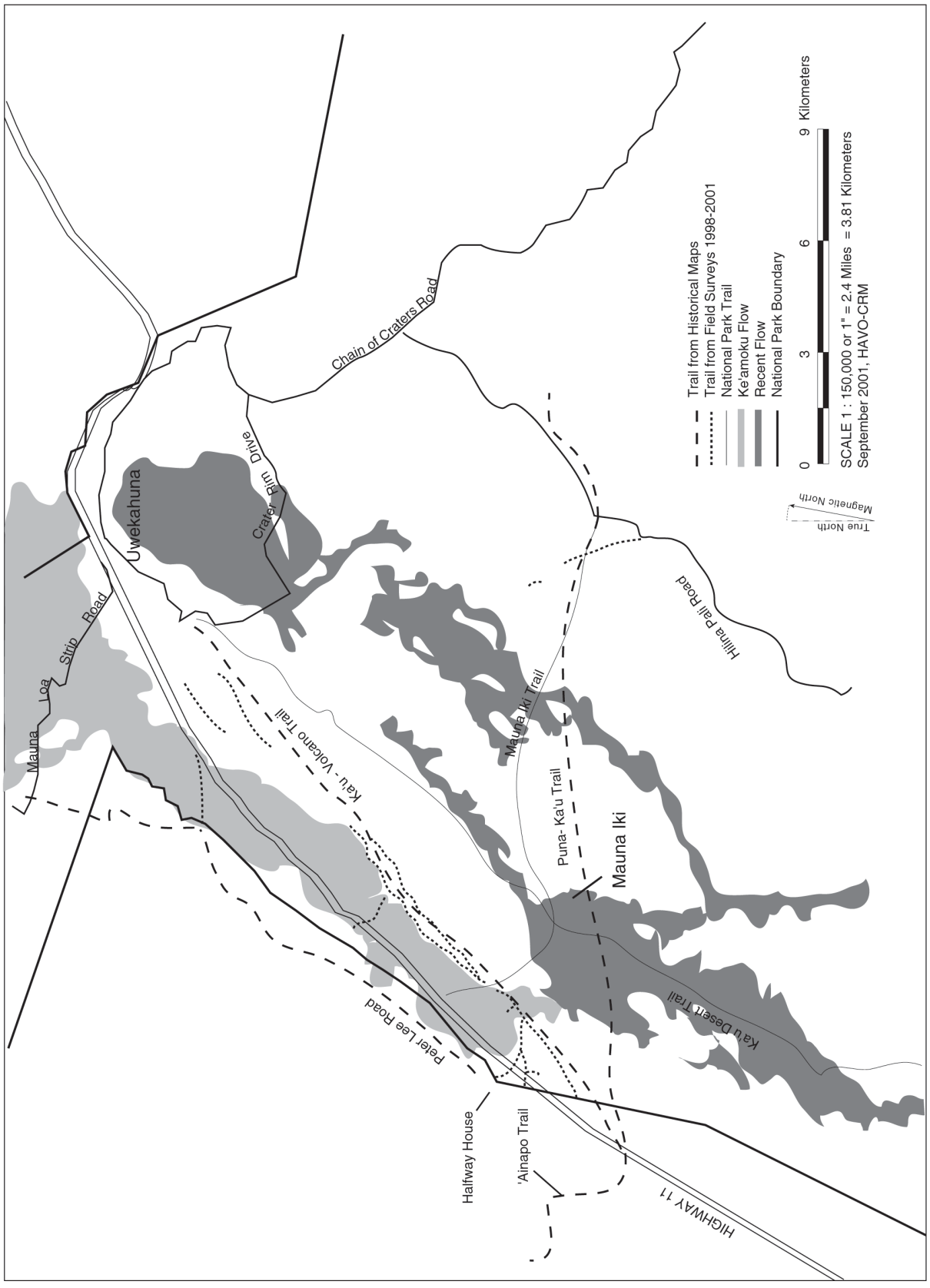


Figure 18. Trails systems in the project area.

The Ka`ū Desert trails were also used during the historic period. Maps, dating to 1910, clearly suggest that these trails were well-known routes of transport through the desert. Neighboring ranch hands no doubt traveled these routes to and from Hilo and Ka`ū until the development of roads. All of the roads that linked Hilo and Ka`ū during the historic periods were identified in the project area to the north of the 1790 Footprints National Register boundary.

Resource Procurement

Travelers moving through the desert not only used the area for shelter and transport, but they also gathered raw materials here. Volcanic glass quarries have been identified in the vicinity of trail systems. The glass has been removed, or quarried, out of the flow surface. Rocks moved during this process have been stacked in a somewhat systematic fashion in the immediate area. These quarry features are similar to other volcanic glass sites located at the 6,000 ft. elevation in the saddle region between Mauna Loa and Mauna Kea. Its not clear whether the area in the desert was being used by those actively pursuing glass, or the glass was gathered as people were traveling through for purposes other than resource procurement. There does not appear to be any reworking of the materials at the sites, thus suggesting raw material was removed and modified elsewhere. Like the excavation at the shelter sites, excavation at one of the quarry areas shows that the volcanic glass was being quarried before the Keanakāko`i eruption series began and during a lull in the eruption.

Footprints

The data collected on the footprint impressions proves that the prints extend beyond the current 1790 Footprints National Register boundary to the north, south and east. The prints suggest people were traveling in both a northeasterly and southwesterly direction. South of the Ke`āmoku flow prints are also aligned east/west. Overall the prints suggest people were traveling along at least two and possibly three known routes. Because of the shifting nature of the sands in the Ka`ū Desert it will be difficult to obtain a clear and precise picture of the footprints distribution. However, footprint impressions can be found east and south of the Ke`āmoku flow and west of the 1974 Kīlauea flow (Figure 8).

Patterns in the Desert

The 1998 and 2000-2001 surveys shed new light in the interpretation of the Footprints area. Although these projects have been important for expanding our knowledge of the site Jaggar must be given credit for recognizing many of the features archeologists have since "discovered." Ahead of his time in many ways, Jaggar recognized what he thought to be two different footprint routes or trails through the area as well as two different ash-bearing layers with footprints going in either direction (Jaggar 1921). In addition, Jaggar (1921:116) also noted that "there is no sign of the pedestrians running" thus suggesting the people who made the prints were not in a

panic. Jaggar would probably not be surprised by the number of precontact architectural features identified by archeologists in the area. In 1921 Jaggar was the first to comment that "stone shelters used by the native wayfarers were overflowed by the lava of 1920 on the East Side of Mauna Iki." His comments suggest the number and distribution of features in the desert was much more widespread than currently documented.

It is understandable that Jaggar would link the eruptive event to the story of Keōua. Little was known about Hawaiian archaeology, precontact settlement and exchange patterns at that time. The idea that trail systems crossed the desert and provided important routes of communication and trade was not known. The idea that the native structures, noted in 1921 by Jaggar, were widespread and numerous was not recognized. The idea that this area was repeatedly used for habitation and resource procurement by local Hawaiians was not imagined at this time. It was not until well after the 1950s that archaeologists began to look beyond the coast, into the interior areas to understand precontact Hawaiian settlement patterns, resource procurement, and transportation. And it was not until the late 1990's that archeologists began to explore the larger more complex story of the Footprints area.

Conclusion

Although our work in the area is far from completed, several new pieces of information can be added to the Parks interpretive story of the Footprints area. First, it is clear that the boundary of the National Register does not include all of the known footprints. Secondly, the footprints are not the only archeological features in this part of the desert; there is more to the history of this area then just the story of the footprints. The sheer number of temporary shelters all along the Ke`āmoku flow as well as the trail systems and quarry sites strongly suggests that this area was frequently used by Hawaiians traveling to and from the caldera; travel did not begin and end with the army of Keōua. Finally, because of the evidence for repeated activity and use of the Ka`ū Desert, some of the footprints may likely be from Hawaiians other than the Army of Keōua traveling through the area.

The archeological evidence, coupled with historic documentation and geologic research, strongly suggests that Hawaiians frequently traveled through this area both before and after the 1790 ash eruption. Eruptive events were common to the residents of the Puna and Ka`ū districts, and they adapted well to these situations. Geologic evidence suggests that the modern Caldera of Kīlauea could have formed shortly after A.D. 1470. The last time the Caldera subsided was before the 1790 event. Thus, for over 400 years the Caldera may, at times, have been below the water table; a time when these kinds of eruptive events would have been common. Despite the frequent explosiveness of the Caldera, the features found in the desert area suggests that Hawaiians did not shy away from this area even though they had frequent experiences with Pele and the forces of Kīlauea. Living with earthquakes and devastation by eruptions and lava flows were a fact of life that did not permanently drive people away from the here. Rather, Native Hawaiians learned to adapt to their environment and thrived under conditions few people today could imagine.

Table 6. Site and Feature Data from 1998 and 2000 surveys.

Site Number	Temp. Feat. #	Formal Type	Function	Project	N.R. Eligibility*
5505	98-300	Historic Structure	Interpretation	Wulzen 98	
22973	1	C-shaped struc.	Habitation	CRM 2000	D
22973	2	C-shaped struc.	Habitation	CRM 2000	D
22973	3	C-shaped struc.	Habitation	CRM 2000	D
22973	4	C-shaped struc.	Habitation	CRM 2000	D
22973	5	Enclosure	Habitation	CRM 2000	D
22973	6	Enclosure	Habitation	CRM 2000	D
22973	7	U-shaped struc.	Habitation	CRM 2000	D
22973	8	Wall	Habitation	CRM 2000	D
22973	9	Wall	Habitation	CRM 2000	D
22973	10	Wall	Habitation	CRM 2000	D
22973	11	Wall	Habitation	CRM 2000	D
22973	12	Mound	Marker	CRM 2000	D
22973	13	C-shaped struc.	Habitation	CRM 2000	D
22973	14	Wall	Habitation	CRM 2000	D
22973	6a	Mound	Marker	CRM 2000	D
22973	6b	Mound	Marker	CRM 2000	D
22973	6c	Mound	Marker	CRM 2000	D
22973	9a	Rock Pile	Marker	CRM 2000	D
22973	9b	Rock Pile	Marker	CRM 2000	D
22973	9c	Rock Pile	Marker	CRM 2000	D
22974	15	Modified Overhang	Habitation	CRM 2000	D
22974	98-491	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
22974	98-550	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
22974	98-562	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
22974	98-563	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
22974	98-564	Wall	Habitation	Wulzen 98	D
22974	98-565	Modified Outcrop	Resource Procurement	Wulzen 98	D
22974	98-590	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
22974	98-83	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
22975	16	Modified Overhang	Habitation	CRM 2000	D
22975	17	C-shaped struc.	Habitation	CRM 2000	D
22975	98-587	Modified Overhang	Habitation	Wulzen 98	D
22975	98-87	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
22976	18	U-shaped struc.	Habitation	CRM 2000	D
22976	19	Modified Overhang	Habitation	CRM 2000	D
22976	20	C-shaped struc.	Habitation	CRM 2000	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
22976	21	C-shaped struc.	Habitation	CRM 2000	D
22976	23	U-shaped struc.	Habitation	CRM 2000	D
22977	24	Rock Pile	Marker	CRM 2000	D
22977	25	U-shaped struc.	Habitation	CRM 2000	D
22977	98-598	Enclosure	Habitation	Wulzen 98	D
22977	98-92	Enclosure	Habitation	Wulzen 98	D
22977	98-92a	Petroglyph	Art/Communication	Wulzen 98	D
22977	98-94	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
22978	26	Rock Pile	Marker	CRM 2000	D
22978	27	Mound	Marker	CRM 2000	D
22978	28	Enclosure	Habitation	CRM 2000	D
22978	29	Rock Pile	Marker	CRM 2000	D
22978	30	Enclosure	Habitation	CRM 2000	D
22979	31	Enclosure	Habitation	CRM 2000	D
22979	32	Modified Overhang	Habitation	CRM 2000	D
22979	33	U-shaped struc.	Habitation	CRM 2000	D
22979	34	U-shaped struc.	Habitation	CRM 2000	D
22979	35	Modified Overhang	Habitation	CRM 2000	D
22979	36	Enclosure	Habitation	CRM 2000	D
22979	37	Wall	Habitation	CRM 2000	D
22979	39	C-shaped struc.	Habitation	CRM 2000	D
22979	40	C-shaped struc.	Habitation	CRM 2000	D
22979	42	Modified Overhang	Habitation	CRM 2000	D
22979	43	Modified Overhang	Habitation	CRM 2000	D
22979	46	Modified Overhang	Habitation	CRM 2000	D
22979	47	Wall	Habitation	CRM 2000	D
22979	48	C-shaped struc.	Habitation	CRM 2000	D
22979	49	C-shaped struc.	Habitation	CRM 2000	D
22979	50	U-shaped struc.	Habitation	CRM 2000	D
22979	51	Mound	Habitation	CRM 2000	D
22979	300a	Enclosure	Habitation	CRM 2000	D
22979	300b	C-shaped struc.	Habitation	CRM 2000	D
22979	38a	U-shaped struc.	Habitation	CRM 2000	D
22979	38b	U-shaped struc.	Habitation	CRM 2000	D
22979	41a	Modified Overhang	Habitation	CRM 2000	D
22979	41b	Mound	Marker	CRM 2000	D
22979	44a	Enclosure	Habitation	CRM 2000	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
22979	44b	Enclosure	Habitation	CRM 2000	D
22979	45a	Enclosure	Habitation	CRM 2000	D
22979	45b	Enclosure	Habitation	CRM 2000	D
22979	45c	Enclosure	Habitation	CRM 2000	D
22979	98-101	Mound	Marker	Wulzen 98	D
22979	98-250	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
22979	98-251	Wall	Habitation	Wulzen 98	D
22980	52	C-shaped struc.	Habitation	CRM 2000	D
22980	54	C-shaped struc.	Habitation	CRM 2000	D
22980	55	Wall	Habitation	CRM 2000	D
22980	56	Wall	Habitation	CRM 2000	D
22980	57	C-shaped struc.	Habitation	CRM 2000	D
22980	58	Wall	Habitation	CRM 2000	D
22980	59	Terrace	Habitation	CRM 2000	D
22980	60	C-shaped struc.	Habitation	CRM 2000	D
22980	61	Wall	Habitation	CRM 2000	D
22980	62	U-shaped struc.	Habitation	CRM 2000	D
22980	301	C-shaped struc.	Habitation	CRM 2000	D
22980	302	Modified Overhang	Habitation	CRM 2000	D
22981	63	C-shaped struc.	Habitation	CRM 2000	D
22981	64	Wall	Habitation	CRM 2000	D
22981	65	Modified Overhang	Habitation	CRM 2000	D
22981	66	Modified Overhang	Habitation	CRM 2000	D
22981	67	Enclosure	Habitation	CRM 2000	D
22981	68	Enclosure	Habitation	CRM 2000	D
22981	70	U-shaped struc.	Habitation	CRM 2000	D
22981	71	U-shaped struc.	Habitation	CRM 2000	D
22981	72	U-shaped struc.	Habitation	CRM 2000	D
22981	73	C-shaped struc.	Habitation	CRM 2000	D
22981	74	C-shaped struc.	Habitation	CRM 2000	D
22981	75	Modified Overhang	Habitation	CRM 2000	D
22981	76	U-shaped struc.	Habitation	CRM 2000	D
22981	77	Terrace	Habitation	CRM 2000	D
22981	303	Modified Overhang	Habitation	CRM 2000	D
22981	75b	Cupboard	Habitation	CRM 2000	D
22982	53	Mound	Marker	CRM 2000	D
22982	69	Modified Overhang	Habitation	CRM 2000	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
22982	315	Modified Outcrop	Resource Procurement	CRM 2000	D
22982	314a	Mound	Marker	CRM 2000	D
22982	98-111	Mound	Marker	Wulzen 98	D
22982	98-112	Wall	Habitation	Wulzen 98	D
22982	98-116	Mound	Marker	Wulzen 98	D
22982	98-117a	Mound	Marker	Wulzen 98	D
22982	98-117b	Mound	Marker	Wulzen 98	D
22982	98-117c	Mound	Marker	Wulzen 98	D
22982	98-120	Mound	Marker	Wulzen 98	D
22982	98-257	Wall	Habitation	Wulzen 98	D
22982	98-281	Wall	Habitation	Wulzen 98	D
22982	98-311	Mound	Marker	Wulzen 98	D
22982	98-312	Mound	Marker	Wulzen 98	D
22982	98-313	Mound	Marker	Wulzen 98	D
22982	98-425	Mound	Marker	Wulzen 98	D
22982	98-430	Mound	Marker	Wulzen 98	D
22982	98-431	Mound	Marker	Wulzen 98	D
22982	98-493	Mound	Marker	Wulzen 98	D
22982	98-494	Wall	Habitation	Wulzen 98	D
22982	98-511	C-shaped struc.	Habitation	Wulzen 98	D
22982	98-512	Mound	Marker	Wulzen 98	D
22982	98-557	Mound	Marker	Wulzen 98	D
22982	98-558	Mound	Marker	Wulzen 98	D
22982	98-559	Mound	Marker	Wulzen 98	D
22982	98-585, 98-473, 98-85, 98-400, 98-440, 98-310, 98-483	Trail - Kau Volcano Trail	Transportation		D
22982	98-789	Mound	Marker	Wulzen 98	D
22982	98-790	Mound	Marker	Wulzen 98	D
22982	98-791	Mound	Marker	Wulzen 98	D
22982	98-793	Mound	Marker	Wulzen 98	D
22982	98-794	Mound	Marker	Wulzen 98	D
22982	98-795	Mound	Marker	Wulzen 98	D
22982	98-796	Mound	Marker	Wulzen 98	D
22983	98-624	Cave	Habitation	Wulzen 98	D
22984	78	C-shaped struc.	Habitation	CRM 2000	D
22984	79	C-shaped struc.	Habitation	CRM 2000	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
22984	80	L-shaped struc.	Habitation	CRM 2000	D
22984	81	Rock Pile	Marker	CRM 2000	D
22984	82	Mound	Marker	CRM 2000	D
22984	83	Modified Overhang	Habitation	CRM 2000	D
22984	305	Mound	Marker	CRM 2000	D
22984	84a	Terrace	Habitation	CRM 2000	D
22984	84b	Terrace	Habitation	CRM 2000	D
22984	98-293	Mound	Marker	Wulzen 98	D
22984	98-84	Mound	Marker	Wulzen 98	D
22985	85	Modified Overhang	Habitation	CRM 2000	D
22985	86	C-shaped struc.	Habitation	CRM 2000	D
22985	87	Wall	Habitation	CRM 2000	D
22985	88	Wall	Habitation	CRM 2000	D
22985	89	Enclosure	Habitation	CRM 2000	D
22985	90	Enclosure	Habitation	CRM 2000	D
22985	91	C-shaped struc.	Habitation	CRM 2000	D
22985	92	Wall	Habitation	CRM 2000	D
22985	93	C-shaped struc.	Habitation	CRM 2000	D
22985	94	Wall	Habitation	CRM 2000	D
22985	95	Modified Overhang	Habitation	CRM 2000	D
22985	308a	Wall	Habitation	CRM 2000	D
22985	308b	Wall	Habitation	CRM 2000	D
22985	86a	Hearth	Habitation	CRM 2000	D
22986	96	Modified Overhang	Habitation	CRM 2000	D
22986	97	Modified Overhang	Habitation	CRM 2000	D
22986	98	Wall	Habitation	CRM 2000	D
22986	99	Modified Overhang	Habitation	CRM 2000	D
22986	100	Modified Overhang	Habitation	CRM 2000	D
22987	101	U-shaped struc.	Habitation	CRM 2000	D
22987	102	Terrace	Habitation	CRM 2000	D
22987	103	Enclosure	Habitation	CRM 2000	D
22987	104	Modified Overhang	Habitation	CRM 2000	D
22987	105	Modified Overhang	Habitation	CRM 2000	D
22987	106	Enclosure	Habitation	CRM 2000	D
22987	108	Wall	Habitation	CRM 2000	D
22987	109	C-shaped struc.	Habitation	CRM 2000	D
22987	110	L-shaped struc.	Habitation	CRM 2000	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
22987	111	Modified Overhang	Habitation	CRM 2000	D
22987	112	C-shaped struc.	Habitation	CRM 2000	D
22987	113	Enclosure	Habitation	CRM 2000	D
22987	114	Wall	Habitation	CRM 2000	D
22987	115	Wall	Habitation	CRM 2000	D
22987	116	Modified Overhang	Habitation	CRM 2000	D
22987	117	Wall	Habitation	CRM 2000	D
22987	118	U-shaped struc.	Habitation	CRM 2000	D
22987	119	Wall	Habitation	CRM 2000	D
22987	120	Enclosure	Habitation	CRM 2000	D
22987	121	Terrace	Habitation	CRM 2000	D
22987	122	C-shaped struc.	Habitation	CRM 2000	D
22987	123	Wall	Habitation	CRM 2000	D
22987	124	Enclosure	Habitation	CRM 2000	D
22987	125	Enclosure	Habitation	CRM 2000	D
22987	126	Enclosure	Habitation	CRM 2000	D
22987	127	C-shaped struc.	Habitation	CRM 2000	D
22987	128	C-shaped struc.	Habitation	CRM 2000	D
22987	129	U-shaped struc.	Habitation	CRM 2000	D
22987	130	Terrace	Habitation	CRM 2000	D
22987	131	L-shaped struc.	Habitation	CRM 2000	D
22987	132	C-shaped struc.	Habitation	CRM 2000	D
22987	133	Wall	Habitation	CRM 2000	D
22987	134	Modified Overhang	Habitation	CRM 2000	D
22987	135	Wall	Habitation	CRM 2000	D
22987	136	U-shaped struc.	Habitation	CRM 2000	D
22987	137	Wall	Habitation	CRM 2000	D
22987	138	Wall	Habitation	CRM 2000	D
22987	139	U-shaped struc.	Habitation	CRM 2000	D
22987	140	C-shaped struc.	Habitation	CRM 2000	D
22987	141	Wall	Habitation	CRM 2000	D
22987	142	Wall	Habitation	CRM 2000	D
22987	143	C-shaped struc.	Habitation	CRM 2000	D
22987	144	Enclosure	Habitation	CRM 2000	D
22987	309	Marine Shell	Habitation	CRM 2000	D
22987	107a	Enclosure	Habitation	CRM 2000	D
22987	107b	C-shaped struc.	Habitation	CRM 2000	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
22987	123a	Wall	Habitation	CRM 2000	D
22987	123a	Wall	Habitation	CRM 2000	D
22987	98-282	Wall	Habitation	Wulzen 98	D
22988	145	Modified Overhang	Habitation	CRM 2000	D
22988	146	Enclosure	Habitation	CRM 2000	D
22988	147	C-shaped struc.	Habitation	CRM 2000	D
22988	148	C-shaped struc.	Habitation	CRM 2000	D
22988	149	C-shaped struc.	Habitation	CRM 2000	D
22988	150	C-shaped struc.	Habitation	CRM 2000	D
22988	151	Enclosure	Habitation	CRM 2000	D
22988	98-227	C-shaped struc.	Habitation	Wulzen 98	D
22989	152	Cave	Habitation	CRM 2000	D
22990	155	Cave	Habitation	CRM 2000	D
22991	154	Cave	Habitation	CRM 2000	D
22992	153	Wall	Habitation	CRM 2000	D
22992	156	C-shaped struc.	Habitation	CRM 2000	D
22992	157	Terrace	Habitation	CRM 2000	D
22992	158	Terrace	Habitation	CRM 2000	D
22992	159	C-shaped struc.	Habitation	CRM 2000	D
22992	160	C-shaped struc.	Habitation	CRM 2000	D
22992	161	Terrace	Habitation	CRM 2000	D
22992	162	Enclosure	Habitation	CRM 2000	D
22992	163	Modified Overhang	Habitation	CRM 2000	D
22993	164	Terrace	Habitation	CRM 2000	D
22993	165	C-shaped struc.	Habitation	CRM 2000	D
22993	166	Wall	Habitation	CRM 2000	D
22993	167	Rock Pile	Habitation	CRM 2000	D
22993	168	L-shaped struc.	Habitation	CRM 2000	D
22993	169	Terrace	Habitation	CRM 2000	D
22993	170	Terrace	Habitation	CRM 2000	D
22993	171	Terrace	Habitation	CRM 2000	D
22993	172	C-shaped struc.	Habitation	CRM 2000	D
22993	173	Terrace	Habitation	CRM 2000	D
22993	174	Terrace	Habitation	CRM 2000	D
22993	175	C-shaped struc.	Habitation	CRM 2000	D
22993	176	Platform	Poss. Burial?	CRM 2000	D
22993	177	C-shaped struc.	Habitation	CRM 2000	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
22993	178	Modified Overhang	Habitation	CRM 2000	D
22993	179	L-shaped struc.	Habitation	CRM 2000	D
22993	180	L-shaped struc.	Habitation	CRM 2000	D
22993	181	Terrace	Habitation	CRM 2000	D
22993	182	Wall	Habitation	CRM 2000	D
22993	183	L-shaped struc.	Habitation	CRM 2000	D
22993	184	Wall	Habitation	CRM 2000	D
22993	185	Wall	Habitation	CRM 2000	D
22993	186	Cave	Habitation	CRM 2000	D
22993	187	Modified Overhang	Habitation	CRM 2000	D
22993	188	C-shaped struc.	Habitation	CRM 2000	D
22993	189	Wall	Habitation	CRM 2000	D
22993	98-206	Mound	Marker	Wulzen 98	D
22993	98-208	C-shaped struc.	Habitation	Wulzen 98	D
22994	190	C-shaped struc.	Habitation	CRM 2000	D
22994	191	Wall	Habitation	CRM 2000	D
22994	192	C-shaped struc.	Habitation	CRM 2000	D
22994	193	L-shaped struc.	Habitation	CRM 2000	D
22994	194	Wall	Habitation	CRM 2000	D
22994	195	U-shaped struc.	Habitation	CRM 2000	D
22994	196	Wall	Habitation	CRM 2000	D
22994	197	C-shaped struc.	Habitation	CRM 2000	D
22994	198	Wall	Habitation	CRM 2000	D
22994	199	C-shaped struc.	Habitation	CRM 2000	D
22994	200	U-shaped struc.	Habitation	CRM 2000	D
22994	192a	Wall	Habitation	CRM 2000	D
22995	201	Wall	Habitation	CRM 2000	D
22995	202	C-shaped struc.	Habitation	CRM 2000	D
22995	203	L-shaped struc.	Habitation	CRM 2000	D
22995	204	C-shaped struc.	Habitation	CRM 2000	D
22995	205	Enclosure	Habitation	CRM 2000	D
22995	206	Modified Overhang	Habitation	CRM 2000	D
22995	207	C-shaped struc.	Habitation	CRM 2000	D
22995	208	Terrace	Habitation	CRM 2000	D
22995	209	Terrace	Habitation	CRM 2000	D
22995	316	Petroglyph	Art/Communication	CRM 2000	D
22995	211a	Enclosure	Habitation	CRM 2000	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
22995	211b	Enclosure	Habitation	CRM 2000	D
22996	212	Wall	Habitation	CRM 2000	D
22996	213	C-shaped struc.	Habitation	CRM 2000	D
22996	214	Wall	Habitation	CRM 2000	D
22996	215	C-shaped struc.	Habitation	CRM 2000	D
22996	216	C-shaped struc.	Habitation	CRM 2000	D
22996	217	Mound	Marker	CRM 2000	D
22996	218	Wall	Habitation	CRM 2000	D
22996	220	Wall	Habitation	CRM 2000	D
22996	221	C-shaped struc.	Habitation	CRM 2000	D
22996	222	Mound	Marker	CRM 2000	D
22996	223	C-shaped struc.	Habitation	CRM 2000	D
22996	224	C-shaped struc.	Habitation	CRM 2000	D
22996	226	Wall	Habitation	CRM 2000	D
22996	228	Wall	Habitation	CRM 2000	D
22996	229	Terrace	Habitation	CRM 2000	D
22996	230	Cupboard	Habitation	CRM 2000	D
22996	231	Mound	Marker	CRM 2000	D
22996	232	C-shaped struc.	Habitation	CRM 2000	D
22996	233	C-shaped struc.	Habitation	CRM 2000	D
22996	234	C-shaped struc.	Habitation	CRM 2000	D
22996	235	C-shaped struc.	Habitation	CRM 2000	D
22996	236	C-shaped struc.	Habitation	CRM 2000	D
22996	237	Terrace	Habitation	CRM 2000	D
22996	238	C-shaped struc.	Habitation	CRM 2000	D
22996	239	Modified Overhang	Habitation	CRM 2000	D
22996	241	C-shaped struc.	Habitation	CRM 2000	D
22996	242	C-shaped struc.	Habitation	CRM 2000	D
22996	243	C-shaped struc.	Habitation	CRM 2000	D
22996	244	C-shaped struc.	Habitation	CRM 2000	D
22996	245	Wall	Habitation	CRM 2000	D
22996	246	C-shaped struc.	Habitation	CRM 2000	D
22996	247	C-shaped struc.	Habitation	CRM 2000	D
22996	248	C-shaped struc.	Habitation	CRM 2000	D
22996	249	C-shaped struc.	Habitation	CRM 2000	D
22996	250	Wall	Habitation	CRM 2000	D
22996	251	Wall	Habitation	CRM 2000	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
22996	252	C-shaped struc.	Habitation	CRM 2000	D
22996	253	C-shaped struc.	Habitation	CRM 2000	D
22996	240a	C-shaped struc.	Habitation	CRM 2000	D
22996	240b	C-shaped struc.	Habitation	CRM 2000	D
22996	240c	C-shaped struc.	Habitation	CRM 2000	D
22996	313a	Historic Dump	Habitation	CRM 2000	D
22996	313b	Terrace	Habitation	CRM 2000	D
22997	98-77	Road - Peter Lee Road	Transportation	Wulzen 98	D , B
22998	254	Wall	Habitation	CRM 2000	D
22998	255	Modified Overhang	Habitation	CRM 2000	D
22998	256	C-shaped struc.	Habitation	CRM 2000	D
22998	257	C-shaped struc.	Habitation	CRM 2000	D
22998	258	Terrace	Habitation	CRM 2000	D
22998	259	Wall	Habitation	CRM 2000	D
22998	260	C-shaped struc.	Habitation	CRM 2000	D
22998	261	C-shaped struc.	Habitation	CRM 2000	D
22998	262	Wall	Habitation	CRM 2000	D
22998	263	Enclosure	Habitation	CRM 2000	D
22998	318	C-shaped struc.	Habitation	CRM 2000	D
22998	98-121	C-shaped struc.	Habitation	Wulzen 98	D
22998	98-676	C-shaped struc.	Habitation	Wulzen 98	D
22998	98-679	C-shaped struc.	Habitation	Wulzen 98	D
22998	98-681	C-shaped struc.	Habitation	Wulzen 98	D
22999	264	C-shaped struc.	Habitation	CRM 2000	D
22999	265	Modified Overhang	Habitation	CRM 2000	D
22999	98-690	Cupboard	Habitation	Wulzen 98	D
23000	269	C-shaped struc.	Habitation	CRM 2000	D
23000	270	C-shaped struc.	Habitation	CRM 2000	D
23000	271	U-shaped struc.	Habitation	CRM 2000	D
23000	272	Cave	Habitation	CRM 2000	D
23000	273	Enclosure	Habitation	CRM 2000	D
23000	274	Enclosure	Habitation	CRM 2000	D
23000	275	Enclosure	Habitation	CRM 2000	D
23000	276	Terrace	Habitation	CRM 2000	D
23000	319	Rock Pile	Marker	CRM 2000	D
23000	320	Modified Overhang	Habitation	CRM 2000	D
23000	98-190	Rock Pile	Marker	Wulzen 98	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
23000	98-192	C-shaped struc.	Habitation	Wulzen 98	D
23000	98-682	Mound	Marker	Wulzen 98	D
23000	98-686	Enclosure	Habitation	Wulzen 98	D
23000	98-688	Lithic Workshop	Resource Procurement	Wulzen 98	D
23001	266	C-shaped struc.	Habitation	CRM 2000	D
23001	267	C-shaped struc.	Habitation	CRM 2000	D
23001	277	Terrace	Habitation	CRM 2000	D
23001	98-114	Wall	Habitation	Wulzen 98	D
23001	98-115	C-shaped struc.	Habitation	Wulzen 98	D
23001	98-118	C-shaped struc.	Habitation	Wulzen 98	D
23001	98-186	Mound	Marker	Wulzen 98	D
23001	98-267	Enclosure	Habitation	Wulzen 98	D
23002	278	C-shaped struc.	Habitation	CRM 2000	D
23002	279	C-shaped struc.	Habitation	CRM 2000	D
23002	280	C-shaped struc.	Habitation	CRM 2000	D
23002	98-179	Wall	Habitation	Wulzen 98	D
23002	98-180	Wall	Habitation	Wulzen 98	D
23002	98-181	C-shaped struc.	Habitation	Wulzen 98	D
23002	98-299	Wall	Habitation	Wulzen 98	D
23002	98-622	C-shaped struc.	Habitation	Wulzen 98	D
23002	98-623	C-shaped struc.	Habitation	Wulzen 98	D
23002	98-759	Enclosure	Habitation	Wulzen 98	D
23002	98-760	Wall	Habitation	Wulzen 98	D
23003	281	C-shaped struc.	Habitation	CRM 2000	D
23003	98-110	Mound	Marker	Wulzen 98	D
23003	98-599	Wall	Habitation	Wulzen 98	D
23003	98-683	Mound	Marker	Wulzen 98	D
23004	98-510	C-shaped struc.	Habitation	Wulzen 98	D
23004	98-513	C-shaped struc.	Habitation	Wulzen 98	D
23004	98-560	Enclosure	Habitation	Wulzen 98	D
23004	98-561	Wall	Habitation	Wulzen 98	D
23005	98-551	Mound	Marker	Wulzen 98	D
23005	98-607	Mound	Marker	Wulzen 98	D
23005	98-613	Platform	Habitation	Wulzen 98	D
23005	98-614	Mound	Marker	Wulzen 98	D
23005	98-621	Mound	Marker	Wulzen 98	D
23006	98-32	Cave	Habitation	Wulzen 98	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
23007	98-31		Resource Procurement	Wulzen 98	D
23007	98-33			Wulzen 98	D
23007	98-515	Lithic Workshop	Resource Procurement	Wulzen 98	D
23007	98-516	Lithic Workshop	Resource Procurement	Wulzen 98	D
23007	98-517	Lithic Workshop	Resource Procurement	Wulzen 98	D
23007	98-518	Lithic Workshop	Resource Procurement	Wulzen 98	D
23007	98-519	Lithic Workshop	Resource Procurement	Wulzen 98	D
23007	98-78	Platform	Habitation	Wulzen 98	D
23008	98-567	Cave	Habitation	Wulzen 98	D
23009	98-568	Cave	Habitation	Wulzen 98	D
23010	98-763	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23011	98-415	C-shaped struc.	Habitation	Wulzen 98	D
23011	98-416	Mound	Marker	Wulzen 98	D
23011	98-471	Enclosure	Habitation	Wulzen 98	D
23011	98-486	Wall	Habitation	Wulzen 98	D
23011	98-487	Wall	Habitation	Wulzen 98	D
23012	98-166	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23012	98-167	Enclosure	Habitation	Wulzen 98	D
23012	98-168	Wall	Habitation	Wulzen 98	D
23012	98-169	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23013	98-443	Enclosure	Habitation	Wulzen 98	D
23013	98-444	Wall	Habitation	Wulzen 98	D
23013	98-445	Enclosure	Habitation	Wulzen 98	D
23013	98-446	C-shaped struc.	Habitation	Wulzen 98	D
23013	98-448	Enclosure	Habitation	Wulzen 98	D
23013	98-470	Mound	Marker	Wulzen 98	D
23013	98-488	Terrace	Habitation	Wulzen 98	D
23013	98-489	Wall	Habitation	Wulzen 98	D
23014	98-490	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23015	98-14	Mound	Marker	Wulzen 98	D
23015	98-16	C-shaped struc.	Habitation	Wulzen 98	D
23015	98-20	Corral	Animal Enclosure	Wulzen 98	D
23015	98-21	Petroglyph	Art/Communication	Wulzen 98	D
23015	98-401	Corral	Animal Enclosure	Wulzen 98	D
23015	98-402	Enclosure	Habitation	Wulzen 98	D
23015	98-413	Mound	Marker	Wulzen 98	D
23015	98-417	Wall	Habitation	Wulzen 98	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
23015	98-418	Wall	Habitation	Wulzen 98	D
23015	98-419	Wall	Habitation	Wulzen 98	D
23015	98-424	Wall	Habitation	Wulzen 98	D
23015	98-426	Enclosure	Habitation	Wulzen 98	D
23015	98-427	Enclosure	Habitation	Wulzen 98	D
23015	98-428	Wall	Habitation	Wulzen 98	D
23015	98-429	Enclosure	Habitation	Wulzen 98	D
23015	98-432	C-shaped struc.	Habitation	Wulzen 98	D
23015	98-433	C-shaped struc.	Habitation	Wulzen 98	D
23015	98-434	C-shaped struc.	Habitation	Wulzen 98	D
23015	98-439	Enclosure	Habitation	Wulzen 98	D
23015	98-459	Modified Overhang	Habitation	Wulzen 98	D
23015	98-460	Enclosure	Habitation	Wulzen 98	D
23015	98-461	C-shaped struc.	Habitation	Wulzen 98	D
23016	98-475	Wall	Habitation	Wulzen 98	D
23016	98-476	Enclosure	Habitation	Wulzen 98	D
23016	98-477	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23016	98-478	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23016	98-479	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23016	98-480	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23016	98-481	C-shaped struc.	Habitation	Wulzen 98	D
23016	98-482	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23017	98-13	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23017	98-17	C-shaped struc.	Habitation	Wulzen 98	D
23017	98-18	Enclosure	Habitation	Wulzen 98	D
23017	98-19	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23017	98-405	Terrace	Habitation	Wulzen 98	D
23017	98-406	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23017	98-407	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23017	98-408	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23017	98-409	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23017	98-410	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23017	98-411	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23017	98-412	Enclosure	Habitation	Wulzen 98	D
23018	98-484	Cave	Habitation	Wulzen 98	D
23019	98-1	C-shaped struc.	Habitation	Wulzen 98	D
23019	98-2	Enclosure	Habitation	Wulzen 98	D

Table 6. Site and Feature Data from 1998 and 2000 surveys (continued).

Site Number	Feature #	Formal Type	Function	Project	N.R. Eligibility*
23019	98-3	Wall	Habitation	Wulzen 98	D
23020	98-474	Wall	Habitation	Wulzen 98	D
23020	98-5	Enclosure	Habitation	Wulzen 98	D
23021	98-314	Mound	Marker	Wulzen 98	D
23021	98-315	Trail - Old Puna Kau Trail	Transportation	Wulzen 98	D
23021	98-316	Mound	Marker	Wulzen 98	D
23021	98-317	Mound	Marker	Wulzen 98	D
23021	98-522	Mound	Marker	Wulzen 98	D
23021	98-778	Mound	Marker	Wulzen 98	D
23021	98-779	Mound	Marker	Wulzen 98	D
23022	98-24	Mound	Marker	Wulzen 98	D
23022	98-523	Terrace	Habitation	Wulzen 98	D
23022	98-524	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23022	98-525	Enclosure	Habitation	Wulzen 98	D
23022	98-526	Volcanic Glass Quarry	Resource Procurement	Wulzen 98	D
23022	98-527	Wall	Habitation	Wulzen 98	D
23022	98-761	Lithic Workshop	Resource Procurement	Wulzen 98	D
23022	98-762	Lithic Workshop	Resource Procurement	Wulzen 98	D
23023	98-528	Cave	Habitation	Wulzen 98	D
23024	98-319	Cave	Habitation	Wulzen 98	D
23032	98-472	Trail - Halfway House Trail	Transportation	Wulzen 98	D
23033	306	Mound	Marker	CRM 2000	D
23033	307	Trail - Keamoku Cross Trail	Transportation	CRM 2000	D
23033	310	Rock Pile	Marker	CRM 2000	D
23033	312	Mound	Marker	CRM 2000	D
23033	321	Mound	Marker	CRM 2000	D
23033	322	Platform	Habitation	CRM 2000	D
23034	98-75	Road - Kau Road	Transportation	Wulzen 98	D

*A = associated with a significant event; B = associated w/persons of significance; C = embody distinctive characteristics of a type, period or method of contruction; D = may yield or likely to yield information important in prehistory or history.

Chapter VIII

MANAGEMENT OF THE FOOTPRINTS NATIONAL REGISTER

Preservation and protection of cultural resources within the Footprints National Register area is mandated by the Organic Act, the Park's enabling legislation, the National Historic Preservation Act (NHPA), and the National Park Service's Management Policies. Nomination of the Footprints area to the National Register of Historic Places highlighted the unique character of the footprint features. The recent discovery of associated trails, structures and quarry areas further exemplifies the unique quality of the area.

Recent surveys coupled with past ARPA incidents and unusual rainstorms highlight the need for a review of management options for the area. This chapter summarizes the Park Services mandate regarding historic preservation in the Footprints Area, reviews the current use of the area, and presents management recommendations.

National Park Mandate

In 1916 the US Congress passed the Organic Act (16 USC 1) which established the National Park Service. The act states that the purpose of the national parks is "*to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations.*"

Hawai'i Volcanoes National Park was established on August 1, 1916 by Congress (Pub Law 95-635, 16 U.S.C. Sec. 1132). The Park's enabling legislation calls for the "*preservation from injury of all timber, birds, mineral*

deposits, and natural curiosities or wonders within said park, and their retention in their natural conditions as nearly as possible."

The National Historic Preservation Act (NHPA) mandates the protection and preservation of cultural resources within federal lands. Section 106 of the NHPA requires that federal agencies consider the effects of their actions on cultural resources that are either eligible for inclusion or are already on the National Register of Historic Places.

The National Park Service's Management Policies (2001) requires the Service to "*preserve and foster appreciation of the cultural resources in its custody, and... demonstrate its respect for the people traditionally associated with those resources, through appropriate programs of research, planning, and stewardship*."

Combined, these three pieces of legislation and the Park Services' internal management policies require the protection and preservation of the Footprints National Register area and associated lands. An appropriate set of management recommendations is therefore warranted to address the various recreational, research, and interpretation activities of the Footprints area.

Preservation and Management Plans (current use)

Currently, there is no specific management plan dedicated solely to the Footprints area. Rather, Hawai`i Volcanoes National Park follows the management policies as set forth by the Park Service (2001). A review of the activities and potential impacts to this area is essential in light of the research gathered over the last ten years.

Established Park Trails

Three established park trails traverse portions of the Footprints area: the Ka`ū Desert Trail Head (formerly known as the Footprints Trail), the Ka`ū Desert Trail, and the Mauna Iki Trail. The Ka`ū Desert Trailhead starts at Highway 11 and crosses the Ke`āmoku lava flow in a southeasterly direction. The trail crosses through the National Register parcel, and eventually links up with the Ka`ū Desert Trail south of the 1971 lava flow (Figure 18). The entire length of this trail is 2.9 km (1.8 mi.).
22 and 23. Wulzen recommended clearance for the project subject to the removal of plots 20, 22 and 23 from the plan. The methodology used for survey was not provided in the January 21, 1999 memo from Wulzen. Thus, it is unclear how Wulzen was able to determine if footprint impressions lay below the layer of surface sand.

The plants were outplanted on three separate occasions. Five groups of 100 plants each were planted in approved plot areas. The plots are discontinuous but are located in areas that would: 1) ease the burden of watering and monitoring for the resource management crew; 2) avoid areas determined to be sensitive due to cultural resources; and 3) be in deeper sand for the ease of planting (J. Chase 2001 pers. comm..). All of the plots lie within the Footprints National Register area.

The Ka`ū Desert Trail starts on the western side of Crater Rim Drive and runs southwest through the Ka`ū Desert for 22.7 km (14.1 mi.). Eventually the trail turns to the east near Pepeiao Cabin. At the cabin the trail again changes direction and runs in a northeasterly direction. This last segment is 7.7 km (4.8 mi.) and ends at the Hilina Pali Overlook.

The third trail that crosses the Footprints National Register Boundary is the 10.1 km (6.3 mi.) Mauna Iki Trail. The trail starts at the Hilina Pali Road and runs in an east/west direction through the desert. The trail ends where it meets the Ka`ū Desert Trail.

These trails are open all year to the public and visitors to Hawai`i Volcanoes National Park may hike across these trails without a permit. Those who are looking for footprints may find them along portions of the trail routes, especially near the junction of the trails.

Kīlauea Run

Each year the Volcano Art Center sponsors a wilderness marathon and run in Hawai`i Volcanoes National Park in the month of July. The annual event features four run or walk options for participants to choose. These include the Wilderness Marathon (26.2 mile run), the Rim Run (10 mi.), the Kīlauea Caldera Run (5 mi.) and the Kīlauea Caldera Walk (5 mi.). Only the 26.2 mile Wilderness Marathon crosses through the Ka`ū Desert and the Footprints National Register area. On this run, participants access the Ka`ū Desert through the Ka`ū Desert Trail from the Hawaiian Volcano Observatory. They travel for 7.1 miles through the desert before taking a left onto Mauna Iki Trail for another 6.3 miles.

In the northern section of the course runners pass within less than 100 meters of known footprint locations. Further south, near the Mauna Iki Trail junction, runners pass within ten meters of footprint impressions. Should runners veer from the established trail route, or should runners "bunch up" near these areas, there is potential for damage to the ash layers and subsequently the footprint impressions.

Revegetation Project

In January 1999 HAVO Natural Resources Management submitted a project review for out-planting of `ihi mākole (*Portulaca sclerocarpa*) a critically rare and endangered plant in the Footprints area. The area was selected for outplanting because the last species of this taxa was found in the area in the 1960's by Derral R. Herbst. At that time only two known populations existed in the park and both were declining. The Footprints area was seen as the best site for the survival of the plant in part because the area has "good soil moisture… and very few alien plants which might present greater competition" (Project Review dated 1/20/99).

Originally, 25 plots were selected for the outplanting of 500 plants. An archeologist (W. Wulzen) surveyed the proposed areas. Footprints were noted near plots 6-8, 20-

Erosion Due to Natural Occurrences

Between October 29 and November 2, 2000 two storms caused record rainfall and flooding in the Hilo and Ka`ū Districts of Hawai`i Island. In a 24 hour period 27 inches fell in Hilo. Over the two days more than three feet fell in some areas of the island. The storms were unprecedented in their magnitudes. They washed out roads, bridges, and created large gullies in the Kapāpala Ranch.

Erosion caused by November 2000 flood. Note layers of ash in the background. Photo HAVO CRM archives.

In the Footprints area the force and quantity of water created a large gully 20 to 30 meters north of the Footprints shelter. The gully extends in a southerly direction, to approximately 40-80 meters south of the Footprints Trail. Significant damage to a portion of the preexisting trail has been caused by the displacement of large amounts of sand and ash sediments. Within the gully, *`ōhi`a* roots have been exposed. Ash layers have been highly deteriorated and footprint impressions no doubt have been lost.

Although unprecedented in its magnitude, the effects of the 2000 flood on the Footprints area are not unusual. On January 17, 1920 while investigating the Ka`ū Desert flow that was forming Mauna Iki, Jaggar (1920) reported that a torrential rainstorm from the southwest was causing flooding in the desert. Jaggar (1920:1098) wrote "the old *pāhoehoe* land was traversed by hundreds of brooks of running water coursing across the desert."

Evidence of the 1920 flood is likely covered over by the shifting sands of the Ka`ū Desert. Today a large channel created by the November 2000 flood cuts across the existing Ka`ū Desert Trailhead trail, exposing and eroding the ash lenses in its path. What kind and how many footprint features were lost during the many floods to hit the Ka`ū District we will never know.

Management Recommendations

The cultural resources in the Footprints area are presently protected by HAVO Law Enforcement's periodic field checks, the vastness of the desert, and the relative obscurity of most of the structures and trails. As future interpretation and research occurs, however, the Footprints area will become considerably more accessible. It

is inevitable that over time more people will visit the Footprints area and more floods will wash through the desert.

While the footprints that are covered by sand will be relatively protected until they are exposed, those prints that are currently exposed or in a flood zone are at risk of being damaged or lost. The rugged Ke`āmoku flow and the vastness of the Ka`ū Desert will serve to limit the number of visitors who choose to wander beyond the established foot trail. However, hardy individuals may choose to adventure across both the flow and the desert.

It is recommended that a more aggressive management approach for site protection and maintenance be taken. This approach can combine public education, further archeological research, outside project reviews, and periodic monitoring to ensure effective management. Some suggested actions include:

(1) monitoring of structure conditions at periodic intervals. The maps contained in this report and in the HAVO CRM files can be used as baseline data against which the condition of sites (in particular structures) can be compared in the future.

(2) continue photogrpahic monitoring of footprint features. In 2000 HAVO CRM established five photo monitoring points near the Footprints Shelter and along the Footprints trail. The goal of this program was to document changes in the ash lenses and known footprint impressions over time, and to identify natural versus human induced change, if any and provide recommendations for preservation.

(3) systematic inventory of the footprints. It is recommended that archeologists undertake systematic analysis of footprints in selected areas of the desert. Field crews in consultation with HVO geologists should identify, among other attributes, the number, angle, and layer the footprints are found in. This research will help archeologists more closely identify the direction people were traveling in as well as during what phase of the eruption they were moving through the area.

(4) soil science research. Conduct a research project with a soil scientist to understand the impact rain may have in re-working the ash lenses. Some very interesting, nonhuman, prints have been identified in the ash lenses. Specifically, archeologists have identified what looks very much like horseshoe prints in the desert ash. Horses were brought to the islands in 1803 and thus the prints could not have been formed during the 1790 or earlier eruptions. These prints may have been formed when sediment conditions were altered to such an extent that softened the ground surface.

(5) Revise and expand the National Register Nomination. As it stands, the National Register Nomination for the Footprints area is incomplete. At the time it was written (1974) the nomination did not include all of the known footprints in its boundary area, nor does it include the recently identified archeological structures, trails, and other features. By revising the nomination form, the true nature of the Footprints area and the unique story behind its development will be given the national recognition it deserves.

Interpretive Recommendations

Currently, the primary interpretive story for the Footprints area can be found in the Jaggar Museum and at the historic Footprints shelter. Both interpretive displays are old and in the case of the shelter, degraded and vandalized. Both interpretive venues should be updated to reflect the new information and interpretive story of the Kaʻū Desert. These sites present a unique story of how Hawaiians adapted to their desert and active lava environment, utilizing the unique *ʻaʻā* lava flow for constructing shelter as well as collecting natural resources the desert provided. This area was a juncture for major trail systems that connected the Kaʻū people to the villages in Puna and Hilo as well as the uplands of Mauna Loa and the ever imposing Kīlauea Caldera.

It is recommended that more active interpretation take place for this site. Some suggested actions include:

(1) restructuring of the Jaggar Museum. The Jaggar Museum should provide the overall background to the Kaʻū Desert. The Park Service should highlight the unique geological and archeological resources of the Kaʻū Desert through this venue. The Museum display should provide a visual guide to visitors who do not choose to take the Kaʻū Desert Trail. The visitor should be able to experience the cultural and natural environment of the Desert through photos, maps and text.

(2) rehabilitation of the Footprints shelter. The Footprints shelter should provide the primary interpretive venue in the Footprints area. It should direct visitors to established Park trails through the area and it should provide a strong message regarding site protection.

(3) development of a loop trail extending off the current Kaʻū Desert Trail leading to the shelter sites, the Kaʻū-Volcano trail and the quarry areas. A constructed trail leading to this area will not only enhance the visitor experience, it will serve as an established route that will help to keep visitors off of the ash lenses.

(4) guided public interpretation at least twice a year. In coordination with HAVO Interpretation Division and CRM, the Park could offer the public guided interpretive tours to some of the newly identified features along the Keʻāmoku flow as well as the footprints.

(5) complete appropriate conservation treatments of footprints. Because of the fragility of the footprint features, it is imperative that conservation treatments be tested on this site. Conservation treatments may include identifying a specific area where footprints will be preserved *in-situ*, or it may include the development of molds or casts of footprints used for interpretive purposes.

Future Research Options

Options for future research in the area by various groups and individuals should remain open, as the National Register parcel is a unique, and fast disappearing archeological asset. Interest in research projects in the area has been expressed on several occasions in the past including research by representatives working for other federal agencies. All requests for access for research purposes should be reviewed by HAVO Resource Council and Cultural Resources Management. From an archeological point of view, several research questions remain unresolved. These include:

(1) identifying the true boundary of the Footprints area. Not all of the desert has been surveyed. Further survey work on the precontact "p4o" *pāhoehoe* lava flow and near the edges of the 1920 lava flow to the east of the desert should be completed.

(2) identifying negative impacts. It is important to identify the kinds of events that have negatively impacted the area in the past if we are to understand how these events impacted the interpretive and preservation potential of the site.

(3) field check footprints. Identify the extent of the footprints coverage (specifically, field check the "blank" areas on Millller's (1992) map and extend survey coverage south to the coast).

(4) test Swanson and Christiansen's (1978) hypothesis. The hypothesis put forth by Swanson and Christiansen (1978) regarding the location of the death of the second warrior party should be tested. This testing can be done by performing a reconnaissance survey in the area where they believe the entire second party perished. Any surface material in the area should be visually examined to confirm or discount historic reports of human remains located in the desert. If human remains are found, consultation with Native Hawaiian groups, Hui Malama I Na Kūpuna O Hawai`ī Nei, Hawai`i Island Burial Council and the State Historic Preservation Office should commence. Proper treatment of the remains in accordance with the wishes of lineal descendents should take place. The Native American Graves Protection and Repatriation Act (NAGPRA) law must be followed.

Summary

The Footprints area is a unique resource on the national, regional and local levels. There are no archeological features within and outside of Hawai`i that come close to comparison of those found in the Ka`ū Desert. The archeological features in the desert should be properly managed, maintained, interpreted, and preserved as they are a pivotal part of the lands managed by Hawai`i Volcanoes National Park. The story of the Footprints area will continue to evolve as archeologists discover more resources in the desert. As it stands, the story of the Footprints area is a testament to the creativity, endurance, and strength of the Hawaiian people.

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APPENDIX I. FOOTPRINT DATA

TEMPORARY FIELD NUMBER	MINIMUM NUMBER OF PRINTS	ANGLE	MINIMUM NUMBER OF PEOPLE	PERCENT EXPOSED COMPLETELY	PERCENT EXPOSED PARTIAL	PERCENT EXPOSED PEDESTAL	PERCENT EXPOSED INSOLE	DIRECTION OF PRINT(S)
1	4	120	2	100				S
1		260		100				S
1A	1	120	1		100			
2	20	140	6	30	70			S
3	4	160	2	50	50			S
4	6	320	2	100				N
4		275		100				N
5	12	160	6	90	10			
5		320		90	10			
6	9	80	1	100				S
6		180		100				S
7	12	150	3	100				S
8	200	160		40	40	20		S
8		340		40	40	20		S
9	6	140	1	?				S
10	3	?		?	?	?	?	
11	1	150	1	100				S
12		160		?				S
13		160		?	?	?	?	S
14	4	360	1	100				N
15	4	140	2	50	50			S
16	3	160	1	33	66		100	S
17	20	140	5	50	50			S
18	3	360	1	50	50			N
19	10	360	5	50	50			N
19A	12	280	6	65	35			
19B	6	310	2	65	35			
19C	12	320	6	65	35			
20	1	300	1	100				N
20A	40	315	6	80	10	10		
20B	6	320	2	70	30			

TEMPORARY FIELD NUMBER	MINIMUM NUMBER OF PRINTS	ANGLE	MINIMUM NUMBER OF PEOPLE	PERCENT EXPOSED COMPLETELY	PERCENT EXPOSED PARTIAL	PERCENT EXPOSED PEDESTAL	PERCENT EXPOSED INSOLE	DIRECTION OF PRINT(S)
20C	10	140	4	100				
20D	18	320	3	80	20			
20D		150	3	80	20			
20E	3	340	1	100				
21	5	180	1	80	20			
21		90		80	20			
21A	12	340	6	100				
21B	4	320	2	100				
21C	16		6	50	50			
22	200	260		66	33			N
22		80		66	33			N
22		140		66	33			N
22A	13	140	3	90	10			
23	4	330	1	100				N
24	4	310	2	100				N
25	1	310	1	100				N
26	2	80	1	50	50			S
26A	1	310	1	100				
27	10	330		50	50			N
28	2	340	1	50	50			N
29	6	360	3	50	50			N
30	1	50	1	100				N
31	3	310	1	100				N
32	10	360	3	50	50			N
33	1	240	1	100				N
34	4	240	2	100				N
35	4	280	2		100			N
36	2	310	2		100			N
37		320		?	?			N
38	14	150	4	75	25			S
39	5	350	3	50	50			N
40	6	330	3	50	50			N
41		130	7	50	50			S

TEMPORARY FIELD NUMBER	MINIMUM NUMBER NUMBER OF PRINTS	ANGLE	MINIMUM NUMBER OF PEOPLE	PERCENT EXPOSED COMPLETELY	PERCENT EXPOSED PARITAL	PERCENT PEDESTAL	PERCENT EXPOSED INSOLE	DIRECTION OF PRINT(S)
41	17	310	7	50	50			S
42	2	360	1	100				N
43	4	180	2	100				S
44	24	300	7	50	50			N
45	56	320		50	50			N
46	1	150	1	100				S
47	5	340	3	50	50			N
48	5	340	2	100				N
49	20	320	7	50	50			N
49		140		50	50			N
50	10	310	6	80	20			N
51	4	160	2	100				S
52	0	0						
53	25	130	2	100				S
54	3	320	1	100				N
55	8	300	2	100				N
56	3	170	1	100				S
56A	6	110	2	100				
56B	4	210	2	100				
57	4	110	2	100				S
57		290		100				S
58	8	140	2	100				S
59	16	180	3	80	20			S
59		360		80	20			S
60	2	240	1	100				N
61	2	280	1	100				N
62	2	320	1	50	50			N
63	3	330	1	33	66			N
64	3	150	2	100				N
64		320		100				N
65	2	10	1	100				S
66	1	315	1	100				N
67	1	340	1	100				N
67A	1	290	1	100				
67B	5	300	3	50	50			
68	3	280	2	100				N

TEMPORARY FIELD NUMBER	MINIMUM NUMBER OF PRINTS	ANGLE	MINIMUM NUMBER OF PEOPLE	PERCENT EXPOSED COMPLETELY	PERCENT EXPOSED PARTIAL	PERCENT EXPOSED PEDESTAL	PERCENT EXPOSED INSOLE	DIRECTION OF PRINT(S)
69	5	230	1	100				S
69A	7	150	3	100				
70	30	310	6	100				N
71	2	230	2	100				N
72	25	130	2	100				N
72A	11	200	7	70	30			
72A		110		70	30			
72B	6		4	70	30			
72C	50	250		30	70			
72C		80		30	70			
73	30	90	6	50	50			S
73		250		50	50			S
74	12		5	50	50			
75	5	100	1	100				S
76	20	260		50	50			S
76		90		50	50			S
76A	10	90		50	50			
76A		260		50	50			
77	300	260		50	50			N
77		90		50	50			N
78	2	320	1	100				N
79	1	100	1	100				S
80	6	100	3	100				S
81	10	90	3	70	30			S
82		290		70	30			
83	6	320	2	80	20			N
84	40	320	6	100				N
84A	24	340	10	80	20			
84B	7	30	4	50	50			
85	4	320	6	70	30			S
85		140		70	30			S
86	2	290	1	100				N
86A	1	290	1	100				
87	14	320	2	70	30			N
87A	9	320	1	100				
88	5	130	2	100				S

TEMPORARY FIELD NUMBER	MINIMUM NUMBER OF PRINTS	ANGLE	MINIMUM NUMBER OF PEOPLE	PERCENT EXPOSED COMPLETELY	PERCENT EXPOSED PARTIAL	PERCENT EXPOSED PEDESTAL	PERCENT EXPOSED INSOLE	DIRECTION OF PRINT(S)
89	4	100	1	100				S
89A	1	100	1	100				
90	3	100	1	100				S
91	6	120	2	70	30			S
92	1	120	1	100				S
93	3	120	1	100				S
93A	5	140	2	70	30			
94	7	120	2	100				S
95	4	320	1	100				N
96	4	340	1	100				N
97	3	310	1	100				N
98	3	300	2	100				N
99	4	310	3	50	50			N
100	2	330	2	100				N
101	6		3	?	?			
101A	4 horse							
101B	5		2	?				
102	6	140	3	100				S
103	3	180	1	100				S
104	8	330	2	80	20			N
105	1	110	1	100				N
105A	12	290	2	100				
106	6	130	1	100				S
107	13	100	2	50	50			S
107A	3	280	1	100				
108	4	320	2	100				N
108A	9	310	4	50	50			
109	30	350	9	50	50			N
110	4	140	3	100				S
111	4	150	3	50	50			N
111		330		50	50			N
112	12	340	5	50	50			N
113	7	320	3	75	25			N
114	2	120	1	100				S
115	2	320	1	50	50			N
116	3	330	3	100				

TEMPORARY FIELD NUMBER	MINIMUM NUMBER OF PRINTS	ANGLE	MINIMUM NUMBER OF PEOPLE	PERCENT EXPOSED COMPLETELY	PERCENT EXPOSED PARTIAL	PERCENT EXPOSED PEDESTAL	PERCENT EXPOSED INSOLE	DIRECTION OF PRINT(S)
117	24	320	3	100				N
117		140		100				N
118	4	?	?	?				
119	18	60	4	100				N
119A	1	360	1	100				
120	1	140	1	100				
121	9	70	3	100				S
121		250		100				S
122	40	0		50	50			N
122		330		50	50			N
122		100		50	50			N
123	80	160		50	50			N
123		330		50	50			N
124	100	330		60	30	10		N
124		160		60	30	10		N
125	5	340	2	?				N
126	24	290	8	80	20			S
126		130		80	20			S
127	30	330	7	80	20			N
127		150		80	20			N
127A	7	300	3	80	20			
128	10	330	4	80	20			N
128		150		80	20			N
129	4	300	1	100				N
130	9	300	2	100				N
130		120		100				N
131	8	320	3	50	50			N
132	3	70	1	100				S
133	8	310	3	100				N
134	2	330	2	100				N
135	2	90	2	100				S
135		180		100				S
135A	4	150	6	100				
135A		330		100				
136	7	340	4	100				

TEMPORARY FIELD NUMBER	MINIMUM NUMBER OF PRINTS	ANGLE	MINIMUM NUMBER OF PEOPLE	PERCENT EXPOSED COMPLETELY	PERCENT EXPOSED PARTIAL	PERCENT EXPOSED PEDESTAL	PERCENT EXPOSED INSOLE	DIRECTION OF PRINT(S)
MEGA SITE 1	400	320		30	30	30	10	
U1	4	180	2	50	50			
U2	5	130	2	100				
U3	8	310	2	50	50			
U3		130		50	50			
U4	1	180	1	100				
U5		?						
U6	1	90	1	100				
U7	1	200	1	100				
U8	1	230	1	100				
U9	3	330	3	100				
U10	2	310	1	100				
U11	1	320	1	50	50			
U12	1	60	1	100				
HP1	20	330	3	100				
HP1		150		100				
HP2	10	80	1	100				
HP3								
HP4	12	140	2					
HP5	36	310	3					
HP6	4	310	1					
HP7	4	320	1					
HP8	4	280	1					
HP8	3	70	1					
HP9	14	180	3					
HP10	2	200	1					

APPENDIX II. SITE AND FEATURE DESCRIPTIONS

SITE NO.: **22973**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 1.149 hectares
DESCRIPTION: This site (see Figure 19) consists of 20 features: five C-shapes, two enclosures, four mounds, three rock piles, one U-shape, and five walls. Features 1 through 4 and 7 through 11 are all located within a recessed area of the Ke`āmoku *`a`ā* lava flow. This inlet represents an area where the lava has flowed in such as way as to create a natural area protected from the prevailing, and at times strong, winds. The Ke`āmoku flow also provided most of the building material for the structures. Loose cobbles and boulders are utilized to create structure walls, mounds, and rock piles.

Some structures located on the undulating *pāhoehoe* are built up against the Ke`āmoku flow edge. Thus, the builders incorporated a natural feature as part of the construction. This methodology for building habitation sites maximized the natural resources available as well cut the time and energy needed to build the structures. None of the structures showed evidence of cultural deposits. Most of the C-shapes and enclosures show evidence of ash buildup in the interior of the feature that may contain some subsurface cultural remains.

Feature 1 is 2 x 2.50 m and about 46 cm high C-shape. It is built of stacked small cobbles two to three courses high. The opening of the structure faces south. The west side of the structure is the natural Ke`āmoku *`a`ā* lava flow. The interior of the structure contains volcanic ash that is built up on the south side of the interior of the structure. A single *pūkiawe* (*Styphelia tameiameaiae*) and *`a`ali`i* (*Dodonea viscosa*) bush are growing on the outside of the northeast corner of the feature. The structure is in good condition.

Feature 2 is 1.5 x 2.00 m and 40 cm high C-shape. Located north of Feature 1, this C-shape is built of stacked medium to large cobbles. The opening of the C-shape faces southeast and like Feature 1 there is buildup of ash on the south side of the interior of the structure. The structure is built on the flat *pāhoehoe* surface near the edge of the Ke`āmoku *`a`ā* flow but not adjacent to it. The structure is in fair condition.

Feature 3 is 1.75 x 2.5 m and 45 cm high C-shape. Located west of Feature 2, this C-shape is built of stacked small to medium

cobbles, one course high. The opening of the structure faces south and like Feature 1 the west wall is built up against the Ke`āmoku lava flow. Vegetation, consisting primarily of *`a`ali`i* is encroaching in on the southeast corner of the structure. The structure is in fair condition.

Feature 4 is 2.50 x 2.5 m and 34 cm high C-shaped structure. Located north of Features 1 through 3, this C-shape is built of stacked medium to large cobbles two to three courses high. The western side of the structure is the natural Ke`āmoku flow edge and the south side is open. A layer of ash is found inside and outside of the structure. No vegetation is directly impacting the structure, which is in good condition.

Feature 5 is 3.50 x 3.50 m and 63 cm high enclosure. Located northwest of Feature 4, Feature 5 is built on the Ke`āmoku flow. The structure is comprised of three low walls built of stacked boulders and cobbles two to three courses high. The fourth side of the structure is the natural *`a`ā* outcrop. The interior surface of the structure has been cleared and a layer of ash lies across the surface. *`ōhi`a* trees (*Metrosoderos polymorpha*) and *`a`ali`i* shrubs are growing in the vicinity but are not intrusive. The structure is in good condition.

Features 6, 6a–6c are an enclosure and three adjacent mounds. The enclosure is 3.50 x 6.00 m and 22 cm high. Three of the enclosure walls incorporate a large natural outcrop on the southeast side. The enclosure walls are not well defined and are quite low. Three mounds are located on the north and east side of the U-shaped structure. Mound 6a is 0.75 x 1 m and 89 cm high. Mound 6b is 1.5 x 1.5 m and 63 cm high. Mound 6c is 1 x 0.5 m and is adjacent to the east wall of Feature 6. All three mounds are built of stacked medium to large cobbles approximately three courses high and are in fair condition.

Feature 7 is a 3 x 3.5 m and 48 cm high U-shape. Located directly east of Feature 4, Feature 7 is comprised of two walls built on the undulating *pāhoehoe* surface, up against the Ke`āmoku flow edge. Thus, a U-shape is formed utilizing the natural boundary of the Ke`āmoku flow. The structure walls are low, one to two courses high medium to large cobbles. Ash deposit is found in the interior and exterior of the feature. A few small *`a`ali`i* plants are scattered on the interior of the feature as well as within the northwest and southeast walls. The feature is open to the southwest and in good condition.

Feature 8 is 1.5 x 0.75 m and 42 cm high wall. This short wall is built of loosely stacked small to medium cobbles one to two courses high. The structure extends just off of the Ke`āmoku flow edge

and is located southeast of Feature 7. A fairly considerable amount of ash is built up both in and around this structure which is in poor condition.

Features 9, 9a-c and 10 are a cluster of three rock piles and two walls. Feature 9 is a 1.50 x 1.00 m and 34 cm high wall. The northeast end of the wall abuts the Ke`āmoku lava flow. Parallel and east of Feature 9 is Feature 10, a 2.50 x 0.75 m and 63 cm high wall. The northeast end of Feature 10 also abuts the Ke`āmoku flow.

Two rock piles (Feature 9a-b) are located near Feature 9 and 10. Feature 9a is located to the northwest of Feature 9 approximately nine and seven meters away (respectively). Feature 9a is 1.25 x 1.0 m and 23 cm high collapsed medium cobble-sized rock pile and Feature 9b is a 2.0 x 1.5 m and 38 cm high rock pile. The third rock pile (Feature 9c) is also collapsed and is constructed of small to medium cobbles. It is located approximately five meters southwest of Feature 9. This rock pile is 1.0 x 1.0m and 42 cm high stacked structure built of medium cobbles to small boulders one to two courses high.

Features 9 and 10 were likely one feature, possibly an enclosure. Currently, the southwest corner rocks of the feature is missing and may have been raided to construct the associated rock piles. Feature 9 and 10 are in good condition. All of the rock piles that comprise Features 9a-c are in poor to fair condition.

Feature 11 is a 4.5 x 1.25 m and 15 cm high wall. Extending off of the Ke`āmoku lava flow, this structure is built of one to two course stacked medium to large cobbles. Much of the segment of the wall that abuts the Ke`āmoku flow is covered by ash. Thus, although the wall may be larger and higher, a substantial portion of it is currently covered. The wall is in poor to fair condition.

Feature 12 is a 0.5 x 0.5 m and 75 cm high mound located on top of the Ke`āmoku lava flow. This structure is well built and consists of stacked, three to four courses of medium to large cobbles. A single upright stone sits on top of the base of the mound and is quite obvious. This stone may have been placed upright some time in the historic period as the style does not conform to many of the other mounds in the area.

The mound may be part of an upper trail system that has yet to be identified. The top of the Ke`āmoku flow has not be thoroughly surveyed, but no other mounds have been identified on the flow in the vicinity. Thus, this mound may be an isolated feature, or it may more likely be associated with the structures at the base of the Ke`āmoku flow.

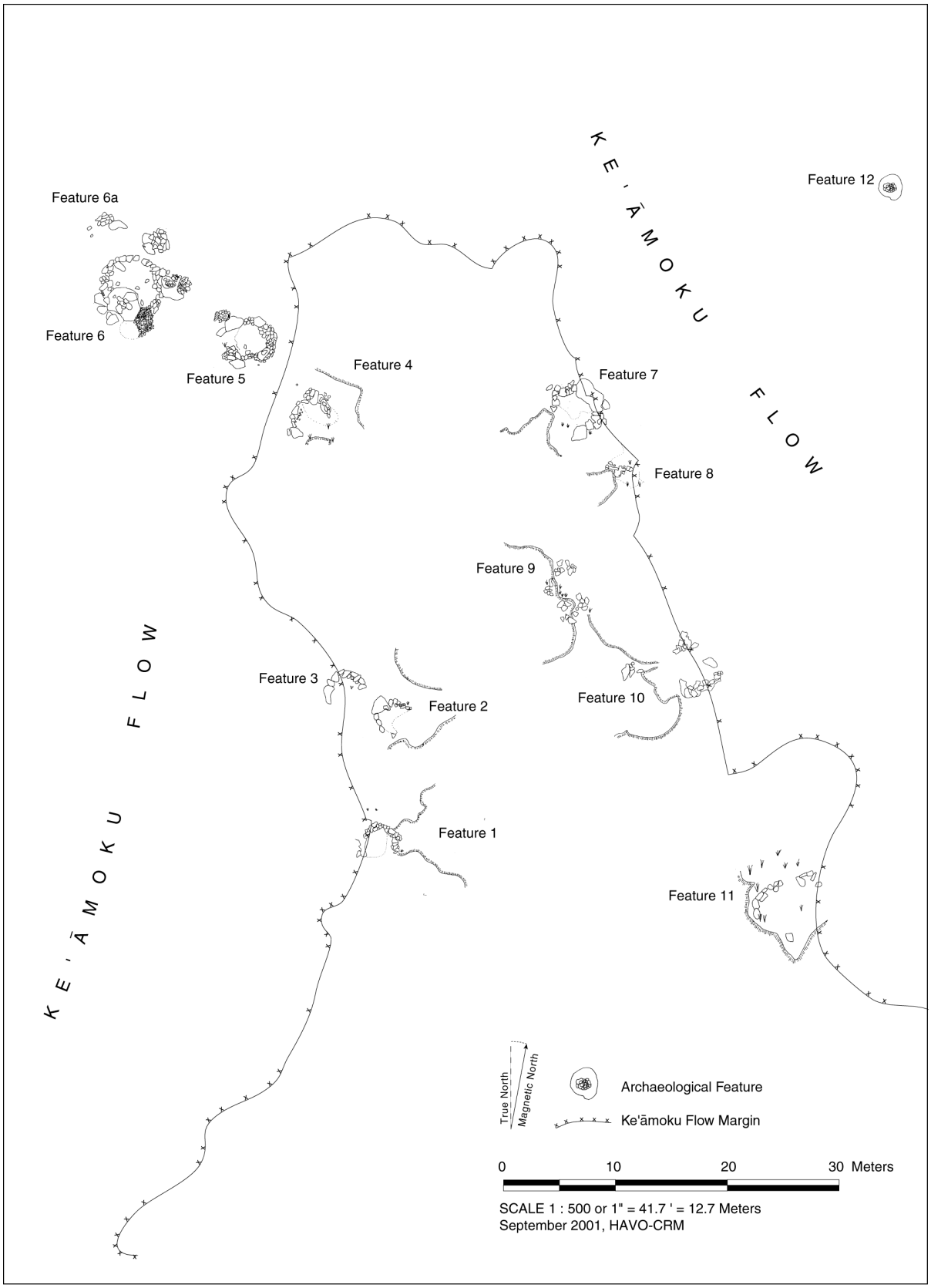

Figure 19. Site 22973 (excludes figures 13 & 14).

Feature 13 is a 3.0 x 0.75 m and 40 cm high C-shape located adjacent to the Ke`āmoku flow edge. The structure is open to the west and contains eolian sand and gravel in the interior of the low walled feature. The walls of the structure are built of stacked, one to two course high small to medium cobbles. Although no vegetation is impacting this structure, the sand is slowly building up around the walls thus obliterating any surface remains. The feature is in fair condition.

Feature 14 is 1.75 x 1.0 m and 40 cm high wall located at the base of, but not adjacent to, the Ke`āmoku flow. Unlike most wall and C-shaped structures in this complex, Feature 14 does not utilize the Ke`āmoku flow as a segment of its construction. The wall is poorly formed, one to two courses high stacked small to medium cobbles. It is likely quite low because a deep deposit of sand appears to be covering the remainder of the feature, which may have once been a C-shape. The wall is in poor condition.

SITE NO.: **22974**
FORMAL TYPE: Complex
FUNCTION: Habitation/resource procurement
TOTAL AREA: 11.393 hectares
DESCRIPTION: This site consists of nine features: one overhang shelter, six volcanic glass quarry areas, one wall and one modified outcrop. Of these features only Feature 15, an overhang shelter, was recorded during the 2000 survey. The other nine features were recorded during the 1998 survey and therefore information available on the structures is limited. Unlike Site 22973, only a single structure, Feature 15, is located along the Ke`āmoku flow. The other features are located to the east of the Ke`āmoku flow boundary on the undulating p4o *pāhoehoe* flow. Due to the survey method used in 1998, it is unknown at this time whether other structures or features located on the p4o flow could potentially contribute to this site. Although these features represent a dispersed group, at least the quarries are likely functionally related.

Feature 15 is 2.0 x 1.0 m and about 48 cm high overhang. A large boulder juts out from the edge of the *`a`ā* flow to form the small crevice in which some shelter can be found. An associated stacked rock wall nearly encircles the exterior of the overhang. The wall is 1.25 x 2.0 m and about 48 cm high. The shelter is open to the southeast. A layer of ash has accumulated on the shelter floor, which is in good condition. The wall is also in good condition. A few p*ūkiawe* and *`a`ali`i* plants are growing outside of the walled area of the structure but are not intrusive.

Feature 98-83 is a volcanic glass quarry identified by W. Wulzen in 1998. Wulzen (1999) describes the feature as a "large area of pried up volcanic glass around eight tumuli. Selected pieces (of volcanic glass) are piled on tumulus."

Feature 98-491 is a volcanic glass quarry identified in 1998. The only description of the feature is that it lies alongside the Ka`ū-Volcano trail (Site 22982).

Feature 98-550 is described as a "very large area of discontinuous volcanic glass quarrying" (Wulzen 1999).

Feature 98-562 is a volcanic glass quarry that includes one large and several small tumuli. Three small enclosures are "formed with the volcanic glass waste piles" (Wulzen 1998).

Feature 98-563 is a volcanic glass quarry identified by Wulzen (1999). The quarry area is located on a single tumulus and encompasses an area 10 m x 4 m wide. A small enclosure with a rubble wall of volcanic glass chunks is located on top of the tumulus. The enclosure is 1.6 m x 0.8 m.

Feature 98-564 is a wall identified in 1998. No data is available on this feature.

Feature 98-565 is a modified outcrop identified in 1998. No data is available on this feature.

Feature 98-590 is a volcanic glass quarry that is formed around five tumuli with small waste piles (Wulzen 1999).

SITE NO.: **22975**
FORMAL TYPE: Complex
FUNCTION: Habitation/resource procurement
TOTAL AREA: 2.918 hectares
DESCRIPTION: This site consists of four features: two overhang shelters, a C-shaped structure, and a volcanic glass quarry. All of the features were found along the flow edge. Due to the survey method used in 1998, it is unknown at this time whether other structures or features on the p4o flow could potentially contribute to this site complex.

Feature 16 is 4.0 x 1.0 m and about 143 cm high overhang. Several large boulders just out from the edge of the *ʻaʻā* flow to form a small overhang in which some shelter can be found. An associated stacked rock wall nearly encircles the opening of the overhang. The wall is 35 cm high. The shelter area is open to

the south. A layer of ash has accumulated within the shelter floor. The wall is also in fair condition. An *ʻōhiʻa* tree grows outside of the shelter, on its northeast corner. A few *pūkiawe* plants are growing on the outside of the southwest corner of the enclosing wall.

Feature 17 is a 3.0 x 3.0 m and 66 cm high C-shaped structure. The structure is comprised of stacked boulders and cobbles. Unlike most features in the area, some of the cobbles are from the adjacent *pāhoehoe* flow. The west wall of the C-shape is built up against the Keʻāmoku flow. The east wall and the west wall are linked by a large natural boulder on the north. The feature is open to the south.

Feature 98-587 is an overhang. As described by Wulzen (1999) this feature is constructed of a large boulder, one meter from the Keʻāmoku flow, and more than eight other boulders piled on the east side. These boulders create a small shelter that is open to the north. The wall is 1.1 m to 40 cm high. The boulder is 1.6 m 1.5 m x 120 cm high. The interior is described as "blackened" with possible flecks of charcoal in the ash (Wulzen 1999).

SITE NO.: **22976**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.319 hectares
DESCRIPTION: This site consists of four features: one U-shaped structures, two C-shaped structures and a single overhang shelter. All of these features were recorded during the 1998 and 2000-2001 surveys. Thus, there is detailed information on each. The features that comprise this site are primarily clustered at the base of the Keʻāmoku flow.

Feature 18 is 2.25 x 2.0 m and about 49 cm high U-shaped structure. Two parallel walls are constructed perpendicular to the base of the Keʻāmoku flow. The base of the flow forms the natural northern edge of the feature. The shelter area is open to the south. Sand and ash has accumulated on the interior of the shelter as well as outside the shelter. Short grasses, *ʻaʻaliʻi* and *pūkiawe* are growing inside the feature. The vegetation is not growing within the walls and therefore does not pose a direct threat to the structural integrity.

Feature 19 is a 3.5 x 1.25 m and 110 cm high overhang. The overhang is a natural crevice located within the Keʻāmoku lava flow. A poorly stacked wall is located across the entrance to the overhang. The 2.5 x 0.5 m and 43 cm high wall may, in part,

be natural. There is ash and sand built on the floor in the interior of the overhang. No vegetation is growing within the shelter area.

Feature 20 is a 1.75 x 1.0 m and 57 cm high C-shaped structure. The feature wall is constructed of stacked cobbles, one to two courses high. The feature is built up against and perpendicular to the Ke`āmoku flow which it is built up against and comprises the north side of the feature. The structure is open to the southwest. The interior of the structure is comprised of ash and eolian deposited sand. No vegetation grows either within the structure or the structure wall. The feature is in good condition.

Feature 21 is a C-shaped structure built of stacked boulders and cobbles one to three courses high. It is freestanding, constructed on the flat p4o flow, very close to the edge of the Ke`āmoku flow boundary. The feature is 2.0 x 1.0 m and 87 cm high and in good condition with no vegetation growing within the structure walls or within the interior of the structure. A few short *`a`ali`i* bushes and grasses are growing just outside of the feature wall. The feature is open to the southwest and there is a level area of ash and sand in the interior of the structure.

SITE NO.: **22977**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 2.047 hectares
DESCRIPTION: This site consists of six features: a rock pile, two enclosures, a petroglyph, a U-shaped structure and a volcanic glass quarry. Three of the features are located on the Ke`āmoku flow while the other three were found on the p4o flow. Only one feature (25) is located within a recessed area of the Ke`āmoku flow. Features 98-92 and 98-92a are located nearly adjacent to the Ka`ū-Volcano Trail (Site 22982).

Feature 24 is a 60 x 40 cm and 25 cm high rock pile. This feature is located on the Ke`āmoku lava flow. The feature is three loosely stacked cobbles located on a large boulder. Its prominent location suggests it was placed there for easy visibility. There is no vegetation associated with this feature. The feature is in poor condition.

Feature 25 is a 2.00 x 3.50 m and 40 cm high U-shape. This feature is located at the base of the Ke`āmoku lava flow. The feature is two roughly parallel walls that abut the base of the Ke`āmoku lava flow to form a rough "U." The walls are constructed from basalt boulders and cobbles that are stacked from one to two

courses high. The floor is ash-filled and level. There is *pūkiawe* and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 98-92 and 98-92a is an enclosure located 35 m from the Keʻāmoku lava flow. The structure is comprised of two constructed walls. No information on feature size is provided by Wulzen 1999. A petroglyph (Feature 98-92a) is associated with this enclosure. No data on petroglyph was provided by Wulzen (1999 upubl. ms.).

Feature 98-93 is a mound. Identified by Wulzen (1999 unpublished ms.), no data on the feature are available.

Feature 98-94 is a volcanic glass quarry identified by W. Wulzen (1999). No additional information on the feature is available. However, it is assumed that this feature is located on the p40 lava flow because all of the volcanic glass quarries have been found on this flow type in the project area.

Feature 98-598 is an enclosure. No structural information is provided on this feature except that the enclosure is near mound 98-93.

SITE NO.: **22978**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 2.107 hectares
DESCRIPTION: This site consists of five features: two rock piles, a mound, and two enclosures. Three of the five features that comprise this site are located on the Keʻāmoku lava flow. The mounds and rock piles may be functionally associated with the Kaʻū-Volcano Trail (Site 22982) but are not spatially associated.

Along the Keʻāmoku flow, between sites 22973 and 22978, there is a paucity of features (<10); the edge of the Keʻāmoku flow was not used intensively along this section of the flow.

Feature 26 is a 1.5 x 1.0 m and 20 cm high rock pile. This feature is located at the base of the Keʻāmoku lava flow. It is a scattered pile of basalt boulders and cobbles. There is a trail located approximately 30 m to the south of the feature. *ʻAʻaliʻi* grows on and around the feature, which is in fair condition.

Feature 27 is a 1.5 x 1.0 m and 40 cm high mound. This feature is located on the Keʻāmoku lava flow. The feature is a

collapsed pile of basalt boulders and cobbles built on a large boulder. Its placement in a high spot suggests it functioned as a trail or other marker. There is no vegetation associated with this feature. The feature is in poor condition.

Feature 28 is a 3.50 x 3 m and 150 cm high enclosure. This feature is located on the Ke`āmoku lava flow. It is a roughly rectangular enclosure constructed from basalt boulders and cobbles that are stacked from one to three courses high. The floor is level and ash-filled with some loose rocks from wall collapse. There is some *`a`ali`i* growing around the feature. The feature is in fair condition.

Feature 29 is a 2.50 x 2.50 m and 40 cm high rock pile. It is located approximately 15 m to the south of the Ke`āmoku lava flow. The feature is a scattered pile of basalt boulders assembled on a low *pāhoehoe* rise. There is *`a`a*li`i, *pūkiawe*, and nonnative grass growing around the feature. The feature is in poor condition due to collapse of the structure.

Feature 30 is a 4.50 x 2.50 m and 130 cm high enclosure. This feature is located on the Ke`āmoku lava flow. A large boulder forms the northern end of the feature. The boulder has been undercut at its southwestern face to form an overhang. A wall constructed from basalt boulders and cobbles that are stacked from two to four courses high abuts the boulder at its southwestern side. The wall curves to the south – southeast to connect with the boulder at its southeastern end. This forms a roughly circular enclosure with a level ash-filled floor. There is *`a`ali`i* and *pūkiawe* bush growing on and around the feature. The feature is in fair condition.

SITE NO.: **22979**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 3.101 hectares
DESCRIPTION: This site consists of a high density of features, a majority of which are located along or near the edge of the Ke`āmoku flow. Thirty-one features comprise this site. They include: six overhangs, eight enclosures, five C-shapes, five U-shaped structures, one volcanic glass quarry, three mounds and three walls. It is the first large cluster of features located north of Site 22973. This site is approximately 70 m south of the Ke`āmoku Cross Trail (Site 23033). The concentration of features beginning in this area may be related to the Ke`āmoku Cross Trail (Site 23033) that runs perpendicular to the Ke`āmoku flow. The trail may have provided quick access to and from the Ka`ū-Volcano Trail (Site 22982) and resource procurement and habitation sites in the

Ka`ū Desert. Thirty of the 31 features that comprise Site 22979 are located on the Ke`āmoku flow.

Feature 31 is a 2.50 x 2.50 m and 250 cm high enclosure. This feature abuts the base of the Ke`āmoku lava flow. This structure consists of two parallel walls; one on the southwestern end and one on the northeastern end. Both walls are constructed from basalt boulders and cobbles that are stacked from two to four courses high. The floor is level and ash-filled. There is *`a`ali`i, pūkiawe,* and various alien grasses growing on and around the feature. The feature is in fair condition.

Feature 32 is a 2.90 x 1.90 m and 104 cm high overhang. This feature is located at the base of the Ke`āmoku lava flow. The feature is a small cave in a southern facing slope near the base of the Ke`āmoku lava flow. There is a basalt boulder and cobble wall stacked four to five courses high built on the eastern side of the entrance that abuts the southeastern corner of the outcrop and extends out to the south. The floor is ash-filled and level. There is *`a`ali`i, pūkiawe,* and molasses grass growing on and around the feature. The feature is in good condition.

Feature 33 is a 3.50 x 4.50 m and 150 cm high U-shape. This feature is located at the edge of the Ke`āmoku lava flow. A large outcrop forms the eastern end of the feature. There are two walls; one on the northern end and one on the southern end of the boulder. Both walls extend out to the west and are constructed from basalt boulders and cobbles that are stacked from three to five courses high. The entrance of the structure opens to the west. The floor of the structure is level and ash-filled. There is *`a`a*li`i and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 34 is a 3.50 x 3.80 m and 109 cm high U-shaped structure. This feature is located on the edge of the Ke`āmoku lava flow. A large *`a`ā* boulder forms the northern end of the feature. The enclosure wall abuts the south side of the boulder. The east side of the structure wall is higher and in better condition than the west. A low one course high alignment of cobbles extends southwest off the east wall. The floor is ash-filled and level with some rocks from wall collapse. There is *pūkiawe, `a`ali`i,* and various alien grasses growing on and around the feature. The feature is in good condition.

Feature 35 is a 3.20 x 2 m and 118 cm high overhang. This feature is located near the base of the Ke`āmoku lava flow. A natural crevice in the Ke`āmoku flow has been modified to provide an area for shelter. A retaining wall of stacked basalt cobbles has been constructed at the southern end of the structure to form

a terraced area immediately to the south of the overhang. The floor is level and rocky. There is *pūkiawe, ʻaʻa*liʻi, and various alien grasses growing on and around the feature. The feature is in good condition.

Feature 36 is a 2.12 x 2.65 m and 54 cm high enclosure. This feature is located on the Keʻāmoku lava flow. It is a circular structure constructed from basalt boulders and cobbles that are stacked from one to three courses high. The floor is level and ash-filled with some rocks being exposed due to erosion. There is *pūkiawe, ʻaʻa*liʻi, and various alien grasses growing on and around the feature. The feature is in fair condition.

Feature 37 is a 2.30 m x 50 cm and 51 cm high wall. This feature is located at the base of the Keʻāmoku lava flow. The wall abuts the base of the flow at its northern end and extends out to the south. It is constructed from basalt boulders and cobbles stacked from one to two courses high. The wall is largely covered with ash. There are alien grasses, *pūkiawe* and *ʻaʻa*liʻi growing on and around the feature. The feature is in fair condition.

Features 38a & 38b are two conjoined and adjacent U-shaped structures. The structures are located on the Keʻāmoku lava flow. A large outcrop forms the northeastern boundary of the feature. There are three walls abutting the outcrop; one at the southwestern end, one at the northwestern end and one in the middle. The central wall is a common wall between the two structures. All walls extend out to the west and are constructed from stacked basalt boulders and cobbles. These elements combine to create two enclosed areas that are open to the south. The floors of both enclosures are level and ash-filled. There is *pūkiawe* and *ʻaʻa*liʻi growing on and around the feature. The feature is in good condition.

Feature 39 is a 3.50 x 3.30 m and 127 cm high C-shape. This feature is located at the base of the Keʻāmoku lava flow. It is a curved wall that abuts the base of the flow at its eastern end and extends out to the west. There is a level ash-filled area on the northwestern side of the wall. There is *ʻaʻa*liʻi and various alien grasses growing on and around the feature. The feature is in fair condition.

Feature 40 is a 3 x 2 m and 143 cm high C-shape. This feature is located at the base of the Keʻāmoku lava flow. The feature is a curved wall that is open to the west. It is constructed from basalt boulders and cobbles that are stacked from one to two courses high. The floor is level and ash-filled. There is *ʻaʻa*liʻi and *pūkiawe* growing on and around the feature.

Features 41a & 41b are a 3.80 x 4 m and 190 cm high overhang and associated mound. These features are located at the base of the Ke`āmoku lava flow. Feature 41 is a small natural overhang located on the side of a southern facing slope at the base of the flow. The exterior entrance to the overhang has been modified. There is a loosely mounded wall at the eastern and western edges of the overhang entrance that extends out to the south to form a protected area.

A metal can (contents unknown) and possibly cat scat were found on the interior of the overhang floor. The floor of the cave and the enclosed area is level and ash-filled. There is *`a`ali`i, pūkiawe,* natal redtop, and a type of sedge growing on and around the feature. The feature is in fair condition.

Feature 41b is a small mound of basalt boulders stacked three courses high located above the overhang on the surface of the flow that formed the overhang cavity.

Feature 42 is a 3.70 x 2.50 m and 115 cm high overhang. This feature is located on the Ke`āmoku lava flow. An outcrop has been undercut at its western base to form a small natural overhang. An alignment of basalt boulders abuts the southern side of the overhang and extends out to the west. Placement of the aligned boulders form a level ash-filled terraced area located immediately outside of the entrance to the overhang. There is molasses grass, *`a`ali`i,* and *pūkiawe* growing on and around the feature. The feature is in good condition.

Feature 43 is a 2.70 x 3 m and 165 cm high overhang. This feature is located on the Ke`āmoku lava flow. It is a natural overhang in a southern facing slope of the flow. There is a wall constructed from basalt boulders and cobbles extending from the southeastern and southwestern corners of the overhang entrance. The east wall is more defined and is 1.50 x 1.0 m and 58 cm high. The east wall is three to four courses high, unlike the west wall which is only a single course high and 1.75 x 0.5 m and 113 cm high. There is a level, ash-filled, terraced area located immediately to the south of the overhang. There is *pūkiawe* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Features 44a & 44b are a group of enclosures. These features are located on the Ke`āmoku lava flow. They are two adjoining enclosures that share a dividing wall that lies between the two. Both features are constructed from basalt boulders and cobbles. The floors of both enclosures are level and ash-filled. There is

ʻaʻaliʻi, pūkiawe, and various alien grasses growing on and around the feature. The feature is in fair condition.

Features 45a, 45b, and 45c are an 8.0 x 8.0 m and 200 cm high concentration of three enclosures. These features are located on the Keʻāmoku lava flow. The features are constructed around a large, central *ʻaʻā* boulder. Feature 45a is constructed from loosely stacked basalt boulders and cobbles. The enclosure is open to the south where the wall is collapsed.

Feature 45b is a rectangular enclosure built on the north side of the large central boulder. Its walls are stacked one to two courses high with *ʻaʻā* cobbles. The east wall is constructed of stacked *ʻaʻā* boulders and cobbles four to five courses high.

Feature 45c is located on the eastern side of the large central boulder. Two parallel walls abut the outcrops eastern side and extend out to the east to form the northern and southern sides of the feature. The eastern side is not as defined and is mostly collapsed. The floor is level and ash-filled. There is *ʻōhiʻa lehua, pūkiawe,* and *ʻaʻaliʻi* growing on and around the features. The features are in fair condition.

Feature 46 is a 3.0 x 3.0 m and 81 cm high overhang. This feature is located at the base of the Keʻāmoku lava flow. It is a small sheltered area in a southern facing slope. The entrance has been modified by the stacking of basalt slabs at the northeastern corner. The floor of the cave is ash-filled. A single *ʻopihi* (*Cellana sp.*) shell was found inside the overhang.

Feature 47 is a 1.40 m x 26 cm and 40 cm high wall. It is located at the base of the Keʻāmoku lava flow. The feature is a low wall constructed from basalt boulders and cobbles that are stacked from one to four courses high. The wall is aligned from the southeast to the northwest. There is *pūkiawe, ʻaʻaliʻi,* and natal redtop growing around the feature. The feature is in fair condition.

Feature 48 is a 3 x 2 m and 200 cm high C-shaped structure. This feature is located at the base of the Keʻāmoku lava flow. It is a curved wall that abuts the base of the flow on its northern end and extends out to the south-southwest. The wall is constructed from basalt boulders and cobbles that are stacked from one to three courses high. The floor is level and ash-filled. There is *pūkiawe* and natal redtop growing on and around the feature. The feature is in fair condition.

Feature 49 is a 4 x 4 m and 110 cm high C-shaped structure. This feature is located at the base of the Keʻāmoku lava flow. It is a

curved wall that abuts the base of the flow on its northern end and extends out to the south-southwest. The wall is constructed from basalt boulders and cobbles that are stacked from one to five courses high. The floor is level and sand – filled. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 50 is a 4.50 x 4.50 m and 170 cm high U-shaped structure. This feature is located on the Keʻāmoku lava flow. A large *ʻaʻā* boulder forms the northern side of the feature. Two parallel walls spaced approximately 1.50 m apart abut the southern end of the boulder and extend out to the south. The walls are constructed of loosely stacked boulders and cobbles two to four courses high. The interior floor of the feature is relatively level and rubble – filled. There is some *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 51 is a 1.50 x 2.80 m and 102 cm high mound. This feature is located on the Keʻāmoku lava flow. The feature is a constructed of stacked basalt boulders. There is a wooden stick protruding out of the top of the mound. The stick appears to be an un-milled tree limb. There is another similar piece of wood lying on the ground immediately to the south of the mound. There is some *ʻaʻaliʻi* growing around the feature. The feature is in fair condition.

Features 300a and 300b are an enclosure and C-shaped structure, respectively. Both structures abut a large accretionary lava ball. Feature 300a is located on the west side of the accretionary ball. This structure is 3.5 x 2.0 m and 52 cm high. It is composed of three stacked *ʻaʻā* boulder walls that form a circular structure. The south wall is less well-defined than the north wall which is faced. The interior area of the structure is a level ash surface. The feature is in good condition with a few short *pūkiawe* and *ʻōhelo* bushes growing in the interior of the structure.

Feature 300b abuts the east side of the accretionary ball. It is 2.5 x 1.0 m and 80 cm high. The structure wall is built of stacked *ʻaʻā* cobbles and small boulders. Adjacent and south of the wall the ground surface is cleared and level. This feature is also in good condition with minimal *pūkiawe* and *ʻōhelo* bushes growing on the level surface area.

Feature 98-101 is a mound. No size dimensions are provided. The feature is located near the Kaʻū-Volcano Trail (Site 22982) but not directly alongside the trail like other mounds in the area.

Feature 98-250 is a volcanic glass quarry located 30 m south of the Ke`āmoku flow. The quarry is 5 m x 3 m. Quarried material are stacked and piled in the area.

Feature 98-251 is an alignment 40 m north of feature 98-250. Other data provided for this feature is difficult to interpret and therefore not included in this description.

SITE NO.: **22980**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 2.272 hectares
DESCRIPTION: This site consists of eight features - five C-shaped structures, and a single terrace, U-shaped structure and overhang. All of the features except Features 55 and 62 are located on top of the Ke`āmoku flow. None of the features are located within a natural recessed area of the Ke`āmoku flow, but they are close to two trail systems, Sites 23033 (Ke`āmoku Cross Trail) and 22982 (Ka`ū Volcano Trail).

Feature 52 is a 1.50 x 1.70 m and 80 cm high C-shaped structure. This feature is located at the base of the Ke`āmoku lava flow. It is a curved wall that abuts the base of the flow on its northern end and extends out to the south-southwest. It is constructed from basalt boulders and cobbles that are stacked from one to two courses high. There is a piece of dense basalt, possibly an adze, located at the northeastern corner of the feature. This material is not from the immediate area and was likely brought to this site. There is *pūkiawe* and *`a`ali`i* are growing on and around the feature. The feature is in fair condition.

Feature 54 is a 1.10 m x 80 cm and 60 cm high C-shaped structure. This feature is located at the base of the Ke`āmoku lava flow. The structure that abuts the Ke`āmoku flow base of the flow at its southern end and curves to the north – northwest. It is constructed from basalt boulders and cobbles that are stacked from one to four courses high. The floor is a level matrix of ash and sand. There is *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 55 is a 3.20 m x 80 cm and 27 cm high wall. This feature is located approximately 3 m to the east of the base of the Ke`āmoku lava flow. The structure wall is slightly curved and open to the southwest. The wall is constructed from basalt boulders and cobbles that are stacked from one to three courses high. The floor is relatively level and ash-filled with some underlying rocks being exposed due to erosion. There is *`a`ali`i* and *`ōhi`a*

lehua growing on and around the feature. The feature is in fair condition.

Feature 56 is a 3 x 2 m and 52 cm high wall. This feature is located at the base of the Ke`āmoku lava flow. The structure wall abuts the base of the Ke`āmoku flow on its western end and extends out to the east. The wall is constructed from basalt boulders and cobbles that are stacked from one to three courses high. The floor of the feature is level and ash-filled. There is *`ōhi`a lehua, pūkiawe,* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 57 is a 3.20 x 0.80 m and 100 cm high C-shaped structure. This feature is located at the base of the Ke`āmoku lava flow. It is a curved wall that abuts the base of the flow. The wall is constructed from basalt boulders and cobbles that are stacked from one to five courses high. The interior is level and ash-filled. There is *`ōhi`a lehua* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 58 is a 3.50 x 1.50 m and 92 cm high wall. This structure is located at the base of the Ke`āmoku lava flow. The structure is perpendicular to the Ke`āmoku flow. The north end of the feature abuts the Ke`āmoku flow and extends south. The wall is constructed from stacked basalt boulders and cobbles. There is *`ōhi`a lehua, pūkiawe,* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 59 is a 2.50 x 2 m and 100 cm high terrace. This feature is located at the base of the Ke`āmoku lava flow. It is a level ash-filled area that lies below an overhang. There is a short wall comprised of basalt boulders and cobbles at the southwestern corner of the terrace. There is natal redtop growing on and around the feature. The feature is in fair condition.

Feature 60 is a 2.50 m x 80 cm and 100 cm high C-shaped structure. It is located on the Ke`āmoku lava flow. The feature is a curved wall that abuts a low rock outcrop on its northern side and extends to the south-southwest. The wall is constructed from basalt boulders and cobbles that are stacked from one to seven courses high. The floor is rocky and uneven. There is *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 61 is a 5 x 1 m and 220 cm high wall. This structure has been constructed on the eastern side of a natural overhang. The overhang is located on the southwest side of a low *pāhoehoe* rise. A low wall, constructed from basalt boulders and cobbles is located on the eastern side of the overhang. The wall is stacked from one to three courses high and forms a rough "c". There is

ʻōhiʻa lehua and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 62 is a 1.40 x 1.50 m and 28 cm high U-shaped structure. This feature is located on the *pāhoehoe* near the base of the Keʻāmoku lava flow. The feature is a U-shaped alignment of basalt boulders. This structure is on level ground and there is much deposition of sand on and around the feature. There is *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 301 is a U-shaped structure that consists of a small (1.5 x 1.0 m) roughly paved *ʻaʻā* interior floor. Two stacked *ʻaʻā* basalt boulder and cobble walls are adjacent to and east of a large accretionary lava ball. The accretionary ball essentially comprises the west "wall" of the structure. The walls are loosely stacked and low (61 cm at the highest point). The structure is in good condition, few low plants composed primarily of *ʻōhelo* and *pūkiawe* grow near the outside of the structure walls.

Feature 302 is a modified overhang that consists of a short (1.75m) low (1.20 m) wall and natural accretionary lava ball. The wall is built up against the accretionary ball on the southwest side. The wall extends to the southwest and is built of loosely stacked cobbles. The interior sheltered area below the overhang is 137 cm high. The 2.0 x 1.0 m area fronting the overhang is level and consists of duff and sediment. The feature is in good condition but vegetation consisting of *pūkiawe*, *ʻōhelo*, and ʻōhiʻa is growing within the feature.

SITE NO.: **22981**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 2.100 hectares
DESCRIPTION: This site consists of 17 features – four C-shape, one cupboard, one enclosure, four modified overhangs, a terrace, four U-shapes, a blister cave and a single wall. This relatively dense cluster of features are located 175 m southeast of the Keʻāmoku Cross Trail. All of the features are located on the Keʻāmoku flow.

Feature 63 is a 2 x 1.50 m and 118 cm high C-shape. This feature is located on the Keʻāmoku lava. It is a curved wall that is aligned from east to west and is open to the south. The wall is constructed from basalt boulders and cobbles that are stacked from one to five courses high. The floor is a level matrix of ash and sand. There is no vegetation associated with this feature. The feature is in fair condition.

Feature 64 is a 2.90 x 3.50 m and 169 cm high wall. This feature was built in association with a natural rise on the Ke`āmoku lava flow. The structure was built to take advantage of a natural *`a`ā* outcrop. Two roughly stacked walls were constructed on the eastern and western sides of the outcrop. Both walls extend out of the outcrop to the south to form an oblong-shaped protected area. The floor is level and ash-filled with some underlying rock being exposed due to erosion. There is and *`ōhi`a lehua* tree growing at the southeastern corner of the feature. The feature is in fair condition.

Feature 65 is a 3 x 2.80 m and 170 cm high modified overhang. The overhang is located on the Ke`āmoku lava flow, and consists of an outcrop that has been naturally undercut at its base to form a shallow space. A well-defined wall abuts the northern end of the overhang and extends to the south. Naturally collapsed boulders abut the southwestern end of the overhang and extend out to the southeast. The enclosed area is level and ash-filled. There is no vegetation associated with this feature. This feature is in fair condition.

Feature 66 is a 4.40 x 2.80 m and 130 cm high modified overhang located on the Ke`āmoku lava flow. The overhang is a natural cavity in the *`a`ā* lava flow that forms a shallow depression. The floor and immediate area outside of the shelter has been leveled to form a terraced surface on the Ke`āmoku flow. A short wall was constructed on the northwest side of the overhang in an exposed cavity. The wall may have served to block wind from flowing through. The wall is constructed from basalt boulders and cobbles that are stacked from one to five courses high on the north side of the overhang. The shelter floor is level and ash-filled with some rubble on the northern portion of the floor. There is *`a`ali`i* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 67 is an enclosure measuring 6.0 x 5.50 m and 195 cm high. This feature is located on the Ke`āmoku lava flow and adjacent to a natural rocky outcrop. The outcrop is utilized as part of the feature construction serving as the north/northeast boundary "wall." A semi-circular wall constructed from loose stacked *`a`ā* boulders and cobbles form the east, south, and west walls. The interior floor is level and ash-filled with some underlying exposed rocks which may be due to erosion. There is a *`ōhi`a lehua* tree growing at the northeastern corner of the feature. The feature is in fair condition.

Feature 68 is a roughly square enclosure that is located in the north half of the site complex. The structure is 1.80 x 2.90 m and 200 cm high and located on the Ke`āmoku lava flow. This feature

incorporates a natural rock outcrop as the northwestern wall. The structure walls are low, with a maximum height of two meters. The feature walls are composed of stacked boulders and acts as a retaining wall for a level ash-filled terraced area on the interior of the feature. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 69 is a 2.5 m x 1.5 m x 200 cm high modified overhang. The feature consists of a small area (2.00 x 0.50 m and 100 cm high) protected by the overhang edge of a 50 x 50 cm outcrop. A 1 m square area fronting this feature is level and covered in small *ʻaʻā* cobbles and a few boulders. A rough L-shaped structure is built approximately 0.5 m to the east of the entrance to the overhang. Each segment of the L-shape is 0.5 m in length. A considerable degree of soil is built up on the surface of the overhang floor.

Feature 70 is a 2.90 x 1.40 m and 172 cm high U-shaped structure. This feature is located at the base of the Keʻāmoku lava flow. A large rock outcrop forms the northern end of the feature. Two walls abut the outcrops – one at the east end and one at the west. Both walls are low (82 cm maximum height) extend out to the south. The walls are constructed from *ʻaʻā* boulders and cobbles that are stacked from one to five courses high. The outcrop has an overhang edge that forms a shallow protected space approximately 172 cm high. The interior floor is level and ash-filled. There is some natal redtop growing on and around the feature. The feature is in fair condition.

Feature 71 is a 4.50 x 3.50 m C-shaped structure. This feature is located on the Keʻāmoku lava flow. There is a large boulder at the northeastern end of the feature. A well-defined wall constructed from *ʻaʻā* boulders and cobbles that are stacked from one to five courses high abuts the western end of the boulder. The wall extends out to the west before curving to the south. Another smaller less well–defined wall abuts the southeastern end of the boulder and extends out to the south. This second wall is 22 cm high at its maximum. The builder incorporated two large natural boulders at the south end as part of the structures architecture. The floor of the feature is level and ash-filled with an accumulation of pebble-size basalt at the northeastern corner of the floor. There is *ʻaʻaliʻi, pūkiawe,* and *ʻōhiʻa lehua* growing on and around the feature. The feature is in fair condition.

Feature 72 is a U-shaped structure that consists of a small area (2.0 x 0.5 x 0.26 m) protected by the overhanging edge of a 165 cm high outcrop. This 3.60 x 4.40 m feature is located on the Keʻāmoku lava flow. A large outcrop forms the northern end of

the feature. There are two walls abutting the southeast and southwestern ends of the outcrop. Both walls extend out to the south and are constructed of loosely stacked *ʻaʻā* boulders. The 1.5 x 1.25 m interior area of this feature is level and filled with pebble and cobble-size basalt. There is *ʻaʻali*ʻ*i, pūkiawe*, and *ʻōhiʻa lehua* growing on and around the feature. The feature is in fair condition.

Feature 73 is a 4.50 x 3.50 m and 21 cm high C-shape. This feature is located on the Keʻāmoku lava flow. It is a curved wall constructed from basalt boulders and cobbles that are stacked from one to two courses high. The whole extent of the wall is unknown due to the inundation of ash. The floor of the feature is level and ash-filled. There is *ʻōhiʻa lehua, pūkiawe,* and *ʻaʻali*ʻ*i* growing on and around the feature. The feature is in fair condition.

Feature 74 is a C-shaped structure that consists of a level interior floor. The structure is 2.50 x 2.70 m and 105 cm high and is located on the Keʻāmoku lava flow. The structure opens to the southwest. The wall is well-constructed from *ʻaʻā* boulders and cobbles that are stacked from four to six courses high. There is *ʻōhiʻa lehua*, *pūkiawe*, and *ʻaʻali*ʻ*i* growing on and around the feature. The feature is in fair condition.

Feature 75 is a modified overhang. The interior of the overhang is 2.75 x 2.50 and 200 cm high. Located on the Keʻāmoku flow, the overhang is open to the east. The interior of the overhang is bisected by natural roof fall that starts at the back of the cave. A wall comprised of loosely stacked *ʻaʻā* boulders and cobbles abuts the roof fall at the overhang's dripline. At the southeast corner of the overhang a loosely stacked *ʻaʻā* boulder and cobble wall is constructed. This wall likely served to block the wind from sweeping into the overhang shelter. The interior of the cave is level and soil – filled. There is *pūkiawe* and *ʻōhiʻa lehua* growing on and around the feature. The feature is in fair condition.

Feature 76 is a 3 x 3 m and 160 cm high U-shaped structure. This feature is located on the Keʻāmoku lava flow. A large boulder forms the eastern end of the feature. Two walls abut the western end of the boulder; one at the northern end and one at the southern end. Both walls are short segments (0.75 m long at its maximum) that extend out to the west and are constructed from stacked *ʻaʻā* boulders and cobbles. The small (1.5 x 0.5 m) interior floor of the feature is level and ash-filled. There is *ʻaʻali*ʻ*i* growing on and around the feature. The feature is in fair condition.

Feature 77 is a 0.75 x 1.75 and 50 cm high terrace. The feature is semicircular paved level area at the base of a large accretionary lava boulder. The paving is comprised of small *ʻaʻā* cobbles. The facing of the terrace is a low (50 cm) one course high *ʻaʻā* boulder wall.

Feature 303 is a blister cave that extends north-northeast under the edge of an *ʻaʻā* flow. The opening to the cave measures about 0.5 m across. The entrance of the main cave floor is about 3.75 m long x 2.00 m wide with a ceiling height of about 41 cm. The floor of the cave is level and clear with only sand and other sedimentary deposits. What appears to be natural boulder collapse partially blocks the west side of the cave entrance. A small (1.0 x 0.75 m) low (38 cm) wall of small stacked *ʻaʻā* boulders and cobbles constructed on the east side of the cave entrance. The structure is in good condition but the entry is obscured by grass (natal redtop) and *pūkiawe*.

Feature 98-281 is a wall consisting of nine boulders on a low tumulus. The structure is 3.2 m long and located 15 m east of the Kaʻū-Volcano Trail (Site 22982).

SITE NO.: **22982**
FORMAL TYPE: Kaʻū-Volcano Trail and associated features
FUNCTION: Transportation
TOTAL AREA: 0.112 hectares
DESCRIPTION: Site 22982 is comprised of two parallel trail segments and 33 associated features. Identified as two worn areas across the p4o *pāhohoe* flow, these trail segments are located east of the Keʻāmoku flow. The segments run in a northeast/southwest direction. The trials were identified over a six mile (9,656 m) distance. The location of the Kaʻū-Volcano Trail on a 1907 digitized map matches the location of the field data collected with GPS (Figure 5). Thus, the author feels confident that Site 22982 is the Kaʻū-Volcano Trail.

Along these trail segments 33 features were identified in close spatial association. Of the 33 features there is one C-shape, one modified outcrop, one modified overhang, 26 mounds and four walls. The mounds were likely used as trail markers by travelers using the area. Mounds are useful trail markers in an area like the Kaʻū Desert because trails worn into the *pāhoehoe* are often hard to see. Therefore, these markers would be useful for keeping the traveler moving in the right direction.

Feature 53 is a 1 x 1.60 m and 89 cm high mound. This feature is located at the base of a low *pāhoehoe* rise several meters to

the south of the Ke`āmoku lava flow. It is a mound of basalt boulders and cobbles that are stacked from three to six courses high. There is some *pūkiawe* growing around the feature. The feature is in poor condition.

Feature 69 is a modified overhang. No additional information is available.

Feature 98-111 is a mound comprised of six *pāhoehoe* boulders. No additional information is available.

Feature 98-112 is a wall constructed of over 25 boulders and cobbles. The structure is built near a tumulus which angles to the northwest.

Feature 98-116 is a mound constructed in a sandy area on the p4o flow approximately 7.0 m from the Ke`āmoku flow. The structure is 2.5 m wide, no height information is provided. Historic glass was found near the structure and 5.0 m to the north of the mound.

Feature 98-117a-c are three small mounds located where the trail leaves the Ke`āmoku flow. Feature 117a is 1.5 m wide and 50 cm high and is the closest mound to the Ke`āmoku flow. Feature 117b is 2.0 m in diameter and feature 117c is 2.5 m x 1.0 m. No additional data are available.

Feature 120 is a mound constructed of over 25 loosely piled *`a`ā* boulders. No dimensional data is provided by Wulzen (1999).

Feature 98-257 is a wall segment ranging from 1.4 m to 0.4 m high. There is an upright stone on the east. The wall is near the Ka`ū-Volcano Trail. No further information is available.

Feature 98-311 is a mound. No structural information is available.

Feature 98-312 is described by Wulzen (1999) as a "cairn," or mound but is constructed of only two single (assumed stacked) boulders at the base of a tumulus.

Feature 98-313 is a mound.

Feature 98-425 is a mound.

Feature 98-430 is a mound.

Feature 98-431 is a mound.

Feature 98-493 is a mound.

Feature 98-494 is a wall.

Feature 98-511 is a C-shape.

Feature 98-512 is a mound comprised of 12 boulders on an outcrop.

Feature 98-557 is a mound.

Feature 98-558 is a mound.

Feature 98-559 is a mound.

Feature 98-789 is a mound located southeast of feature 98-491.

Feature 98-793 is reported to be a cairn, however, the brief description suggests it is a single boulder located on the west side of the Ka`ū-Volcano trail (Wulzen 1999).

Feature 98-791 is a mound.

Feature 98-793 is a mound.

Feature 98-794 is a mound.

Feature 98-795 is a mound.

Feature 98-796 is a mound.

Feature 313 is a mound.

Feature 315 is a modified outcrop.

Feature 314a is a mound.

Feature 425 is a mound.

SITE NO.: **22983**
FORMAL TYPE: Cave
FUNCTION: Habitation (possible)
TOTAL AREA: 0.153 hectares
DESCRIPTION: This site is comprised of a single feature. See description below.

Feature 98-624 is a cave that extends under the edge of the Ke`āmoku lava flow. The shelter is 12 m x 8 m x 300 cm high. No information on cultural modifications such as associated walls or deposits was is provided. Thus, this feature could possibly be natural and deserves further evaluation.

SITE NO.: **22984**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 1.336 hectares
DESCRIPTION: This site consists of 10 structures - two C-shapes, four mounds, one rock pile, one modified overhang, and two terraces. Features 78, 79, 83, and 84 are located on the Keʻāmoku lava flow, while features 80, 81, and 82 are located at the base of the Keʻāmoku flow. The Keʻāmoku lava flow has provided most if not all of the building material for the structures in the form of loose cobbles and boulders. None of the structures showed any evidence of cultural deposits. Most of the structures show evidence of ash buildup in the interior that may contain some subsurface cultural remains.

Feature 78 is an 2.25 x 3.5 m 67 cm high C-shaped structure. Feature 78 is constructed from a large central boulder with two stacked walls, 1 – 3 courses high, which abut the boulder; one on the southeast end and one on the northwest end. The floor of the feature is level and made up of a matrix of pebbles, small cobbles, and highly eroded ash. The feature is open to the southwest. The structure is in fair condition.

Feature 79 is a 1.5 x 1.0 m and 44 cm high C-shaped structure. The feature is a stacked *ʻaʻā* boulder and cobble wall that abuts an *ʻaʻā* outcrop. The outcrop forms the northeastern end of the feature. The floor of the structure is level and made up of a matrix of sand and ash. The feature is open to the south and is in fair condition.

Feature 80 is a low (45 cm at its highest point) L-shaped structure. Measuring 2.25 x 2.25 m the structure walls are constructed of stacked small boulders and cobbles 1-4 courses high. The east wall is perpendicular to the Keʻāmoku flow and abuts the base of the flow on its eastern end. The floor of the feature is level and made up of a matrix of eroded ash. The feature is open to the south and is in fair condition.

Feature 81 is a 2.0 x 2.0 m and 32 cm high rock pile. It is constructed from loosely stacked *pāhoehoe* blocks that appear to have been excavated from the *pāhoehoe* rise on which it sits. The feature is collapsed and little integrity is left. The feature is in fair condition.

Feature 82 is a 1.75 x 1.25 m and 33 cm high mound. Constructed from stacked *pāhoehoe* boulders and cobbles, this mound is roughly circular in shape and is located on a low, *pāhoehoe*

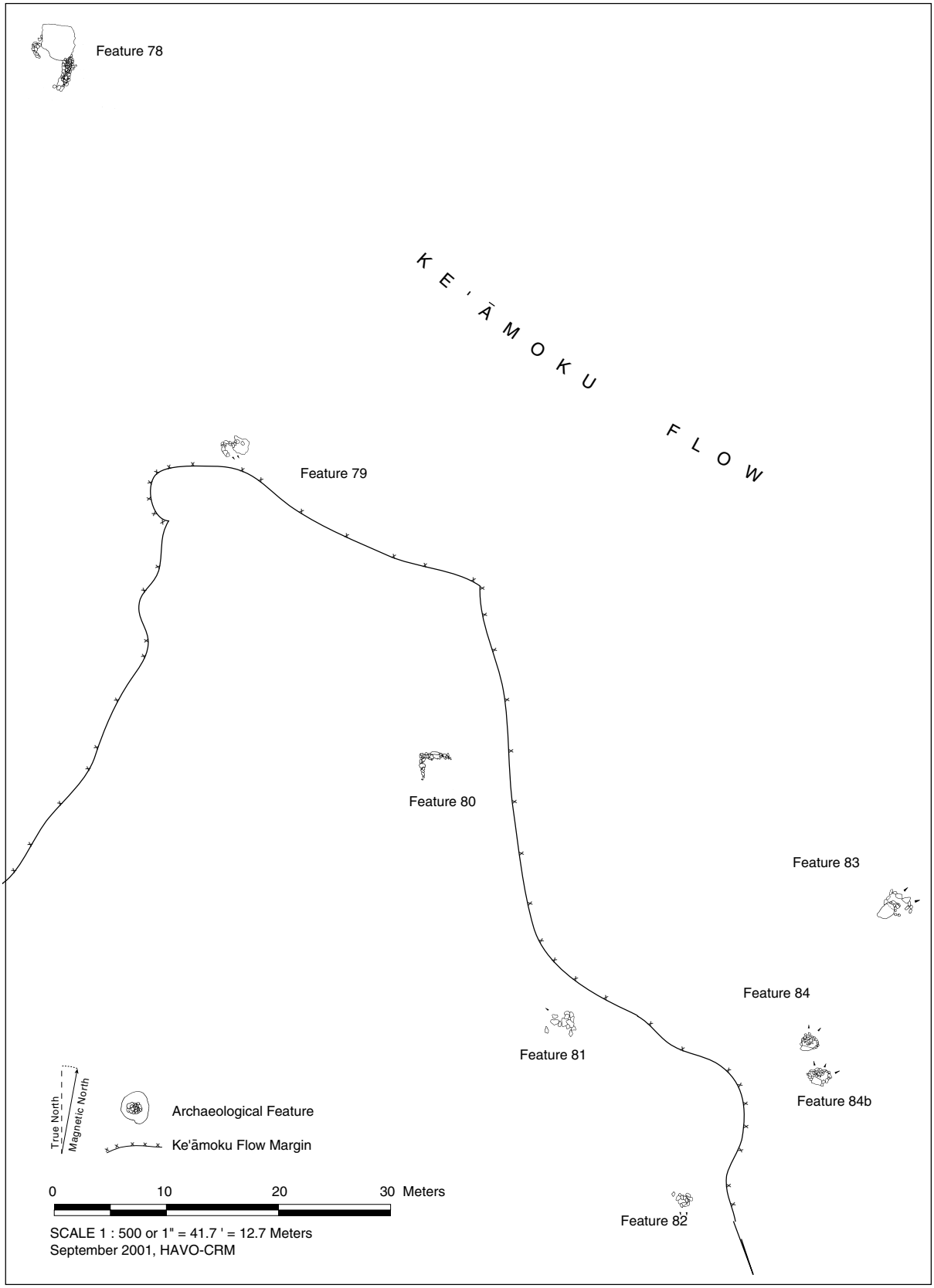

Figure 20. Site 22984 (excluding feature 305).

rise at the base of the Ke`āmoku lava flow. There is a scattering of *pūkiawe, `a`ali`i,* and natal redtop growing around the feature. The feature is in fair condition.

Feature 83 is a 1.5 x 2.25 m and 51 cm high modified overhang. A large natural boulder provides an overhanging edge that protects a small 0.75 x 0.5 m level area. Two loosely stacked walls abut this boulder; one on the northwestern end and one on the southeastern end. The boulder and the walls combine to form a roughly circular structure. The interior floor of the structure is a level matrix of eroded ash and basalt boulders. The boulders may be a result of wall collapse. There is a *`ōhi`a lehua* tree growing in the southeastern corner of the structure, as well as a scattering of *`a`ali`i* growing about. The feature is in fair condition.

Features 84a and 84b are a pair of terraces. Located on the Ke`āmoku lava flow, these terraces are constructed at the base of an *`a`ā* outcrop. The terrace wall is built with *`a`ā* boulders and cobbles stacked one to three courses high. There is some cobble fill in the interior of the terrace on the western side and a deposition of sand on the eastern side. The feature slopes downward from southwest to northeast. There is a scattering of *`a`ali`i, pūkiawe,* and alien grasses growing around the feature. The feature is in fair condition.

Feature 98-293 is a 1 m x 0.75 m x 65 cm high mound. The feature is located on a tumulus approximately five meters from the Ke`āmoku lava flow. No trail systems are evident in the close vicinity. However, the Ka`ū-Volcano trail does lie east of this feature.

Feature 305 is a 1.75 x 1.15 x 35 cm high mound. The feature is located on the edge of the Ke`āmoku *`a`ā* flow. Constructed of stacked cobbles and small boulders 3-4 courses high, some of the structure rocks appear to have been quarried from the local area. The feature is in good condition with no vegetation growing on or around it.

Feature 98-84 is a mound described by Wulzen (1999) as consisting of 15 boulders and cobbles "piled" on a tumulus to a height of 0.4 m.

SITE NO.: **22985**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.650 hectares
DESCRIPTION: This site consists of 15 structures - six walls, two overhangs, four C-shapes, two enclosures, and one associated possible hearth.

Features 85, 89, 92, 93, 94, and 95 are located on the Ke`āmoku lava flow, while features 86, 87, and 88 are located at the base of the flow. The Ke`āmoku lava flow has provided most if not all of the building material for the structures in the form of loose cobbles and boulders. None of the structures showed any evidence of cultural deposits. Most of the structures show evidence of ash buildup in the interior that may contain some subsurface cultural remains.

Feature 85 is a 1.75 x 2.0 m and 90 cm high modified overhang. Located on the Ke`āmoku lava flow, a natural outcrop has an overhanging edge that has been modified by the building of a stacked basalt boulder and cobble wall. The wall is 1- 4 courses high and located on the southeastern end of the overhang. There is also some stacking of cobble – size *`a`ā* at the north end of the overhang. The feature is open at its southern end. The floor of the feature is a level matrix of eroded ash with some deposition of wind blown sand. There is a gradual, downward sloping of the ground on the south – southwestern end of the feature. There is a scattering of *pūkiawe*, *`a`ali`i*, and alien grasses growing in and around the feature. The feature is in fair condition.

Feature 86 is a C-shaped structure located at the base of the Ke`āmoku flow. The structure wall is 2.0 x 3.0 m and 80 cm high. Constructed from a single, stacked *`a`ā* boulder and cobble wall, the feature is 1-3 courses high. Open to the southwest, the floor of the feature is a level matrix of eroded ash. The bottom most rocks that make up the feature are encrusted with ash suggesting that the feature was at least partially covered at one time. There is a scattering of *`a`ali`i* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Associated with feature 86 is a roughly circular alignment of cobble and small boulder size rocks (Feature 86a). Some of the rocks that make up the feature are partially submerged in a matrix of ash. A possible hearth, this subcomponent feature is 80 x 50 cm and 12 cm high. Natal red top, *pūkiawe*, and *`a`ali`i* are growing on and around the feature. The feature is in fair condition.

Feature 87 is a 1.75 x 0.50 m and 30 cm high wall. Its northern end nearly abuts the base of the Ke`āmoku lava flow. A *pāhoehoe* tumulus forms the terminus at the southern end of the feature wall appears to rest on a layer of highly eroded ash though more of the feature may be covered. The ground on the eastern side of the feature is level for approximately two meters then terminates sharply due to erosion. A deposition of sand has accumulated in this eroded area. There is some *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 88 is a 3.0 x 1.0m and 60 cm high wall. This feature abuts the base of the Keʻāmoku lava flow on the north. While the wall is mostly aligned from north to south, there is some curvature to the west on the southern end. This curvature is consistent with similar features that have been labeled as C-shapes, though it is not pronounced enough to warrant that designation. The feature sits on a layer of ash and its full extent may not be visible. There is an *ʻōhiʻa lehua* tree located approximately 2.5 m to the west of the feature and a mixture of natal red top, *ʻaʻaliʻi*, *pūkiawe*, and alien grasses are concentrated in the proximity of the ʻōhiʻa. The feature is in fair condition.

Feature 89 is a rectangular enclosure. The structure is 4.50 x 3.0 m and 79 cm high and is located on the Keʻāmoku lava flow, near the flow edge. The walls of the structure are constructed from stacked *ʻaʻā* boulder and cobbles two to five courses high. The interior floor of the feature is a level matrix of highly eroded ash and a few scattered rocks, probably a result of wall collapse. There is some cobble-size rock fill in the southern and northeastern walls . There are *ʻōhiʻa lehua* trees growing to the north and south of the feature along with a scattering of *ʻaʻaliʻi* and *pūkiawe*. The feature is in fair condition.

Feature 90 is a 2.0 x 2.0 m and 136 cm high enclosure. This feature is roughly rectangular in shape and is constructed from stacked *ʻaʻā* boulders. The feature abuts the base of the Keʻāmoku lava flow which forms its southern boundary. The interior floor of the feature is a fairly level mixture of ash and sand. There is a *ʻōhiʻa lehua* tree growing in the northwestern corner of the feature as well as a scattering of *pūkiawe*. The feature is in fair condition.

Feature 91 is a 4.25 x 2.50 m and 35 cm high C-shaped structure. This feature incorporates a large, central boulder to form its north boundary. A well-defined, stacked *ʻaʻā* boulder and cobble wall, three to four courses high, abuts the southeastern side of the boulder and extends to the southwest. There is an accumulation of pebble and cobble – size basalt rubble in the southwestern corner of the feature. The interior floor of the feature is a matrix of highly eroded ash that slopes downward from east to west. There is a single upright boulder located at the southern end of the feature and a rough alignment of rocks that extends southward from the southwestern corner of the boulder suggesting that this feature may have once been enclosed. The feature is located on the Keʻāmoku lava flow approximately seven meters from the flow edge. There is an *ʻōhiʻa lehua* tree growing in the southeastern corner of the

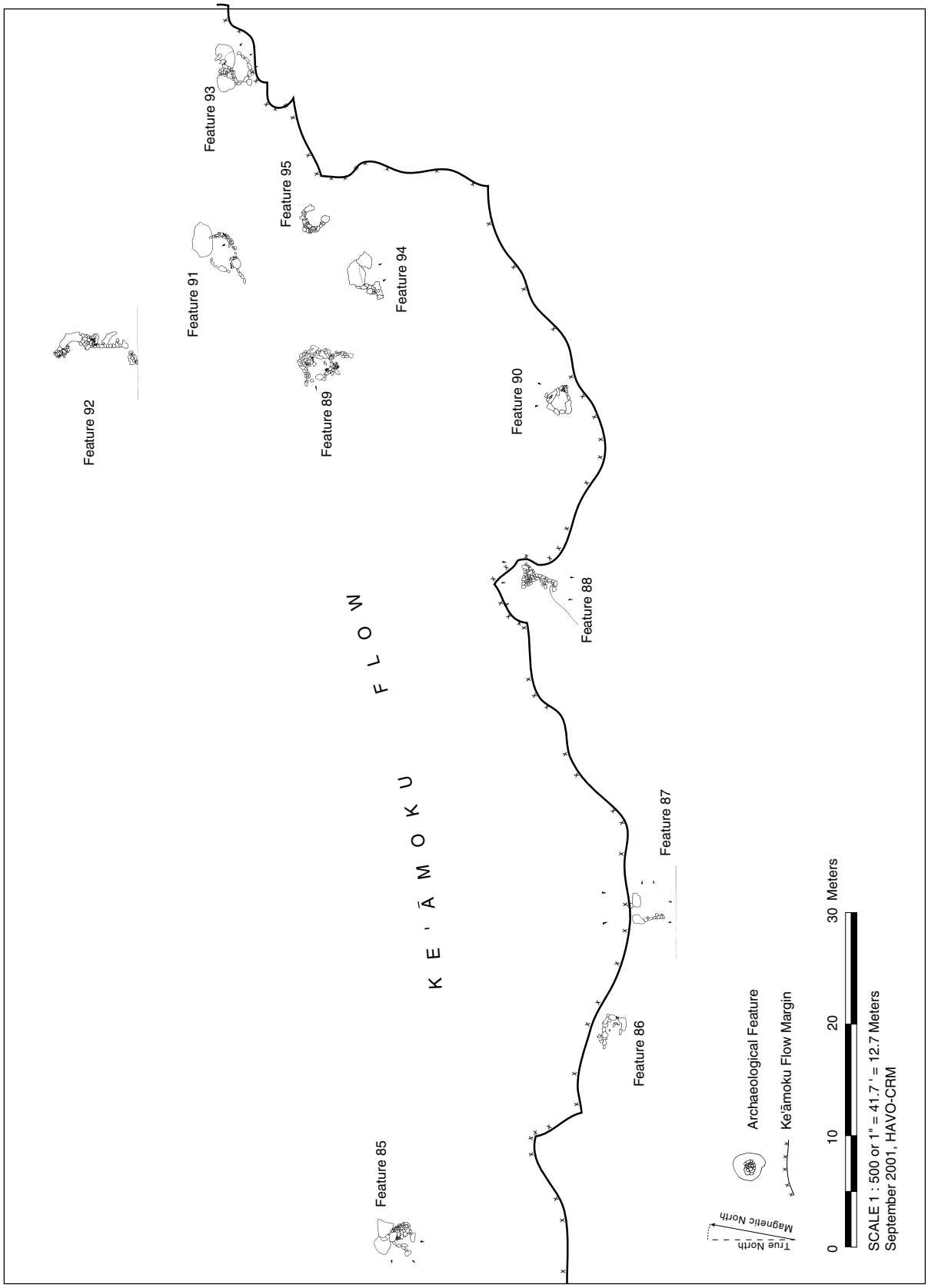

Figure 21. Site 22985 (excluding figures 308a and 308b).

feature as well as a scattering of *pūkiawe*, *ʻaʻaliʻi*, and *ʻōhelo*. The feature is in fair condition.

Feature 92 is a 6.00 x 1.50 m and 143 cm high wall and associated mound. The structures are located on the Keʻāmoku lava flow. At the northern end of the feature is a large natural outcrop modified by a stacked *ʻaʻā* boulder wall on its northern and southeastern end. A natural curvature on the west side of the outcrop is thus enhanced by these rock wall segments. Within the protected area the floor surface is level and clear. A second natural outcrop incorporated into the south half of the structure also provides two additional protected, leveled areas. The floors of the leveled areas are ash-filled and highly eroded. An associated mound located approximately 50 cm to the west of the southern end of the feature. There are *ʻōhiʻa lehua* trees and a scattering of natal redtop, *pūkiawe*, and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 93 is a well constructed C-shaped structure 2.20 x 2.40 m and 113 cm high. Located on the Keʻāmoku lava flow approximately four meters from base of flow. The structure is 2.5 x 2.0 x 113 cm high continuous wall, one to five courses high constructed from stacked *ʻaʻā* boulders and cobbles. The feature is open to the southeast and has a level, ash floor. There is some *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 94 is a 3.90 x 3 m and 200 cm high wall. Located on the Keʻāmoku lava flow, this feature incorporates a large outcrop on its northeastern end. A stacked basalt boulder wall, two to three courses high abuts the southwestern end of the outcrop. A second boulder abuts the southeastern end of the outcrop. These elements combine to form a level protected area. The level floor within the structure is a matrix of highly eroded ash. The feature is open to the south and overlooks the *pāhoehoe* below. There is a single *ʻōhelo* plant growing in the northwestern corner of the structure. The feature is in fair condition.

Feature 95 is a 3.0 x 2.75 m and 125 cm high modified overhang and associated terrace. This feature utilizes a large natural outcrop that is undercut on its southern end exposing a shallow, protected overhang. One meter to the west of the outcrop is a large accretionary lava ball. Between these two natural features a roughly stacked wall of *ʻaʻā* boulders has been constructed to fill the 1 m space. To the south of the overhang is a single course, curved, alignment of *ʻaʻā* boulders. The alignment is level with the floor surface and supports a level terrace. The floor of the terrace is a level matrix of highly eroded ash. There are two small, 0.8 m or less, pieces of dried *ʻōhiʻa lehua* wood in

the southeastern corner of the feature. A single *pūkiawe* is growing in the northeastern corner of the feature. The feature is in fair condition.

Feature 308a is a 2.20 x 0.40 m and 70 cm high wall. The wall is located at the edge of a tumulus that rises approximately 60 cm above the lower surface flow. The wall is constructed of loosely stacked small boulders and large cobbles that appears to have come from the local *pāhoehoe* flow. The structure follows the curvature of the tumulus rise. Its location suggests this feature may have been used as a windbreak.

Feature 308b is a wall about 1.50 x 0.40 m and 0.54 cm high. The wall is constructed with angular, blocky small boulders from the p4o *pāhoehoe* flow. The structure is located at the base of a southerly facing *pāhoehoe* tumulus.

SITE NO.: **22986**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.492 hectares
DESCRIPTION: This site consists of four overhangs and one wall. All features in this site with the exception of two, (features 98 and 99), are located on the Ke`āmoku lava flow. The Ke`āmoku lava flow also provided most of the building material for the Features. None of the structures of the structures showed any evidence of cultural deposits.

Feature 96 is a 4.5 x 2.5 m and 209 cm high modified overhang. The feature is located on the Ke`āmoku lava flow and utilizes a natural outcrop as part of the structure construction. The southwestern face of the outcrop is naturally undercut to expose a small, approximately 1 x 1.4 m, protected area. A stacked *`a`ā* boulder and cobble wall is located on the east side of the outcrop. The south wall is 4.5 x 0.25 and 52 cm high. The wall is a part of a terrace – like structure on the eastern end of the feature that is formed in a natural depression on the east side of the outcrop. A second smaller (1.0 x 0.75 x 0.70 m high) wall abuts the west side of the outcrop. The enclosed area between the two walls is mostly a level matrix of highly eroded ash. The ground slopes gently downward towards the protected shelter area of the overhang. There is a deposition of cobble-size *`a`ā* located at the entrance of the overhang. There is a *`ōhi`a lehua* growing approximately one meter to the west of the feature, as well as a scattering of *pūkiawe* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 97 is a 4.00 x 3.00 m and 33 cm high modified overhang. This feature is an outcrop that consists of a small area (1.0 x 1.25 x 0.42 m) protected by the overhanging edge. There are two stacked basalt boulder and cobble walls, three to five courses high, abutting the boulder. One wall is on the northern end and the second is on the southern end of the outcrop. The walls extend to the west partially enclosing the overhang area. The feature is open to the west. The ground immediately outside of the overhang area is mostly basalt rubble which slopes downward into the cave interior. At the northeastern end of the boulder, there is a short stacked basalt boulder wall that abuts the boulder and extends out to the north. There is a *ʻōhiʻa lehua* tree growing at the northern end of the feature. The feature is in fair condition.

Feature 98 is a 3 x 1.50 m and 30 cm high wall. Located at the base of the Keʻāmoku lava flow, this feature abuts the flow on its northern end and extends out to the south. It appears that the feature is partially buried by a layer of highly eroded ash and its full extent is unknown. It is constructed from small basalt boulders and cobbles and is one to two courses high. There is a *ʻōhiʻa lehua* tree growing approximately two meters to the southwest of the feature as well as a scattering of *ʻaʻaliʻi* and natal redtop growing around the feature. The feature is in fair condition.

Feature 99 is a 1.40 x 2 m and 137 cm high modified overhang. This feature is located at the base of the Keʻāmoku lava flow and faces south. Its main component is a large outcrop jutting out of the Keʻāmoku lava flow that is undercut exposing a small, 70 x 80 cm and 80 cm high, cave-like interior. There is a wall constructed of stacked basalt boulders, two to three courses high abutting the southeastern end of the outcrop and extending southward approximately 1.4 m. The interior of the overhang and the surface just outside of the overhang is a level matrix of highly eroded ash.

Feature 100 is located approximately 1.5 m to the east of this feature. There is *pūkiawe* and *ʻaʻaliʻi* growing in the southwestern corner of the feature. The feature is in fair condition.

Feature 100 is a 1.50 x 2 m and 160 cm high overhang. Located at the base of the Keʻāmoku lava flow. It sits adjacent to feature 99 and is similar in size and construction. As with feature 99, this feature is open to the south and uses a large outcrop as its main component. The outcrop is undercut to expose a small, 1 m x 50 cm, overhanging shelter. Unlike feature 99, however, the floor of this feature is a pavement of basalt boulders and cobbles. There is a retaining wall of basalt boulders on the southernmost

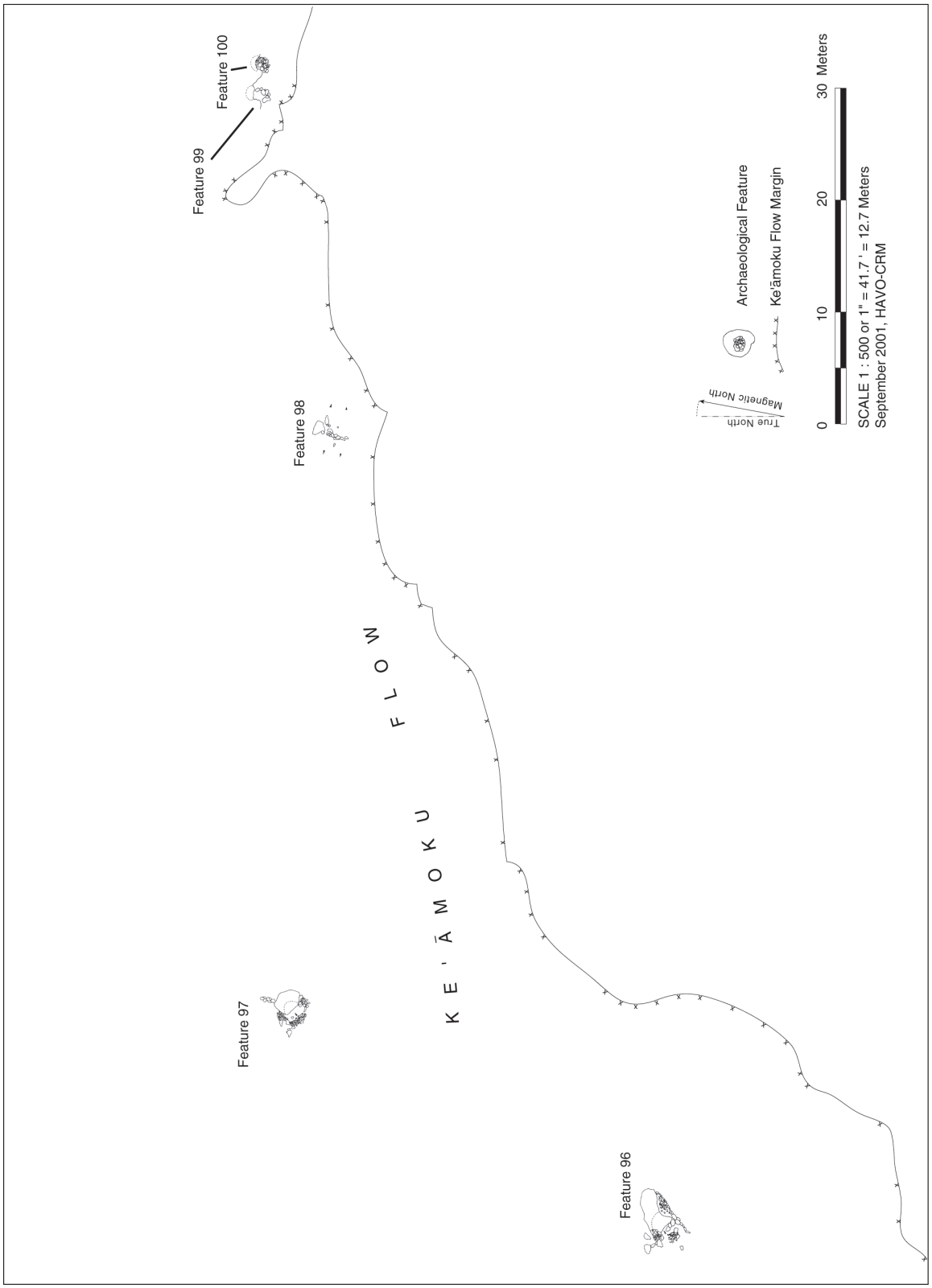

Figure 22. Site 22986.

end of the feature. There is some natal redtop, *pūkiawe*, and *ʻaʻaliʻi* growing in the northeastern corner of the feature. The feature is in fair condition.

SITE NO.: **22987**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 2.219 hectares
DESCRIPTION: This site consists of 47 features and one isolated marine shell fragment. The features include: nine enclosures, four terraces, 14 walls, eight C-shapes, five overhangs five U-shapes, and two L-shapes. This is the largest site in the project area and contains the most features. Features within this site are found both on and off the Keʻāmoku lava flow. The Keʻāmoku lava flow is the source for most if not all of the building material for all the features.

Feature 101 is a 4 x 4.30 m and 132 cm high U-shaped structure. This feature is located on the Keʻāmoku lava flow approximately fifteen meters from the edge of the flow. The central component of this feature is a large *ʻaʻā* boulder on the east side. There are two stacked *ʻaʻā* boulder walls abutting the central boulder; one on the northern end and one on the southern end. Both walls extend out to the west. The western end of the feature is primarily natural basalt rubble. The floor of the U-shape appears to be lower than the surrounding lava flow suggesting that the surface rocks may have been removed to provide a level surface. There is some *ʻaʻaliʻi* and *pūkiawe* growing within the feature. The feature is in fair condition..

Feature 102 is a 3.20 x 2.80 m and 195 cm high terrace. This feature is located on the Keʻāmoku lava flow. At the northeastern end of the feature is a large, columnar outcrop. There is a stacked basalt boulder and cobble wall, five to seven courses high, that abuts the outcrop on its northwestern side. At the southwestern end of the feature there is an alignment of boulders that forms the terminus for a terraced area that extends from the base of the outcrop to the alignment. The alignment acts as a retaining wall for the extreme end of the feature. The floor of the terrace is a level matrix of highly eroded ash. There is *ʻaʻaliʻi* and natal redtop growing on the terraced area. The feature is in fair condition.

Feature 103 is a 4.30 x 5 m and 142 cm high enclosure. The feature is located on the Keʻāmoku lava flow approximately fifty meters from the flow edge. There is a large boulder at the northern end of the feature. A stacked *ʻaʻā* boulder and cobble wall, seven to ten courses high abuts the boulder on its western end. The

boulder is abutted by another wall, three to four courses high, on its eastern end. Both walls curve southward from their positions and meet at another large boulder located at the southern end of the feature completing the enclosure. The large boulder at the northern end is undercut on its southern end exposing a small, 1 m x 30 cm, overhang. The surface floor of the feature is a matrix of highly eroded ash and is fairly level. There is some *ʻaʻali ʻi* growing at the northeastern corner of the feature.

Feature 104 is a 1.50 x 2.40 m and 225 cm high modified overhang. It is located on the Keʻāmoku lava flow and utilizes a large, boulder as its central feature. The southeastern face of the boulder forms a natural shallow overhang. A terraced area measuring 90 cm x 1.30 m has been constructed immediately adjacent to the overhang. The floor of the terraced area is an uneven pavement of basalt rubble. A retaining wall constructed of cobbles and boulders stacked 2-3 courses high encircles the base of the terraced area. There is some natal redtop is growing nearby. The feature is in fair condition.

Feature 105 is a 2.90 x 2.80 m and 165 cm high modified overhang. This feature is located on the Keʻāmoku lava flow approximately twenty meters from the edge of the flow. A naturally formed overhang at the southwest base of an outcrop is the central feature of this structure. A large boulder abuts the overhang on its southeastern end which likely provided additional shelter from the elements. A low wall constructed from basalt boulders and cobbles, three to four courses high abuts the boulder on its southern end and circles around to the northwestern end of the outcrop to form a terraced area measuring 80 cm x 1.40 m. The floor of the shelter is level and paved with *ʻaʻā* pebbles and tabular small boulders. There is some *ʻaʻali ʻi* growing at the southern end of the feature. The feature is in fair condition.

Feature 106 is a 3.80 x 4.30 m and 200 cm high roughly square enclosure. This feature is located on the Keʻāmoku lava flow approximately twenty meters from the east edge of the flow. There is a stacked *ʻaʻā* boulder and cobble wall, five to seven courses high that on the eastern end of the feature. This wall is aligned northwest to southeast and faced on both the eastern and western sides. The other three walls that make up the enclosed structure area built of loosely stacked *ʻaʻā* boulders and cobbles and are a maximum 150 cm high. The interior floor of the structure is approximately 2.0 x 1.75 m. The floor is a level matrix of highly eroded ash and cobble and pebble-size *ʻaʻā*. There is no vegetation growing within the feature, which is in fair condition.

Feature 107a & 107b are a complex of enclosures. Both features are built around the same, central large *ʻaʻā* boulder which functions as a fourth side around which walls are constructed. Feature 107a is located on the west side of the boulder. This feature is a roughly rectangular structure comprised of three loosely stacked walls. At its greatest height, Feature 107a is 70 cm high. The walls are constructed with small to medium *ʻaʻā* boulders and large cobbles 3-4 courses high. The interior of the feature is a level, cleared ash floor.

Feature 107b is constructed in the same manner as feature 107a. The central boulder, however, is located to the north of the structure walls. At its highest point, the walls of Feature 107b stand at 100 cm high. Like the interior of Feature 107a, the interior floor of feature 107b is level, and ash-filled with *ʻaʻā* pebbles on the surface. The feature is in fair condition.

Feature 108 is a 3.20 x 1.10 m and 65 cm high wall. This feature abuts the base of the Keʻāmoku lava flow on its northeastern end and extends southward. It is constructed from stacked *ʻaʻā* boulders and cobbles. The western side of the wall is faced. Small clumps of *ʻaʻaliʻi* growing on the northwestern side of the feature which is in fair condition. Concentrations of highly eroded ash to the east and west of the wall may obscure some of the construction.

Feature 109 is a 2.30 x 1 m and 70 cm high C-shaped structure. This feature abuts the base of the Keʻāmoku lava flow on its northern end and extends southward. It is constructed from stacked basalt boulders and cobbles. A second alignment of *ʻaʻā* boulders and cobbles located immediately to the west of the feature. This alignment abuts the Keʻāmoku lava flow on its northern end and curves to the southeast. The full extent of both the wall and the alignment is unknown due to a layer of highly eroded ash that has inundated the structures. These two features likely form a continuous C-shape. There is a *ʻōhiʻa lehua* tree growing at the eastern end of the feature as well as some *pūkiawe* at northwestern end. The feature is in fair condition.

Feature 110 is a 4.30 x 6 m and 170 cm high L-shaped structure. This feature is located at the base of the Keʻāmoku lava flow. There is a large *ʻaʻā* boulder at the northeastern end of the feature that serves as the nucleus of this structure. A wall constructed from medium *ʻaʻā* boulders abuts the large central boulder on its northern end and bridges the gap between the boulder and the Keʻāmoku lava flow. There is a highly collapsed wall constructed from medium *ʻaʻā* boulders and cobbles that abuts the central boulder on its southwestern end. This second wall extends to the southwest and turns, in a nearly ninety-degree

angle to the north until it meets the base of the Ke`āmoku lava flow. Together, these feature components form a sheltered area. The interior floor of the structure is level ash – filled. There is a scattering of *pūkiawe*, *ʻaʻaliʻi*, and natal redtop growing on and around the feature. The feature is in fair condition.

Feature 111 is a 3.85 x 2.80 m and 130 cm high modified overhang. This feature is located on the Ke`āmoku lava flow. A large boulder is its central component. The base of the west side of the boulder is naturally undercut, thus a slight overhang is formed. The overhang area is small (1.0 x 0.50 m) but large enough to provide some shelter from the elements. A stacked *ʻaʻā* boulder and cobble wall, two to six courses high, abuts the central boulder on its northwestern end then curves south – southeast forming a "c." The interior floor of the feature is a level, sandy deposit. Together, the overhang and wall provide a fairly comfortable sheltered area. The feature is in fair condition.

Feature 112 is a 3.10 x 1.68 m and 140 cm high C-shape. This feature is located on the Ke`āmoku lava flow. The central component of this feature is a large central boulder that appears to be partially excavated on its western end. There are two stacked *ʻaʻā* boulder walls; one on the northern end of the boulder and one on the southern end. Both walls extend out to the west to form the C-shape. The interior floor of the feature is a mixture of collapsed rock and highly eroded ash. There is some *pūkiawe* and *ʻaʻaliʻi* growing in and around the feature. The feature is in fair condition.

Feature 113 is a 4.90 x 4.60 m and 100 cm high enclosure. This feature is located on the Ke`āmoku lava flow. Roughly rectangular in shape, the structure walls encompass a level interior floor. The surface of the floor is clear and ash-filled forming a nice living or work space. The walls themselves are constructed of loosely stacked *ʻaʻā* medium boulder to cobble-sized rocks. The walls are built into the adjacent *ʻaʻā* outcrops. The feature is in fair condition.

Feature 114 is a 2 x 2.56 m and 250 cm high wall. This feature is located at the base of the Ke`āmoku lava flow. There is a large boulder at the northern end of this feature. A stacked *ʻaʻā* boulder and cobble wall abuts the boulder on its southeastern end then extends southward. The interior floor to the feature is a level matrix of sand and ash. An *ʻōhiʻa lehua* tree is growing at the southeastern corner of the feature. The feature is in fair condition.

Feature 115 is a 1.85 m x 30 cm and 136 cm high wall. This feature is located at the base of the Ke`āmoku lava flow. Constructed

from stacked *ʻaʻā* medium boulders and small cobbles, this feature abuts the Keʻāmoku lava flow on its western end and extends out to the east. The base of the feature is obscured due to the deposition of ash. There is some *ʻaʻaliʻi* growing on the southern end of the feature. The feature is in fair condition.

Feature 116 is a 2.10 x 1.60 m and 180 cm high modified overhang. This feature is located on the Keʻāmoku lava flow. The base of a large *ʻaʻā* boulder on the western end has been cleared and undercut to expose the base of the boulder. A shallow, 70 x 80 cm, cavity was thus formed that could provide some shelter from the elements. A stacked *ʻaʻā* boulder and cobble wall abuts the boulder on its northeastern end. The wall extends out to the east for approximately 45 cm then curves down to the south to form a "c." The interior floor of the feature is a level matrix of highly eroded ash. One individual Fountain grass (*Pennisitum satacium*), a highly invasive weed species, was pulled from the interior of the feature. The feature is in fair condition.

Feature 117 is a 30 cm x 1.10 m and 20 cm high wall. This feature is located approximately 60 cm south to the south of the base of the Keʻāmoku lava flow. The wall is low (20 cm at its maximum height) and roughly stacked *ʻaʻā* medium cobbles to small boulder sized rocks 1-2 courses high. It is aligned from north to south and is partially inundated by a matrix of ash and sand that obscures the true depth of the feature. A possible core (material type unknown) was found at the base of, and adjacent to the eastern side of the wall. There is some natal red top growing around the feature. The feature is in fair condition.

Feature 118 is a 2 x 1.50 m and 34 cm high U-shaped structure. This feature is located approximately 70 cm to the east of the base of the Keʻāmoku lava flow. There is a large, central boulder located on the western end of the feature that is utilized as part of the feature construction. Two stacked *ʻaʻā* boulder and cobble walls, two to three courses high, abuts the boulder; one on the northern end of the boulder and one on the southern end. Both walls extend out to the southeast. The feature sits on a fairly level matrix of ash, but there is a deposition of sand on the eastern, (interior), portion of the feature that slopes to the southeast. The feature is in fair condition.

Feature 119 is a 4.50 x 2.50 m and 54 cm high terrace. Located at the base of the Keʻāmoku lava flow, this feature consists of a two – tiered terrace. The first terrace abuts the base of the Keʻāmoku lava flow on its eastern end and the second terrace abuts the western end of the first. Both terraces have level, highly eroded ash floors. Stacked *ʻaʻā* boulder to cobble-sized alignments serve as retaining walls. The terrace walls are low,

one to two courses high (56 cm at their maximum height). There is a scattering of *ʻaʻaliʻi* and alien grasses growing on and around the feature. The feature is in fair condition.

Feature 120 is a 2.70 x 3.30 m and 65 cm high enclosure. This feature abuts the base of the Keʻāmoku lava flow on its northeastern end. Thus, the Keʻāmoku flow functions as a natural "wall" segment of the feature. Rectangular in shape, this feature is constructed from a stacked but not faced, boulders and cobbles one to three courses high. The walls are low (30 cm at its maximum height), but much of the feature is likely covered by ash which surrounds the base of the structure. The interior floor of the feature is a matrix of ash and sand. Vegetation around the feature consists of molasses grass, *pūkiawe*, natal redtop, and *ʻaʻaliʻi*. The feature is in fair condition.

Feature 121 is a 3.00 x 2.60 m and 177 cm high terrace built on the Keʻāmoku lava flow. The feature is built against two large boulders to the north. The feature has a stacked, but not faced, *ʻaʻā* boulder and cobble wall, one to four courses high, is located approximately 1 m to the southeast of the boulders. The terraced surface measures 1.30 x 1.0 m and is a relatively flat matrix of cobble and pebble fill. Molasses grass is growing on the terrace surface. The feature is in fair condition.

Feature 122 1.40 x 2.20 m and 110 cm high C-shaped structure. This feature is located at the base of the Keʻāmoku lava flow. A stacked basalt boulder and cobble wall, five to seven courses high abuts the base of the Keʻāmoku lava flow to form the northern end of the feature. Two large boulders form the southeastern and southwestern ends of the feature. The C-shape is open to the south. The interior floor of the feature is a level matrix of highly eroded ash. There is some *pūkiawe* and *ʻaʻaliʻi* growing in and around the feature. The feature is in fair condition.

Feature 123 is a 3.50 x 1.5 m and 26 cm high wall. This feature is located approximately 2 m to the south of the base of the Keʻāmoku lava flow. It is a stacked basalt boulder and cobble wall, one to three courses high, aligned east to west. The ground in and around the feature is a matrix of highly eroded ash. Molasses grass and *ʻaʻaliʻi* grow on and around the feature. The feature is in fair condition.

Feature 123a, a wall, is 2.50 x 0.80 m and 15 cm high and abuts the base of the Keʻāmoku lava flow on its eastern end and feature 123 on its western end. Feature 123a is likely an extension of feature 123, but it is unclear due to the inundation of ash. Feature 123 is 3.0 x 0.75m and 22 cm high. Both walls are constructed from *ʻaʻā* boulders and cobbles. The walls are poorly

stacked one to two courses high with no facing. There is molasses grass growing at the northern end of the feature as well as *pūkiawe* and *ʻaʻaliʻi*. The feature is in fair condition.

Feature 124 is a 2.40 x 2.30 m and 120 cm high enclosure. This feature is located on the Keʻāmoku lava flow. It is a circular-shaped enclosure constructed from stacked *ʻaʻā* boulders and cobbles. A large, naturally placed boulder forms part of the feature on the eastern end. The interior floor of the feature is a level matrix of ash. There is some *pūkiawe* and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 125 is a 2.50 x 3.10 m and 112 cm high enclosure. This feature is located on the Keʻāmoku lava flow. It is a roughly rectangular-shaped enclosure constructed from stacked *ʻaʻā* boulders, two to five courses high. The interior floor of the feature is rocky and relatively flat. There is some *ʻaʻaliʻi* growing on the interior of the feature. The feature is in fair condition.

Feature 126 is a 3 x 2.80 m and 209 cm high enclosure. This feature is located on the Keʻāmoku lava flow. It is a circular-shaped enclosure constructed from stacked basalt boulders and cobbles one to five courses high. There is a large, natural outcrop at the northern end of the feature that forms part of the structure wall. The level interior floor is a mixture of pebble and cobble-size *ʻaʻā* and highly eroded ash. There is some *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 127 is a 2 x 3.30 m and 35 cm high C-shaped structure. This feature is located on the Keʻāmoku lava flow and it abuts feature 126 on its western end. It is constructed from stacked basalt boulders and cobbles with some cobble fill. The wall curves from the west to the south. There is a deposit of pebble-size basalt at the southern end of the feature. The interior of the structure is relatively flat with a deposit of lithified ash and a scatter of large cobble-sized *ʻaʻā*. There is *pūkiawe* and *ʻaʻaliʻi* growing on the western side of the feature. The feature is in fair condition.

Feature 128 is a 3.30 x 3.40 m and 249 cm high C-shaped structure. This feature is located on the Keʻāmoku lava flow. There is a large boulder on the eastern end of the feature which is incorporated into the structure wall. A stacked *ʻaʻā* boulder and cobble wall abuts the northwestern end of the boulder and curves from west to south forming a C-shape. There is some stacked basalt boulders and cobbles at the southern end of the large boulder that extends from the south to the east. These elements combine to form a nearly circular structure. The boulder is abutted by feature 129 on its eastern end. The interior

floor of the feature is a level matrix of ash with some boulder and cobble – size rock protruding through the ash. natal redtop, *pūkiawe*, and *ʻaʻaliʻi* grow on and around the feature. The feature is in fair condition.

Feature 129 is a 2 x 2 m and 90 cm high U-shaped structure. This feature is located on the Keʻāmoku lava flow. This feature incorporates the same large boulder as Feature 128 in its construction as well. Two parallel walls extend southeast on the west end of the large boulder. The wall is not faced, but stacked boulder and cobble wall, one to three courses high abuts the boulder on its northwestern end. The ground on the southern side of the wall is a level matrix of ash. There are two upright stones located on the northeastern side of the feature. *Pūkiawe*, molasses grass, and *ʻaʻaliʻi* grow on and around the feature. The feature is in fair condition.

Feature 130 is a 2.80 x 2.20 m and 110 cm high terrace. This southern facing terrace is located at the edge of the Keʻāmoku lava flow overlooking the *pāhoehoe* below. A stacked *ʻaʻā* boulder and cobble wall, three to four courses high forms the northern end of the feature. The wall is nicely faced on the inner, southwestern side. A relatively flat cleared ash-filled terrace extends out from the southern base of the wall. The terraced floor area measures 1 x 1.50 m. A retaining wall is constructed on the south face of the terrace approximately one meter high. The feature is in fair condition.

Feature 131 is a 4.0 x 1.30 m and 133 cm high L-shaped structure. This feature is located on the Keʻāmoku lava flow just west of feature 130. It is constructed from a nicely stacked *ʻaʻā* boulder and cobble wall, one to four courses high. A large boulder that forms the southeastern end of the wall. The feature is open to the south. There is a concentration of pebble-size basalt in the northwestern end of the feature. The interior floor is fairly level with a scattering of small cobble to pebble-sized *ʻaʻā*. Natal redtop, *pūkiawe*, and *ʻaʻaliʻi* grow on and around the feature. The feature is in fair condition.

Feature 132 is a 3 x 1.80 m and 81 cm high C-shape. This feature is located on the Keʻāmoku lava flow approximately 4 m from the edge. The wall of the structure is of stacked *ʻaʻā* boulders and cobbles, two to seven courses high. The south wall is nicely faced on the southwestern end. The feature is open to the south. The interior floor of the feature is a level matrix of highly eroded ash. There are two *ʻōhiʻa lehua* trees growing on the northern end of the feature and one growing on the southwestern end. The feature is in fair condition.

Feature 133 is a 10 x 1.50 m and 100 cm high wall. This feature is located at the edge of the Keʻāmoku lava flow overlooking the *pāhoehoe* to the east. This structure wall is constructed of stacked *ʻaʻā* boulders and cobbles, one to four courses high. It is aligned from east to west. The western end of the wall curves towards the southwest to form a modified "c." There is *māmane*, *ʻōhiʻa lehua*, *pūkiawe*, and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 134 is a 2.40 x 2 m and 208 cm high modified overhang. This feature is located at the edge of the Keʻāmoku lava flow overlooking the *pāhoehoe* below. There is a large outcrop that forms the northwestern portion of the feature. The outcrop has been undercut on its southern side to form an overhang. There are two large basalt boulders abutting the outcrop on its eastern end that partially encloses the eastern end of the overhang. A stacked basalt boulder and cobble wall, four courses high abuts the southwestern end of the boulder to form a partially enclosed and protected area that is open to the south. An alignment of small boulders is located at the southern terminus of the feature that acts as a retaining wall for the interior floor of the structure. The floor is a level surface with a mixture of ash and sand. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 135 is a 4.50 x 2.55 m and 63 cm high wall. It is located at the base of the Keʻāmoku lava flow and is an alignment of nine *ʻaʻā* boulders. The structure is aligned from north to south. It abuts the base of the Keʻāmoku lava flow on its northern end. The feature is set on an ash embankment. Erosion on the southern end has undercut the embankment and may have possibly impacted the feature. ʻaʻaliʻi, *ʻōhiʻa lehua*, and *pūkiawe* are growing on and around the feature. The feature is in fair condition.

Feature 136 is a 2.50 x 4.50 m and 136 cm high U-shaped structure. This feature is located at the base of the Keʻāmoku lava flow. There is a large *ʻaʻā* boulder outcrop that forms the eastern end of the feature. The structure consist of two stacked *ʻaʻā* boulder

and cobble walls, one to three courses high, one on northwestern side of the boulder and one on the southwestern side. Both walls extend out to the west and run parallel to each other. The interior floor of the feature is level and contains a combination of ash and sand that slopes down gently to the west. *ʻAʻaliʻi*, *pūkiawe*, and natal redtop grow around the feature. The feature is in fair condition.

Feature 137 is a 3.10 x 2 m and 40 cm high wall. This feature is located at the base of the Keʻāmoku lava flow. An alignment of roughly stacked *ʻaʻā* boulders extends from the base of the Keʻāmoku lava flow to the south – southeast. Molasses grass and other alien grasses are growing on and around the feature. The feature is in fair condition.

Feature 138 is a 2.30 x 2.50 m and 52 cm high wall. This feature abuts the base of the Keʻāmoku lava flow at its northwestern end. It is constructed from *ʻaʻā* boulders and cobbles loosely stacked one to three courses high. Surrounding the feature is a level matrix of ash. The base of the structure is obscured due to the inundation of ash. Molasses grass, *pūkiawe*, and *Fimbristulus bulbulstylus* grow on and around the feature. The feature is in fair condition.

Feature 139 is a 3.80 x 3 m and 118 cm high U-shaped structure. This feature abuts the base of the Keʻāmoku lava flow on its northern end. There is a large *ʻaʻā* boulder outcrop jutting out of the base of the Keʻāmoku lava flow that forms the northern end of the feature. Two stacked *ʻaʻā* boulder and cobble walls, one to five courses high abut the outcrop, on the east and one on the west. Both walls extend out to the south to form the "u" of the structure which is open to the west. The interior floor of the feature is level and sandy. *ʻaʻaliʻi*, molasses grass, and natal redtop grow on and around the feature. The feature is in fair condition.

Feature 140 is a 3.90 x 3.60 m and 54 cm high C-shape. The feature is located approximately 20 m to the south – southwest of the base of the Keʻāmoku lava flow on the *pāhoehoe*. The feature is constructed from stacked *pāhoehoe* slabs that appear to have been excavated from the *pāhoehoe* flow. Many of the *pāhoehoe* slabs have been placed on their edge. This is a unique attribute for structures in this project area. The structure is open to the southeast. The interior floor of the feature is mainly *pāhoehoe* with some sand deposition against the base of the east wall. There is some *ʻaʻaliʻi* and various alien grasses growing on and around the feature. The feature is in fair condition.

Feature 141 is a 1.80 m x 50 cm and 13 cm high wall. This feature is located approximately 2.50 m away from the base of the Ke`āmoku lava flow. It is constructed from stacked single course *`a`ā* boulders and cobbles is open to the west. Much of the feature is covered by sand that has blown over the wall. There is some *`a`ali`i* growing around the feature. The feature is in fair condition.

Feature 142 is a 3.80 x 1.50 m and 46 cm high wall. This feature is located 1 m to the east of the base of the Ke`āmoku lava flow. It is constructed from stacked, faced *`a`ā* boulders and cobbles, three to four courses high. The structure wall curves slightly to the west. The structure is surrounded by a matrix of highly eroded ash and wind – blown sand. There is some natal redtop growing around the feature. The feature is in fair condition.

Feature 143 is a 3.80 x 2.75 m and 200 cm high C-shaped structure. The "C" opens to the south. The wall of the structure is medium to large *`a`ā* cobbles and small boulders roughly piled one to three courses high. It is located at the base of the Ke`āmoku lava flow. Erosion at the southern end of the wall is undercutting the structure. *`A`ali`i* and natal redtop are growing around the feature. The feature is in fair condition.

Feature 144 is a set of three parallel walls. Two of the walls abut the east base of the Ke`āmoku flow and are aligned from north to south. There are level sandy areas between the walls. A dense basalt core was found on the western side of the central wall. *`A`ali`i* and natal redtop are growing on and around the feature. The feature is in fair condition.

Feature 309 is a single, fragmented *`opihi* (*Cellana sp.*) shell isolate. Although it was assigned a feature number in the field, a single shell is not a feature but the number will be maintained for database purposes. The shell is located about four meters above the edge of the Ke`āmoku flow on the northwest facing edge.

Feature 98-282 is a 3 m x 1 m x 100 cm wall. The feature is located eight meters from the Ke`āmoku flow. No other data is available for this feature.

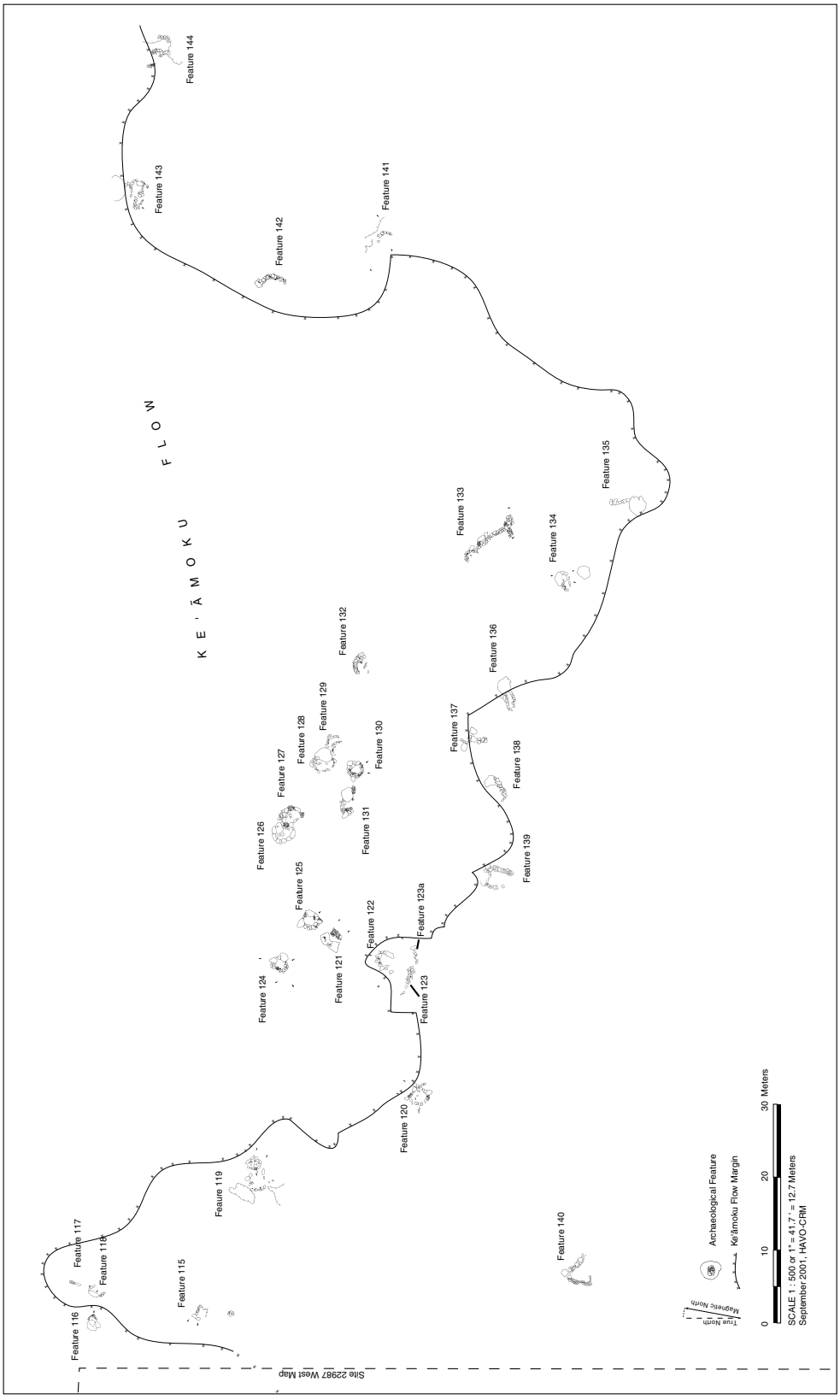

Figure 23. Site 22987, East.

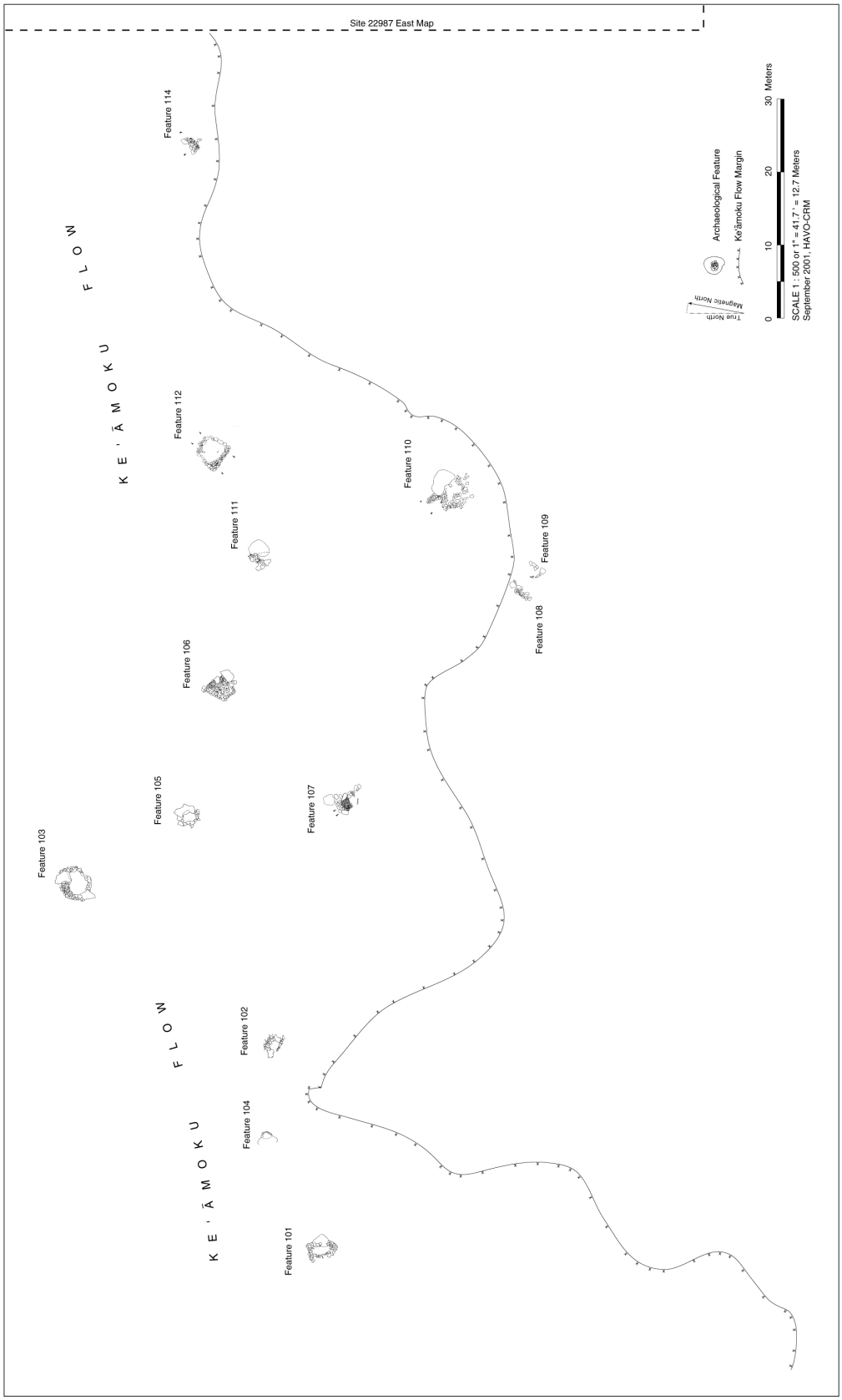

Figure 24. Site 22987, West.

SITE NO.: **22988**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.397 hectares
DESCRIPTION: This site consists of one overhang, two enclosures, and five C-shapes. The Ke`āmoku lava flow has provided most if not all the building material for all features. Most of the features are located at the base of the Ke`āmoku flow. Thus, the flow edge is utilized as part of the structure construction.

Feature 145 is a 1.30 x 2.30 m and 18 cm high modified overhang. It is located on the edge of the Ke`āmoku lava flow. There is a large outcrop on the western end that has been undercut to expose a very shallow overhang. A wall constructed from basalt boulders and cobbles abuts the northeastern end of the outcrop and extends to the north. The wall is nicely faced on the eastern side. These elements combine to form a nice floor area between the northeastern face of the outcrop and the southwestern side of the wall. The floor area is a level pavement of pebble – size *`a`ā*. The feature is in fair condition.

Feature 146 is a 3.50 x 3.50 m and 150 cm high enclosure. This feature is located on the Ke`āmoku lava flow approximately 2 m from the edge. There is a large natural outcrop on the northern end of the feature. A highly collapsed, stacked basalt boulder and cobble wall, one to four courses high abuts the western end of the outcrop. There is a berm of basalt rubble that extends from the eastern edge of the natural outcrop to the western end of the wall. Together these elements form a roughly circular-shaped enclosed area. The interior of the structure is a flat matrix of ash. *`a`ali`i* and *pūkiawe* grow on and around the structure. The feature is in fair condition.

Feature 147 is a 1.90 x 1.50 m and 66 cm high C-shaped structure. It is located at the base of the Ke`āmoku lava flow. This structure is a single stacked *`a`ā* wall constructed from boulders and cobbles, one to three courses high. The wall abuts the base of the Ke`āmoku lava flow on its western end and curves to the east-southeast. The "C" is open to the south. The interior floor of the feature is a level matrix of highly eroded ash. There is *`a`ali`i, pūkiawe,* natal redtop and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 148 is a 1.70 x 1 m and 48 cm high C-shape. This feature is located at the base of the Ke`āmoku lava flow. It is a single wall constructed from loosely stacked *`a`ā* boulders and cobbles. The wall abuts the Ke`āmoku lava flow on its western end and curves to the east – southeast. The "C" opens to the south. The interior floor of the feature is a level matrix of highly

eroded ash. There is *ʻaʻaliʻi, pūkiawe,* natal redtop and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 149 is a 2 x 2.30 m and 67 cm high C-shaped structure. It abuts the base of the Keʻāmoku lava flow on its western end. It is a single wall constructed from stacked basalt boulders and cobbles. The wall extends out from the base of the Keʻāmoku lava flow to the east – southeast. The "C" opens to the south. The interior floor of the feature is a level matrix of highly eroded ash. There is *ʻaʻaliʻi, pūkiawe,* natal redtop and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 150 is a 2.20 x 1.70 m and 30 cm high C-shape. This feature is a low single course alignment of *ʻaʻā* boulders that abuts the base of the Keʻāmoku lava flow on its northwestern end and extends out to the east-southeast. The "C" opens to the southwest. The interior floor and surrounding area is a level matrix of ash and wind-blown sand. Much of the structure is obscured by the sediment that has built up around it. Natal redtop and *ʻaʻaliʻi* grow on and around the feature. The feature is in fair condition.

Feature 151 is a 3.50 x 3 m and 43 cm high enclosure. It is located on the Keʻāmoku lava flow. There is a large boulder on the northern end that has been undercut at its base to form a small, 30 cm x 1 m overhang. A stacked *ʻaʻā* small boulder and large cobble wall, three to four courses high, abuts the southeastern end of the boulder and extends out to the south– southwest to form a roughly circular enclosure. The interior floor of the enclosure is a level matrix of eroded ash and rubble. *Pūkiawe,* natal redtop, *ʻaʻaliʻi,* and Molasses grass are growing on and around the feature. The feature is in fair condition.

Feature 98-227 is a C-shaped structure located eight meters from the Keʻāmoku flow below the tephra. No other data is available for this feature.

SITE NO.: **22989**
FORMAL TYPE: Cave Shelter
FUNCTION: Habitation
TOTAL AREA: 0.028 hectares
DESCRIPTION: This site consists of a single feature described below.

Feature 152 is a 2 x 3 m and 150 cm high cave. It is located on a southeastern facing slope of the Keʻāmoku lava flow. There is an alignment of *ʻaʻā* boulders immediately outside of the

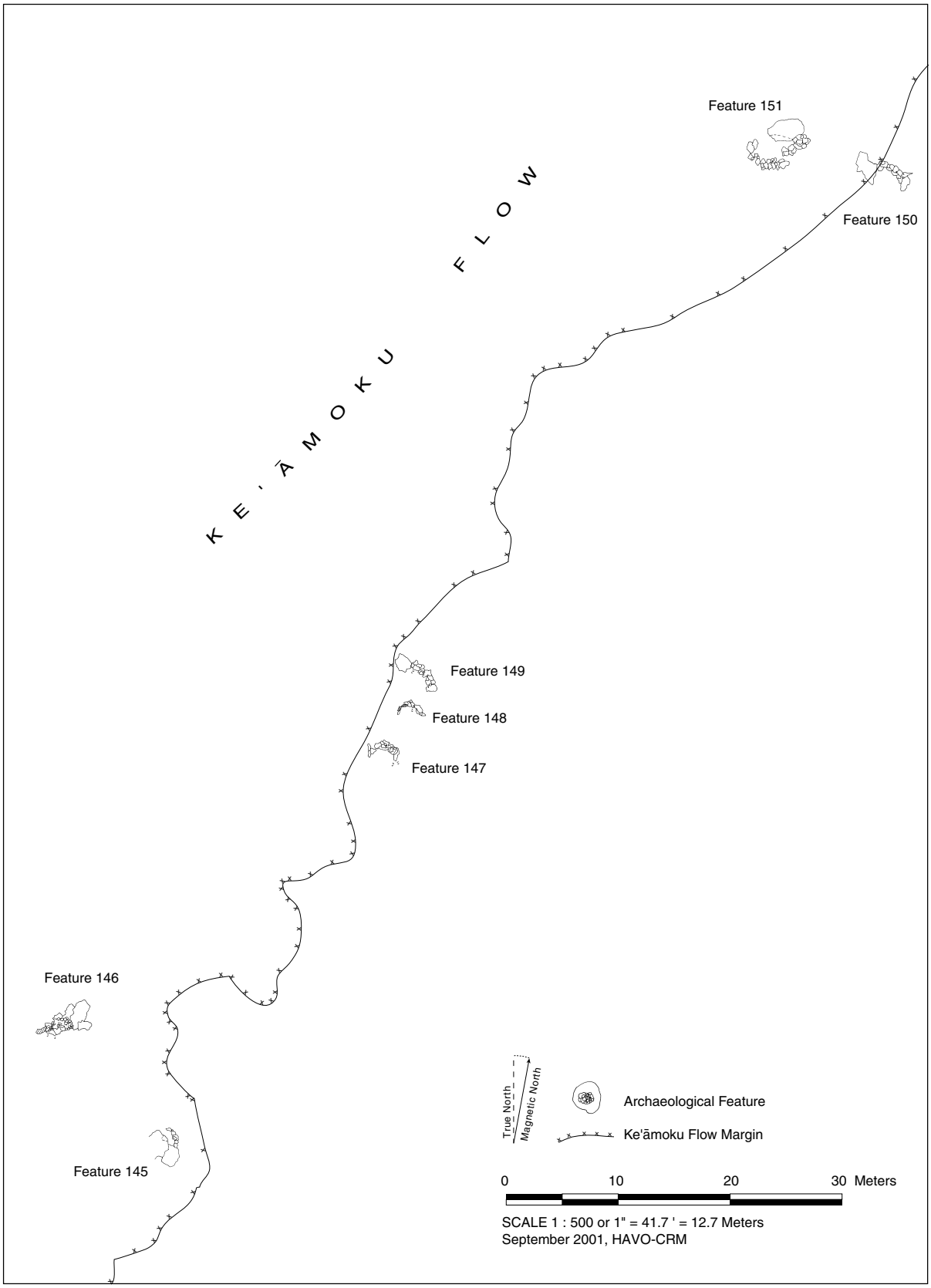

Figure 25. Site 22988.

entrance, aligned from east to west that is filled with ash on its northern side to form a terraced area. Both the ceiling and the floor of the cave have much calcareous deposits. *Pūkiawe* and Molasses grass grows on and around the feature. The feature is in fair condition.

SITE NO.: **22990**
FORMAL TYPE: Cave Shelter
FUNCTION: Habitation
TOTAL AREA: 0.013 hectares
DESCRIPTION: This site consists of a single feature described below.

Feature 155 is a 1.80 x 1.80 m and 95 cm high cave. It is located at the base of the Ke`āmoku lava flow. There is some stacking of basalt boulders and cobbles at the southwestern and northeastern ends of the cave entrance. The interior floor surface of the cave is level and covered with leaf litter. *`A`ali`i, pūkiawe,* and various alien grasses are growing near the entrance of the cave. The feature is in fair condition.

SITE NO.: **22991**
FORMAL TYPE: Cave Shelter
FUNCTION: Habitation
TOTAL AREA: 320 x 200 x 40 cm
DESCRIPTION: This site consists of a single feature described below.

Feature 154 is a 3.20 x 2 m and 40 cm high cave. This feature is located at the base of the Ke`āmoku lava flow. The cave entrance is open to the south-southwest. There is a stacked *`a`ā* boulder wall three to four courses high 0.75 m west of the dripline. The wall lies in a north-south direction parallel to the cave entrance. Between the dripline and the wall is a flat cleared area with a few small *pūkiawe* bushes growing on it. The feature is in fair condition.

SITE NO.: **22992**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.183 hectares
DESCRIPTION: This site consists of nine features: one wall, three C-shapes, three terraces, one overhang, and one enclosure. Unlike Site 22988, a majority of the features that comprise this site complex are constructed on the Ke`āmoku flow itself. All of the features are found north/northwest of a natural inlet area in the Ke`āmoku flow.

Feature 153 is a 2 x 1 m and 60 cm high wall. It is located at the base of the Ke`āmoku lava flow. The feature is constructed from

stacked *ʻaʻā* boulders and cobbles, three courses high. It abuts the base of the Keʻāmoku lava flow on its northern end and extends to the south. A matrix of ash surrounds the feature. *ʻAʻaliʻi* and molasses grass grows on and around the feature. Large ʻōhia trees grow just beyond the southern terminus of the structure. The feature is in fair condition.

Feature 156 is a 2 x 1.50 m and 90 cm high C-shaped structure. This feature abuts the base of the Keʻāmoku lava flow. The "C" opens to the southwest. The wall of the structure is built of *ʻaʻā* boulders and medium cobbles stacked one to five courses high. The wall is nicely faced on its interior surface. The interior surface of the feature is a level matrix of ash. *Pūkiawe* and broomsedge grows on and around the feature. The feature is in fair condition.

Feature 157 is a 2.80 x 2.60 and 117 cm high terrace. It is located on the Keʻāmoku lava flow. A large *ʻaʻā* boulder on the northeastern end of the feature is incorporated into the structure. A wall constructed from *ʻaʻā* boulders, five to six courses high abuts the western side of the boulder. There is another wall constructed from basalt boulders and cobbles, one to three courses high located approximately one meter to the south of the first wall. The area between the two walls is a level matrix of ash. The upper wall rises 108 cm above this level terraced floor. The ground drops off sharply at the southern end of the feature. The feature is in fair condition.

Feature 158 is a 3.20 x 2 m and 160 cm high terrace. This semi-circular terrace is located on a southwestern facing slope of the Keʻāmoku lava flow. The terrace wall is constructed from *ʻaʻā* boulders and cobbles, five courses high. The terraced area is a level matrix of ash and pebble-size basalt approximately 1.5 x 1.5 m There is some *pūkiawe* growing near the feature. The feature is in fair condition.

Feature 159 is a 1.70 x 1.20 m and 52 cm high C-shape. This feature is located on the Keʻāmoku lava flow and abuts the southern end of feature 160. It is a curved wall, the "C" is open to the east. The wall is constructed from *ʻaʻā* cobbles, two to three courses high. The interior surface of the feature is a level matrix of sand and highly eroded ash. There is some *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 160 is a 1 x 1.50 m and 179 cm high C-shaped structure. It is located on the Keʻāmoku lava flow and it abuts the northern end of feature 159. It is a curved wall, the "C" is open to the west. The wall is constructed from *ʻaʻā* boulders and cobbles. The interior surface is uneven and rocky. There is a *ʻōhiʻa lehua*

tree growing on the interior of the feature as well as some *pūkiawe* and *ʻaʻaliʻi*. The feature is in fair condition.

Feature 161 is a 2.60 x 3.80 m and 145 cm high terrace. This feature is located on a western facing slope on the Keʻāmoku lava flow. A large *ʻaʻā* boulder with a natural overhang is incorporated into the structure possibly providing shelter for the terrace floor. Just west of the boulder is the level terrace floor. The floor of the terrace is filled in with pebble-sized *ʻaʻā* and sand to create a level surface. The terrace retaining wall is one to three courses high, well-faced and stacked with *ʻaʻā* boulders and cobbles. The retaining wall is 0.35 m at its highest point. There is some natal redtop growing around the feature. The feature is in fair condition.

Feature 162 is a 3.30 x 3 m and 240 cm high enclosure located on the Keʻāmoku lava flow. This structure abuts the northeastern end of feature 161. This circular-shaped enclosure utilizes a large boulder outcrop to form its eastern end. A wall of stacked medium to large *ʻaʻā* boulders nearly encircle the large boulder outcrop. The wall is well-built but partially collapsing on the northern end. The interior surface the feature is a cleared level matrix of ash and pebble-size basalt. There is a *ʻōhiʻa lehua* tree growing in the northwestern corner of the feature. The feature is in fair condition.

Feature 163 is a 2.70 x 2.40 m and 108 cm high modified overhang. This feature is located on the Keʻāmoku lava flow. It utilizes a large outcrop that has been undercut on its western end to for a small overhang. The overhanging area of the outcrop provides a small sheltered area. A stacked boulder and cobble wall, one to six courses high abuts the western end of the boulder. Another highly collapsed wall abuts the east end of the feature. The surface area between the walls the overhang is level but rocky. There is *pūkiawe* and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

SITE NO.: **22993**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.463 hectares
DESCRIPTION: This site consists of 28 features: seven terraces, eight C-shapes, four walls, three overhangs, three L-shapes, one rock pile, one platform, and one mound. A majority of the features are located on the Keʻāmoku flow with several features constructed on the adjacent *pāhoehoe*. None of the features are located within recessed areas of the Keʻāmoku flow.

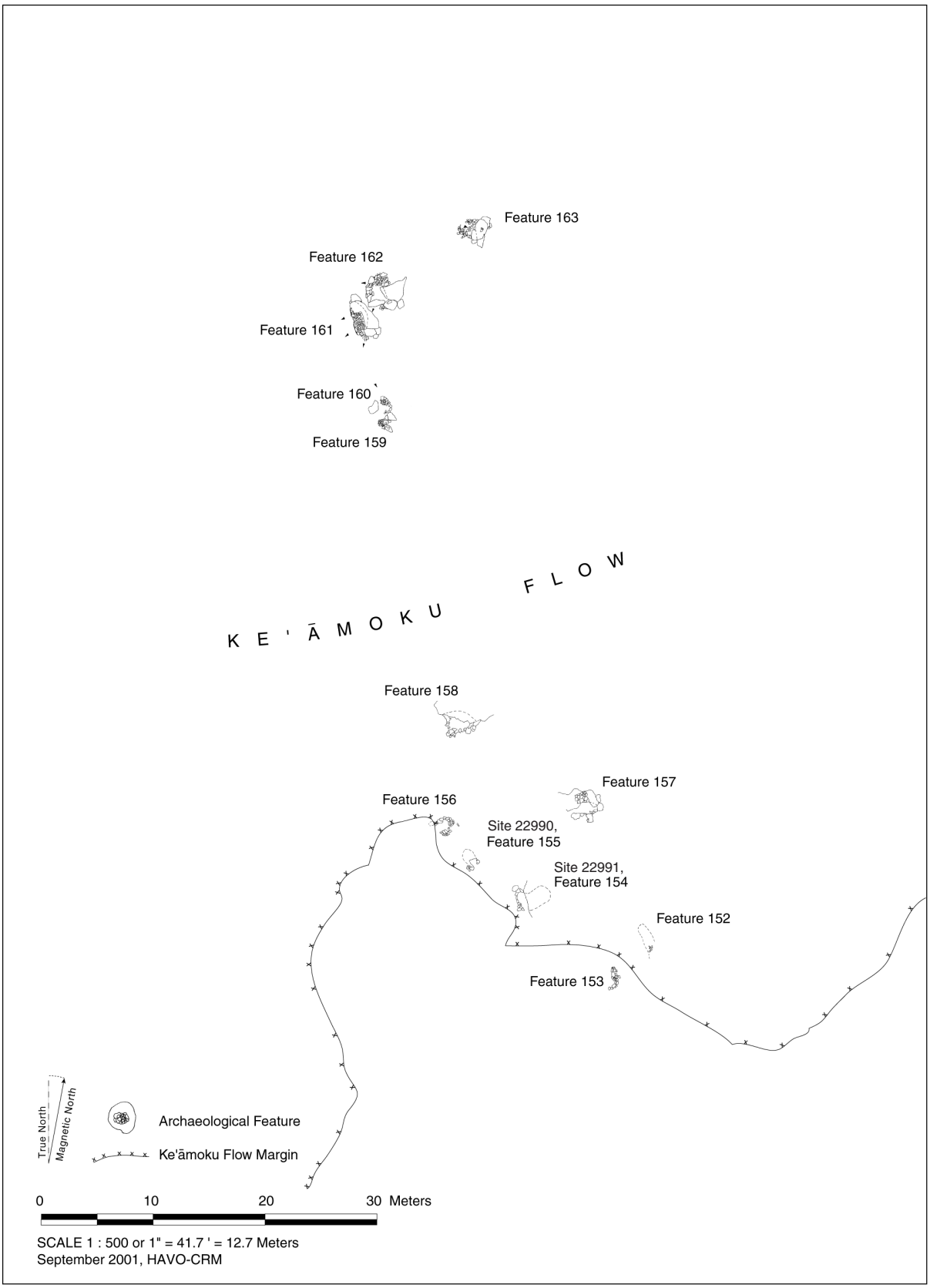

Figure 26. Sites 22990, 22991 and 22992.

Feature 164 is a 1.80 x 1.70 m and 162 cm high terrace. This feature is located at the edge of the Ke`āmoku lava flow. There is a large *`a`ā* boulder at the northwestern end of the feature that provides some shade and shelter. A basalt boulder and cobble retaining wall has been built into the surrounding *`a`ā* flow. The terrace is level with the ground surface on the west. The terrace surface is level with a matrix of ash and sand. *Pūkiawe* and *`a`ali`i* are growing on and around the feature. The feature is in fair condition.

Feature 165 is a 1.90 x 2.50 m and 56 cm high C-shaped structure. It is located at the edge of the Ke`āmoku lava flow. This C-shape utilizes a natural depression in the lava flow as part of its construction. *`A`ā* boulders and cobbles form a somewhat collapsed wall that nearly encircles the depression. The interior of the feature is an uneven matrix of cobble – size basalt, sand, and ash. There is *pūkiawe* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 166 is a 3.80 x 1.50 m and 44 cm high wall. This feature abuts the base of the Ke`āmoku lava flow on its northern end. It is a slightly curved wall, open to the west, constructed from *`a`ā* cobbles. The cobbles are stacked one to three courses high. There is much accumulation of ash in the area surrounding the feature and the full extent of the feature is unknown due to ash inundation. *Pūkiawe* and *`a`ali`i* are growing on and around the feature but the plants are small and not intrusive. The feature is in fair condition.

Feature 167 is a 1.20 x 1.10 m and 67 cm high rock pile. This feature is a poorly stacked rock pile two to three courses high, constructed from *`a`ā* boulders. It is located on the *pāhoehoe* flow approximately 20 m to the south of the base of the Ke`āmoku lava flow. The feature is somewhat collapsed; two boulders have toppled off. There is some *`a`ali`i* growing in the area. The feature is in fair condition.

Feature 168 is a 4.50 x 3.50 m and 61 cm high discontinuous L-shape. This feature is located south of the base of the Ke`āmoku lava flow. There is a stacked *`a`ā* boulder and cobble wall, one to three courses high that abuts the flow on its northern end and extends to the south to form the eastern side of the feature. Approximately 3 m to the south of the base of the flow, there is another wall that runs parallel to the flow. This wall is one to two courses high and it forms the southern boundary of the feature. Neither wall connects to the other, there is approximately one meter of space between the two walls. The interior of the feature is a level matrix of sand and pebble-size basalt. There is *pūkiawe*,

ʻaʻaliʻi, and various alien grasses growing on and around the feature. The feature is in fair condition.

Feature 169 is a 1.50 x 2 m and 180 cm high terrace. This feature is located on the Keʻāmoku lava flow. Two stacked *ʻaʻā* boulder retaining walls have been built into the natural *ʻaʻā* outcrop. At its highest point, the walls are 95 cm and one to two courses. The terrace surface is clear, level, and ash-filled. This feature abuts southern end of Feature 174. *ʻAʻaliʻi* and *pūkiawe* grow on and around the feature. The feature is in fair condition.

Feature 170 is a 2.50 x 2 m and 175 cm high terrace. This feature is located at the edge of the Keʻāmoku lava flow on a southern facing slope. The slope forms the northern side of the feature and an alignment of large boulders forms the southern retaining wall. The wall is one to two courses high (62 cm at its highest point). The terraced area is a clear level matrix of ash. There is *pūkiawe, ʻaʻaliʻi,* and natal redtop growing on and around the feature. The feature is in fair condition.

Feature 171 is a 1.50 x 2 m and 200 cm high terrace. This feature is located at the edge of the Keʻāmoku lava flow on a southwestern facing slope. This slope forms the east-northeast side of the feature. There is some stacked basalt boulders on the northern end of the feature that forms the retaining wall. The southwestern end of the feature is a steep natural drop-off. The terraced floor is a level matrix of ash and cobble-size basalt. *Pūkiawe* and *ʻaʻaliʻi* grow on and around the feature. The feature is in fair condition.

Feature 172 is a 3 x 1.70 m and 120 cm high C-shaped structure. This feature is located at the base of the Keʻāmoku lava flow. The "C" is open to the south. Two walled segments make up this structure. The north terminus of both segments abut the base of the Keʻāmoku flow which forms the north end of this structure. Both wall segments are constructed of small boulders and cobbles. The interior of the structure is a level combination of ash boulders and cobbles to form the southwestern end and a highly collapsed wall to form the northeastern end. The terraced area is a level combination of ash and pebble fill. There is *ʻaʻaliʻi,* molasses grass, and *Fimbristulus* growing on and around the feature. The feature is in fair condition.

Feature 173 is a 1.30 x 2.10 m and 70 cm high terrace. It is located on the Keʻāmoku lava flow on an eastern facing slope. A stacked *ʻaʻā* boulder and cobble wall forms the terrace retaining wall on the western end of the feature. The surface of the terraced area is a level combination of ash and pebble fill. There is

pūkiawe and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 174 is a 1.80 x 2.50 m and 20 cm high terrace. It is located on the Keʻāmoku lava flow and it abuts the northern end of Feature 169. The feature is built into the Keʻāmoku flow edge. The terraced area is a level matrix of ash that faces the southeast. The terrace is bisected by two upright *ʻaʻā* boulders. There is ʻūʻulei, *pūkiawe, ʻaʻaliʻi,* broomsedge, and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 175 is a 3 x 2.60 m and 108 cm high C-shaped structure. This feature is located on the Keʻāmoku lava flow on a ridge of a south-facing slope. The walls are constructed from *ʻaʻā* boulders and cobbles, one to six courses high. The "C" is open to the southwest. The interior floor of the structure is a level matrix of ash and scattered *ʻaʻā* boulders. There is some *pūkiawe, ʻaʻaliʻi,* and andropogon grasses growing on and around the feature. The feature is in fair condition.

Feature 176 is a 2.80 x 2.90 and 110 cm high platform. It is located on the Keʻāmoku lava flow approximately 25 m from the edge. There is a large boulder at the northwestern end of the feature. A stacked basalt boulder and cobble wall abuts the southeastern end of the boulder and extends out to the southeast. This wall is the best defined side of the feature. Abutting the wall is a paved area which comprises the remainder of the structure. To the east of the feature wall is a level filled area of boulders, cobbles, and pebbles. This fill area forms a rough square that is approximately the same width as the large boulder it abuts. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 177 is a 3.50 x 4.50 m and 135 cm high C-shape. This feature is located on the Keʻāmoku lava flow. It is a curved wall constructed from basalt boulders and cobbles, one to eight courses high. The feature is open to the southwest. The interior floor of the feature is a level matrix of ash and gravel. There is broomsedge, *ʻaʻaliʻi,* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 178 is a 2.50 x 2.80 m and 100 cm high modified overhang. This feature is located on a south-facing slope on the Keʻāmoku lava flow. There is an outcrop on the western side of the feature that has been undercut at its southern base to form a small overhang. *ʻAʻā* boulders and cobbles have been stacked on the northwestern corner of the overhang wall that functions as a windbreak. Immediately east of the overhang and wall is a

level, cleared area which contains *ʻaʻaliʻi, pūkiawe,* and natal redtop. The feature is in fair condition.

Feature 179 is a 3 x 3 m and 75 cm high L-shape. This feature is a "backward" "L" that abuts the base of the Keʻāmoku lava flow on its northern end. The wall extends to the south, then angles 90 degrees to the west. The "C" is open to the west. It is constructed from stacked *ʻaʻā* boulders and cobbles, two to four courses high. Erosion of the ash matrix at the base of the structure has exposed the *pāhoehoe* below. There is broomsedge, *pūkiawe, ʻaʻaliʻi, māmane,* and *ʻōhiʻa lehua* growing on and around the feature. The feature is in fair condition.

Feature 180 is an L-shape.

Feature 181 is a terrace. The feature is located at the edge of the Keʻāmoku flow approximately 10 m above the base of the flow. The terraced surface is level and filled with ash and *ʻaʻā* boulders and cobbles. A small segment of the retaining wall, on the east end, is faced. At its highest point, the retaining wall is 90 cm.

Feature 182 is a short wall segment constructed of *pāhoehoe* boulders and cobbles one course high. The ash that surrounds the structure likely covers the true height of the feature. The wall extends to the southeast from the base of the Keʻāmoku flow but does not abut the flow. A stand of ʻōhiʻa and *māmane* trees are located just south of the wall.

Feature 183 is an L-shaped structure. The feature abuts and is parallel to the Keʻāmoku flow on a northwest/southeast axis. A second extension of the wall runs northeast/southwest at a 90 degree angle from the first wall. This second segment is partially faced. The structure is 1-7 courses high stacked boulders and cobbles.

Feature 184 is a 2.20 x 1.50 m and 46 cm high wall. It is located approximately 3 m to the south of the Keʻāmoku lava flow. The feature is constructed from *ʻaʻā* boulders and cobbles, one to three courses high. The wall is aligned from northwest to southeast. The feature is partially inundated with sand. There is *māmane, ʻōhiʻa lehua ʻaʻaliʻi,* and *pūkiawe* growing on and around the feature especially on the southeast end. The feature is in fair condition.

Feature 185 is a 2.50 x 1 m and 31 cm high wall. It is located 25 m to the south of the base of the Keʻāmoku lava flow and the p4o *pāhoehoe*. The feature is constructed from *ʻaʻā* boulders and

cobbles, one to three courses high. It is aligned from north to south. The feature is collapsed on the northern end. There is *ʻōhiʻa lehua*, *pūkiawe*, and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 186 is a 1.80 x 2.70 m and 153 cm high modified overhang. This feature is located on a southern facing slope on the Keʻāmoku lava flow. There is an outcrop on the northern end of the feature that has been undercut at its southern base to expose a small, 1.50 x 1 m cavity. There is a stacked *ʻaʻā* boulder and cobble wall, one to five courses high approximately 1.50 m to the south of the overhang entrance that acts as a retaining wall for the terraced area. This feature abuts the eastern end of Feature 187. The terraced area is flat and ash-filled. There is *ʻaʻaliʻi* and natal redtop growing on and around the feature.

Feature 187 is a 1.80 x 1.70 m and 194 cm high modified overhang. It is located on a southern facing slope on the Keʻāmoku lava flow, abutting the western end of Feature 186. There is an outcrop on the northern end that has been undercut at its southern end to form a small overhang. A small outcrop at the southern end forms a terrace 2 m from the base of the overhang. Four basalt boulders aligned from north to south at the eastern end of the terrace forms windbreak. The floor of the terrace is rocky and fairly level. There is some *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 188 is a 2.50 x 2 m and 81 cm high C-shape. This feature is located on a southern facing slope on the Keʻāmoku lava flow. It is a curved wall roughly aligned from east to west and open to the south. It is constructed from basalt boulders and cobbles, three to four courses high. The interior floor of the feature is a relatively flat matrix of ash and basalt boulders. There is *ʻaʻaliʻi*, *pūkiawe*, broomsedge, and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 189 is a 2.50 x 2.50 m and 114 cm high C-shape. It is located on the Keʻāmoku lava flow. The feature is a curved wall aligned from north to south and open to the west. It is constructed from *ʻaʻā* boulders and cobbles, three to five courses high. The interior surface is an uneven scattering of *ʻaʻā* cobbles, gravel, and ash. There is *ʻōhiʻa lehua*, *ʻaʻaliʻi*, and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 98-205 is a C-shaped structure that "may be natural" (Wulzen 1999). The interior structure within the alignment of upright boulders is two meters square.

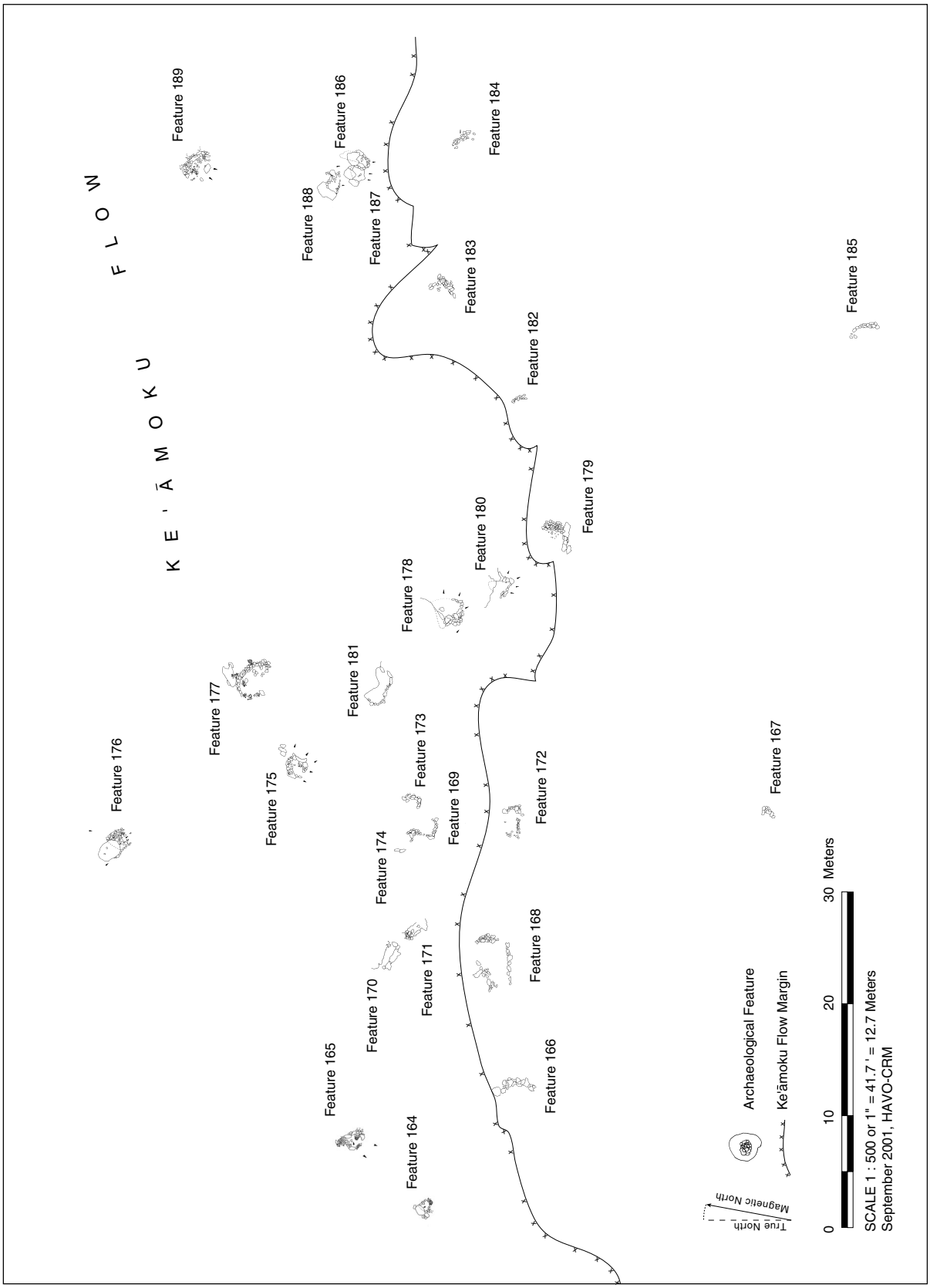

Figure 27. Site 22993.

Feature 98-206 is a mound that is approximately 65 cm high. The feature is located 15 m from the Keʻāmoku flow nearly halfway between the flow and the Kaʻū-Volcano trail (Site 22982).

Feature 98-208 is a C-shaped structure constructed on an outcrop 12 m from the Keʻāmoku flow. The structure is 4 m long.

SITE NO.: **22994**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.160 hectares
DESCRIPTION: This site consists of four C-shapes, one L-shape, two U-shapes and five walls. A majority of the features abut the base of the Keʻāmoku flow, while three are located on the Keʻāmoku flow and one south of the flow on the p4o flow. A rather small cluster of features, Site 22994 is located just northeast of Site 22993.

Feature 190 is a 3 x 3 m and 65 cm high C-shape. It is located approximately 7 m to the south of the base of the Keʻāmoku lava flow on the p4o *pāhoehoe* surface. The structure is a curved wall open to the west. It is constructed from faced basalt boulders and cobbles, one to four courses high. The interior floor is a flat matrix of ash. There is some *ʻaʻaliʻi* growing around the feature. The feature is in fair condition.

Feature 191 is a 2.40 x 1 m and 42 cm high wall. The structure abuts the base of the Keʻāmoku lava flow on its northern end and extends to the south. It is constructed from stacked *ʻaʻā* boulders and cobbles, one to two courses high. The wall is faced on the western side. The feature is largely inundated with sand. There is some natal redtop growing around the feature. The feature is in fair condition.

Feature 192 is a 2 x 2 m and 61 cm high C-shaped structure. The structure abuts the base of the Keʻāmoku lava flow on its northern end. The "C" is open to the west. It is constructed from *ʻaʻā* boulders and cobbles, two to three courses high. The structure wall is faced on both the east and west side. The base of the feature is partially obscured by ash. There is natal redtop, *ʻaʻaliʻi*, and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 192a is a wall. The structure abuts the Keʻāmoku flow on its north end and extends to the southeast. Constructed of stacked *ʻaʻā* boulders and cobbles the feature is partially faced on the west side.

Feature 193 is a 3.50 x 2.50 m and 73 cm high L-shape. It abuts the base of the Keʻāmoku lava flow on its northern end. It is a 90 degree angled wall aligned from north to south and open to the west. It is constructed from *ʻaʻā* boulders and cobbles three to four courses high. There is an accumulation of highly eroded ash around the feature. Broomsedge, *pūkiawe, ʻaʻaliʻi,* and molasses grass are growing on and around the feature. The feature is in fair condition.

Feature 194 is a 2.20 m x 70 cm and 58 cm high wall. This feature abuts the base of the Keʻāmoku lava flow on its northern end. It is aligned from north to south. It is constructed from stacked *ʻaʻā* boulders and cobbles, one to three courses high. The structure is inundated with ash. There is *ʻōhiʻa lehua* and natal redtop growing on and around the feature. The feature is in fair condition.

Feature 195 is a 2.50 x 1.0 m and 40 cm high U-shape. The feature consists of two discontinuous walls, both of which abut the base of the Keʻāmoku lava flow on their northern ends. It is slightly curved, aligned from north to south and open to the west. It is constructed from stacked *ʻaʻā* boulders and cobbles. The area surrounding the feature is covered with sand. There is natal redtop and *ʻaʻaliʻi* growing in the area. The feature is in fair condition.

Feature 196 is a 2.50 x 1 m and 40 cm high wall. It abuts the base of the Keʻāmoku lava flow on its northern end. It is slightly curved, aligned from north to south and open to the west. The structure is constructed from stacked boulders and cobbles, one to two courses high. There is a large amount of sand accumulation around the feature. There is some *ʻaʻaliʻi* growing around the feature. The feature is in fair condition.

Feature 197 is a 2.50 x 2 m and 49 cm high C-shape. This feature abuts the base of the Keʻāmoku lava flow on its northern end. It is a curved wall, with the "C" open to the southwest. It is constructed from stacked *ʻaʻā* boulders and cobbles, one to two courses high. The feature is constructed on the open *pāhoehoe* and there is an accumulation of ash and sand on the western side of the structure. There is *ʻaʻaliʻi* and broomsedge growing on and around the feature. The feature is in fair condition.

Feature 198 is a 4 x 2 m and 100 cm high wall. This feature abuts the base of the Keʻāmoku lava flow on its northern end. It is a straight wall aligned from north to south. It is constructed from *ʻaʻā* boulders and cobbles stacked one to two courses high. There is an accumulation of ash on the northeastern end and

sand accumulation on the southwestern end. The rocks that form the feature appear to be "cemented" by ash. There is some *ʻaʻali ʻi* growing around the feature. The feature is in fair condition.

Feature 199 is a 1.80 x 3 m and 111 cm high C-shape. This feature is located on the Keʻāmoku lava flow. It is a curved structure open to the southwest. The feature is a natural rubble berm on the western side and an outcrop on the eastern side. The northern end is stacked *ʻaʻā* boulders and cobbles arranged to fill the gap between the eastern and western sides. The interior floor is fairly flat with ash and rubble fill. There is *ʻaʻali ʻi* growing on and around the feature. The feature is in fair condition.

Feature 200 is a 2.60 x 3.20 m and 200 cm high U-shaped structure. This feature is located on the Keʻāmoku lava flow. It utilizes a large central boulder as its eastern "walls." There is a constructed wall on the northern end and another wall on the southern end of the boulder. Both walls abut the western side of the boulder and extend out to the west. The interior floor is level and ash-filled. There is *ʻōhiʻa lehua*, *ʻaʻali ʻi*, and *pūkiawe* growing on and around the feature. The feature is in fair condition.

SITE NO.: **22995**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.164 hectares
DESCRIPTION: This site consists of 12 features: three C-shapes, two terraces, one L-shape, one modified overhang, three enclosures, one wall and one petroglyph. A majority of features within this site cluster are located on the Keʻāmoku flow. Feature 202 is the only structure built within a protected inlet area of the Keʻāmoku flow.

Feature 201 is a short wall segment. The structure is constructed of stacked *ʻaʻā* boulders and cobbles one to four courses high. The wall is aligned east to west and is located on the Keʻāmoku flow.

Feature 202 is a 2.50 x 2.50 m and 60 cm high C-shaped structure. This feature is located at the base of the Keʻāmoku lava flow on the p4o *pāhoehoe* flow. A stacked *ʻaʻā* wall abuts the base of the Keʻāmoku lava flow on the east. The interior is a level matrix of ash. There is some natal redtop, *pūkiawe*, and *ʻaʻali ʻi* growing on and around the feature. The feature is in fair condition.

Feature 203 is a 2.50 x 3.50 m and 33 cm high L-shape. This feature abuts the base of the Keʻāmoku lava flow on its northern end then extends to the south before turning abruptly to the

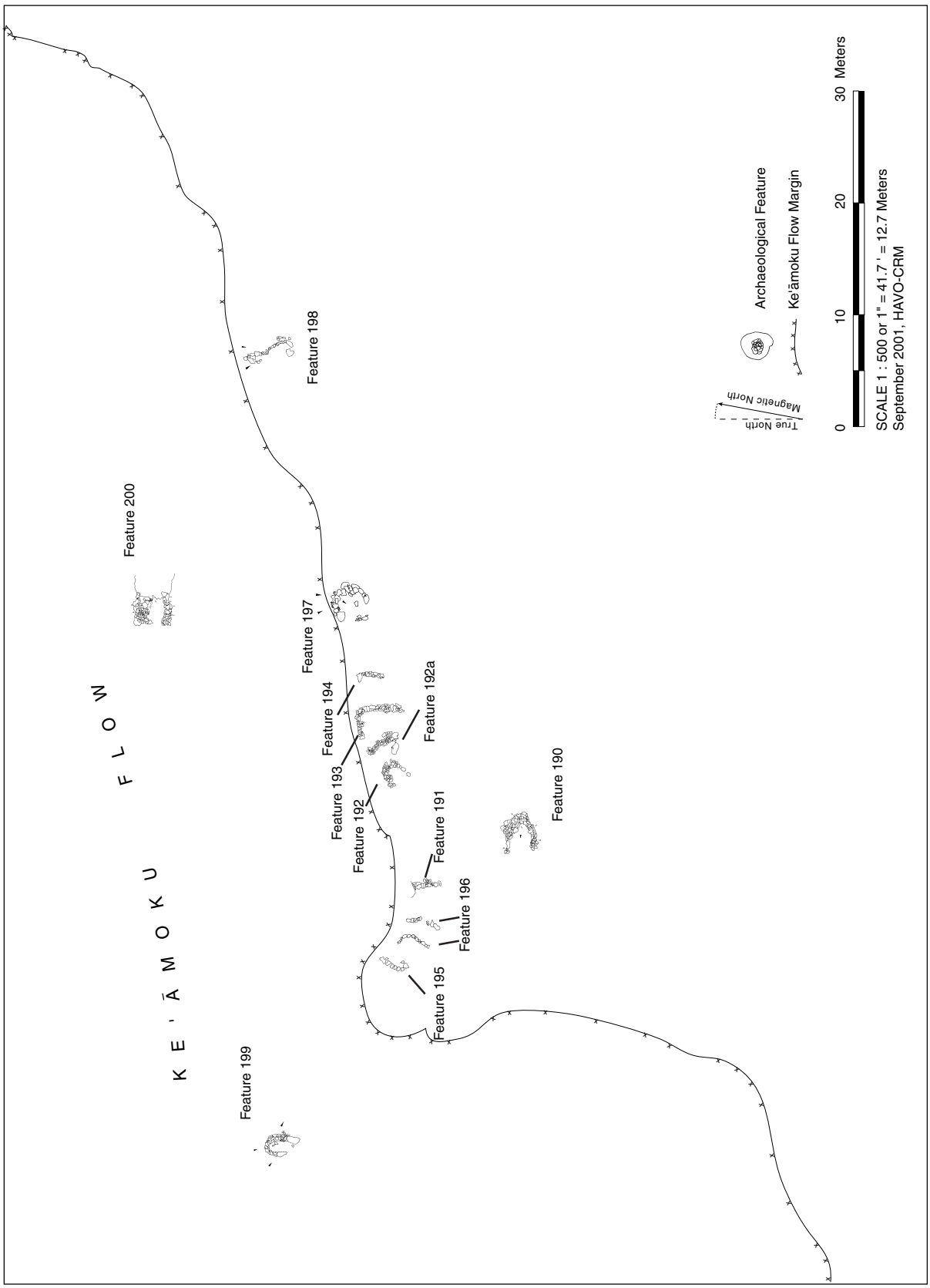

Figure 28. Site 22994.

west. It is constructed from *ʻaʻā* boulders and cobbles stacked one to two courses high. The feature is partially buried in sand but some facing is evident on the north. There is nictitans, *pūkiawe, ʻaʻaliʻi,* and various alien grasses growing on and around the feature. The feature is in fair condition.

Feature 204 is a 1.80 x 2 m and 38 cm high C-shaped structure. This feature is located approximately 1 m to the south of the base of the Keʻāmoku lava flow. It is a curved wall aligned from northwest to southeast and open to the southwest. It is constructed from basalt boulders, one to two courses high. It is located in an area inundated with sand. There is *ʻaʻaliʻi, pūkiawe,* and various alien grasses growing on and around the feature. The feature is in fair condition.

Feature 205 is a 2.50 x 1.90 m and 62 cm high enclosure. It is located on the Keʻāmoku lava flow on a western facing slope. There is a large outcrop on the eastern end of the feature which forms a natural wall. The remainder of the feature consists of three raised stacked *ʻaʻā* walls, one to five courses high abutting the northern end of the outcrop in a roughly rectangular shape. There is pebble-size *ʻaʻā* and ash fill in the interior of the structure. *ʻAʻaliʻi, pūkiawe,* and natal redtop are growing on and around the feature. The feature is in fair condition.

Feature 206 is a 1.50 x 1.80 m and 200 cm high modified overhang. It is located on the Keʻāmoku lava flow. This overhang utilizes a large outcrop on its eastern end that is undercut at its western base to form a small overhang. There is an alignment of *ʻaʻā* boulders and cobbles abutting the northwestern end of the boulder extending out to the south-southwest. The interior of the feature is a level matrix of highly eroded ash and basalt rubble. There is *ʻōhiʻa lehua, ʻaʻaliʻi,* and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 207 is a 1.60 x 1 m and 101 cm high C-shaped structure. This feature is located on a western facing slope on the Keʻāmoku lava flow. It is constructed from loosely stacked *ʻaʻā* boulders one to four courses high and open to the northwest. The interior floor is uneven and rocky. It appears that ash covered the structure, then eroded away over time exposing rocks that appear to be "cemented" by ash. There is some *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 208 is a 2.80 x 3.0 m and 100 cm high group of four linear and parallel terraces. This feature is located within a ravine on a southern facing slope within the Keʻāmoku lava flow. The series of four terraces are aligned from north to south. The northernmost terrace has a stacked basalt boulder wall, one to

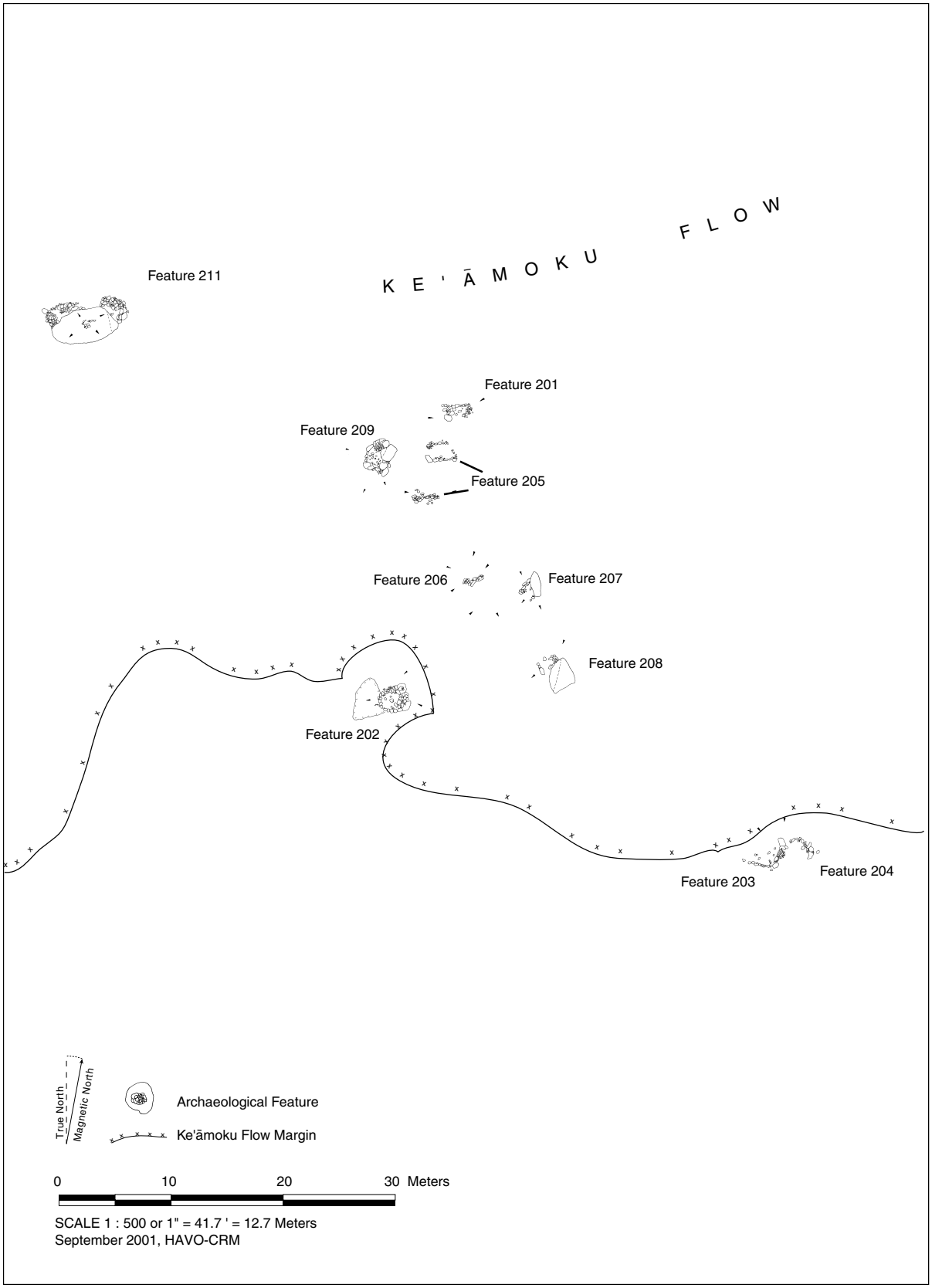

Figure 29. Site 22995.

five courses high on its southern end. The second terrace abuts this wall on its northern end and has no wall on its southern end. The third terrace is almost identical to the second. The fourth terrace has a retaining wall on its southern end. All terraces are level and ash-filled. Ash inundation on and around the structures suggests that ash covered the structures and is now being exposed by the elements. There is *ʻōhiʻa lehua*, *ʻaʻali ʻi*, and natal redtop growing on and around the feature. The feature is in fair condition.

Feature 209 is a 1.20 x 1 m and 99 cm high terrace. This feature is located on the Keʻāmoku lava flow. The retaining wall is roughly circular constructed from stacked *ʻaʻā* boulders and cobbles. Wall heights are greatest at the northern end. The interior of the feature is uneven, rocky, and cobble-filled. There is no vegetation in the immediate vicinity of the feature. The feature is in fair condition.

Feature 211a & 211b are a pair of enclosures. These enclosures are not adjacent to one another. However, they are both built up against the same large accretionary lava ball which forms the south "wall" of each structure. Structure 211a is located on the northwest corner of the lava ball. This structure is 1.25 x 2.5 m and 57 cm high. Constructed of stacked *ʻaʻā* boulders and cobbles the interior surface area of the enclosure is very small (1.0 x 0.75 m).

Structure 211b is located on the northeast corner of the accretionary lava ball. It was built using the same kinds of materials and construction methodology. The interior floor surface is cleared, level, and ash-filled (0.5 x 1.5 m). Structure 211b is 1.5 x 2.25 m and 31 cm high.

Feature 316 is a petroglyph. Consisting of the letter "K" and "I" these pecked set of letters are located approximately 3 m northwest of the Kaʻū-Volcano trail (Site 22982) on the p4o *pāhoehoe* flow. The letters are in the old historic style of writing.

SITE NO.: **22996**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.802 hectares
DESCRIPTION: This site consists of 48 features: four terraces, 27 C-shapes, eight walls, one cupboard, five mounds, one modified overhang, one possible cupboard, and one historic dump. A majority of the features are built on the Keʻāmoku flow. Less than a half-dozen of the features that comprise this site are located either at the base of the Keʻāmoku flow or on the p4o

flow. The style of construction of all of the features excluding the glass bottles suggest they are either precontact or early historic in nature.

Feature 212 is a C-shaped structure. The wall is built of loosely stacked and mounded *ʻaʻā* boulders. The "c" is open to the south. The surface are around the structure, which is located on the Keʻāmoku flow is uneven and rocky. The wall is one to seven courses high and is highest at the north end of the feature. An associated mound is located to the southeast.

Feature 213 is a 2.16 x 1.72 m and 87 cm high C-shape. This feature is located on the Keʻāmoku lava flow approximately 20 m from the edge. Two large *ʻaʻā* boulders make up the eastern and northeast sides of the feature. A stacked *ʻaʻā* boulder and cobble wall, one to three courses high northwestern side of the wall and extends out to the south-southwest from the north corner of the east boulder. There is *ʻaʻā* rubble fill at the northern end of the structure between the main wall and two large boulders. There is an alignment of stacked basalt boulders and cobbles on top of the eastern boulder. The interior portion of the outcrop is uneven and rocky. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 214 is a 1.50 x 1.70 and 84 cm high wall. It is located on a southern facing slope on the Keʻāmoku lava flow. The wall is constructed from stacked *ʻaʻā* boulders and cobbles, one to four courses high. The northern end of the feature is level with the slope. The area to the southwest is level, and contains ash and cobbles and slopes gently to the south. There is some *ʻaʻaliʻi* and natal redtop growing on and around the feature. The feature is in fair condition.

Feature 215 is a 3.0 x 2.50 m and 139 cm high C-shape. It is located on the Keʻāmoku lava flow approximately 20 m from the edge. It is a curved wall, aligned from north to south, and open to the west. The wall is constructed from stacked boulders and cobbles, five to eight courses high. The interior surface to the southwest is level and ash-filled. There is *pūkiawe*, *ʻaʻaliʻi*, and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 216 is a 3.0 x 2.50 m and 200 cm high C-shape. This feature is located at the terminus of a ravine on a southern facing slope on the Keʻāmoku lava flow. There is a large boulder at the northern end of the feature. A stacked *ʻaʻā* boulder and cobble wall, one to eight courses high abuts the eastern side of the boulder. The wall extends out to the east and then curves to the south forming a C-shape that is open to the southwest. The interior

floor of the feature is level and rocky with some pockets of ash. There is molasses grass and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 217 is a 2.30 x 1.30 m and 85 cm high mound. This feature is located on the Keʻāmoku lava flow. It is a roughly piled assortment of *ʻaʻā* boulders and cobbles, two to four courses high. The feature is somewhat elongated and is aligned from east to west. There is *pūkiawe* and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 218 is a 2.30 x 1.0 m and 148 cm high wall. This feature is located at the terminus of a small ravine on a southern facing slope on the Keʻāmoku lava flow. The wall is oriented from east to west. It is constructed from stacked *ʻaʻā* boulders and cobbles, one to five courses high. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 220 is a 1.30 x 1.0 m and 57 cm high wall. This feature is located on the Keʻāmoku lava flow just north of Feature 218. It is constructed from stacked *ʻaʻā* boulders and cobbles. The wall is aligned east to west. There is some facing on the southern side of the wall and the northern side of the feature appears to abut a naturally formed mound of basalt rubble. There is some *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 221 is a 2.30 x 1.70 m and 80 cm high C-shape. This feature is located on the Keʻāmoku lava flow. It is a curved wall roughly oriented from east to west and open to the southwest. The feature is constructed from stacked basalt boulders and cobbles, three to five courses high. The wall is partially faced on the southwestern and northern ends. The interior floor is a level matrix of ash. There is *ʻaʻaliʻi, pūkiawe, ʻōhiʻa lehua,* and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 222 is a mound located just southwest of Feature 224. The mound is partially collapsed. The feature consists of stacked *ʻaʻā* boulders six courses high.

Feature 223 is a 2.80 x 3.30 m and 164 cm high C-shape. This feature is located on the Keʻāmoku lava flow southeast of Feature 221. A large *ʻaʻā* outcrop forms the northern side of the feature. There is a stacked *ʻaʻā* wall, eight to ten courses high, abutting the southeastern side of the outcrop and extending to the southeast before curving to the southwest. This wall is partially faced on either side. There is also a short alignment of rocks at

the southwestern end of the outcrop. The interior floor is a level matrix of ash with some loose rocks that are likely a result of wall collapse. There is some *ʻaʻaliʻi* and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 224 is a 2.20 x 2.10 m and 90 cm high C-shaped structure. This feature is located 20 m to the north of the base of the Keʻāmoku lava flow. It is a curved wall constructed from stacked *ʻaʻā* boulders and cobbles, one to seven courses high and open to the south. The eastern end of the feature is heavily collapsed but some facing remains on the interior west section of the wall. The floor is level and ash-filled with some boulders and cobbles from wall collapse. There is *ʻaʻaliʻi* growing around the feature. The feature is in fair condition.

Feature 226 is a 2.50 x 3 m and 102 cm high wall. This feature is located on a southwestern facing slope on the Keʻāmoku lava flow. The wall segment is highly collapsed, aligned from northwest to southeast. It is constructed from *ʻaʻā* boulders one to five courses high. There is an ash-filled level terrace area on the southwestern side of the wall. The wall appears to be built upon a substrate of pebble – size basalt. There is *ʻaʻaliʻi* and natal redtop growing on and around the feature. The feature is in fair condition.

Feature 228 is a 1.80 x 1.50 m and 128 cm high wall. This feature is located on a southern facing slope on the Keʻāmoku lava flow. It is constructed from *ʻaʻā* boulders and cobbles, one to five courses high. The wall abuts an outcrop on its northeastern side. The base to the northwest floor is level and ash-filled with some boulders and cobbles from wall collapse. There is molasses grass and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 228a is located 236 degrees southwest of Feature 228. Located on the upper edge of the Keʻāmoku flow the structure is constructed of stacked small boulders to medium cobbles. The mound is in good condition.

Feature 228b is a second mound located 70 degrees northeast of Feature 228. This mound is located just inside of the edge of the Keʻāmoku flow. The feature is rather low (37 cm high) and is only 0.64 x 0.48 m wide. The mound, however, is built on top of a large *ʻaʻā* boulder that is 80 cm high elevating the entire feature. Like Feature 228a it is constructed of stacked *ʻaʻā* small to medium sized cobbles. Together, Feature 228a and 228b likely functioned as markers for the cluster of features located in this area of the Keʻāmoku flow.

Feature 229 is a 2.0 x 2.0 m and 66 cm high terrace. It is located on the Ke`āmoku lava flow north of Feature 228. There is a retaining wall on the southeastern end of the feature. It is constructed from *`a`ā* boulders tacked one three courses high. The terrace floor is level and ash-filled. There is some molasses grass growing around the feature. The feature is in fair condition.

Feature 230 is a 1.20 x 1 m and 50 cm high cupboard. It is located on the Ke`āmoku lava flow. A natural cavity in the Ke`āmoku flow has been modified to form a small opening sufficient for storage of goods and materials. A low mound of stacked *`a`ā* boulders encircles the base of the small opening which is open to the south. The rock mound is approximately one meter high. The interior floor is level and ash-filled. The floor is roughly circular in shape. There is no vegetation near this feature which is in fair condition.

Feature 231 is a 1.70 m x 1.10 m and 110 cm high mound. This feature is located on the Ke`āmoku lava flow approximately 20 m from the southern edge. It is circular in shape constructed from stacked *`a`ā* boulders and cobbles seven courses high. A long tree branch, approximately five meters in height has been placed in the middle of the mound in an upright position. There is no vegetation near this feature. This feature is in fair condition.

Feature 232a & 232b is a 4.30 x 6 m and 124 cm high C-shaped structure. This feature is located on the Ke`āmoku lava flow. It consists of two side by side C-shapes that share a central wall. The walls are constructed from *`a`ā* boulders and cobble one to ten courses high. There is facing on the interior of the structure. The structure is open to the west. The interior floor is level and ash-filled with some boulders and cobbles from wall collapse. There is some *pūkiawe* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 233 is a 7.30 x 3.20 m and 110 cm high C-shape. It is located on the Ke`āmoku lava flow. A large *`a`ā* boulder has been incorporated as part of this feature and forms a "wall" of the structure. A constructed stacked *`a`ā* boulder and cobble wall abuts the southwestern end of the boulder and extends to the south. Another wall abuts the southeastern side of the boulder and extends out to the east. This southeast wall adjoins the southwest wall of Feature 234. The interior floor of the feature is level and sandy. There is *pūkiawe* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 234 is a 2.70 x 3 m and 72 cm high C-shaped structure located on the Ke`āmoku lava flow. The southwest wall of the structure abuts the eastern end of Feature 233. It is a curved wall

constructed from stacked *ʻaʻā* boulders and cobble, one to five courses high. The west wall is partially collapsed. The "c" opens to the south/southeast. A nicely formed structure, overall construction of this feature did not incorporate any natural features such as large boulders into its construction. The interior floor is level and sandy. There is molasses grass and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 235 is a 3.50 x 2.50 m and 49 cm high C-shape. It is located on the Keʻāmoku lava flow immediately south of Feature 234. It is a curved wall constructed from stacked *ʻaʻā* boulders and cobbles, one to seven courses high. The structure is open to the west and has a level ash-filled floor. There is molasses grass and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 236 is a 5.30 x 7.30 m and 190 cm high C-shape. This feature is located 10 m from the southern edge of the Keʻāmoku lava flow at the terminus of a small ravine. A large accretionary lava ball forms the eastern end of the feature. A mound of boulder, cobble, and pebble – size *ʻaʻā* forms the western end. The southeastern end consists of a stacked basalt boulder and cobble wall that is one to five courses high. The feature is open to the south. The floor is level and ash-filled. The southern end of the floor has been filled and leveled to form a level terraced area. The retaining wall is 63 cm high but not faced. There is *pūkiawe* and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 237 is a 3.30 x 3 m and 85 cm high terrace. This feature is located on the southern edge of the Keʻāmoku lava flow at the distal edge of a small ravine. It is a curved wall, one to five courses high, constructed from stacked basalt boulders and cobbles. The feature is open to the south and features a level floor that is ash and sand-filled to form a terrace. There is broomsedge, *pūkiawe*, and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 238 is a 3 x 4.50 m and 46 cm high C-shaped structure. This feature is located at the base of the Keʻāmoku lava flow. It abuts the base of the flow on its northwestern end and extends out to the south to form a "C" that is open to the southwest. Constructed from *ʻaʻā* boulders and cobbles the wall is low, one to three courses high and inundated with sand. Due to the extent of the sand deposit the base of the structure is not visible. Therefore we can not identify the true height or extent of the structure. There is facing on much of the wall, especially the northern end. The floor of the feature is sandy and level. There is

some *pūkiawe, ʻaʻaliʻi,* and *ʻōhiʻa lehua* growing on and around the feature. The feature is in poor condition.

Feature 239 is a 3.60 x 2.80 m and 109 cm high overhang. It is located at the base of the Keʻāmoku lava flow. There is a large outcrop at the northern end of the feature that is undercut to expose a small overhang area. A short curved wall constructed from *ʻaʻā* boulders and cobbles that are stacked from two to four courses high abuts the southeastern end of the outcrop. The wall is constructed to provide a barrier for the overhang area possibly from the wind and other natural elements. This wall extends to the south to form a C-shape. The floor within the overhang and adjacent wall area is uneven and rocky. There is molasses grass, *pūkiawe,* natal redtop, and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 240a-d is a series of C-shaped wall segments. Feature 240a is discontinuous from Feature 240b-d but is the most defined and well constructed of the four subfeatures. This structure is 3.0 x 2.75 m and 160 cm high. The "C" is open to the southwest. The structure is constructed of stacked *ʻaʻā* boulders. The interior of the "C" is well-faced. There is little to no collapse of the structure wall. The surface floor of the structure is level sand with some boulder scatter.

Structures 240b-d are three contiguous C-shapes. The "C's" are open to the south/southwest. Some facing is evident in the interior wall of each subfeature. However, structure 240d is considerably more collapsed than 240b and 240c. Each structure is constructed of stacked *ʻaʻā* boulders. Combined these subfeatures are 4.0 x 8.0 m and 99 cm high.

Feature 241 is a 3 x 3.50 m and 160 cm high C-shape. This feature is located on the upper edge of the Keʻāmoku lava flow which is partially collapsed on the central interior portion of the structure. It is a curved wall that is aligned from north to south and is open to the west/southwest. The wall is constructed from stacked *ʻaʻā* boulders and cobbles. The interior floor is level and sandy with some loose rocks from wall collapse. There is some *ʻaʻaliʻi, pūkiawe*, and natal redtop growing on and around the feature. The feature is in good condition.

Feature 242 is an 8.50 x 4 m and 97 cm high C-shape. This feature is located on the Keʻāmoku lava flow. There is a large accretionary lava ball at the western edge of the feature. A stacked basalt boulder and cobble wall abuts the eastern side of the lava ball and extends out to the east. A second wall conjoins this wall at a perpendicular 90 degree angle to the north. The second wall extends to the east then curves around to the

south then back to the west to form a "C." The "C" is open to the west. Like the first wall this second structure wall is constructed of stacked *ʻaʻā* boulders. The interior floor of the "C" is level and ash-filled and there is a level ash-filled area on the southern side of the first wall. There is *pūkiawe*, *ʻaʻaliʻi*, *ʻōhiʻa lehua*, and *dubautia* growing on and around the feature. The feature is in fair condition.

Feature 243 is a 2 x 2.50 m and 57 cm high C-shape. It is located on the Keʻāmoku lava flow. The structure wall is constructed from stacked *ʻaʻā* boulders and cobbles, two to four courses high and is open to the southwest. The floor of the feature is level and ash-filled. There is *pūkiawe*, *ʻaʻaliʻi*, and *ʻōhiʻa lehua* growing on and around the feature. The feature is in fair condition.

Feature 244 is located 1.5 m southeast of Feature 243. It is a 3.30 x 3.90 m and 103 cm high C-shaped structure. The feature is a curved wall constructed from *ʻaʻā* boulders and cobbles that are stacked three to five courses high. The feature is open to the south and it abuts an accretionary lava ball on its northern end. The floor is uneven with rubble fill at the northern end and ash to the south. There is some *ʻaʻaliʻi* growing around the feature. The feature is in fair condition.

Feature 245 is a 6.60 x 3.50 m and 104 cm high wall. This feature is located on the Keʻāmoku lava flow. The wall is oriented from north to south and is constructed from stacked and mounded basalt boulders, cobbles, and pebbles. There is some facing on the wall on the west side near the north end. There is *ʻaʻaliʻi*, *pūkiawe*, and *ʻōhiʻa lehua* growing on and around the feature. The feature is in fair condition.

Feature 246 is a 2 x 1.80 m and 121 cm C-shape. This feature is located on the Keʻāmoku lava flow. The "c" is open to the northwest. The wall is constructed from stacked *ʻaʻā* boulders and cobbles stacked four to six courses high. There is some facing on the western side of the structure wall. The floor is level and ash-filled with some loose rocks from wall collapse. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 247 is a 3.50 x 3.40 m and 126 cm high C-shaped structure. This feature is located on the Keʻāmoku lava flow. It is a roughly circular structure constructed from loosely stacked *ʻaʻā* boulders and cobbles stacked three to four courses high. The structure walls are not well-developed like Feature 246 and other structures in the area. The floor is level and rocky. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 248 is a 4.60 x 4.0 m and 169 cm high C-shape. This feature is located on the Ke`āmoku lava flow. A large accretionary lava ball forms the eastern side of the structure. A curved wall constructed from stacked *`a`ā* boulders and cobbles abuts the northwestern end of the outcrop. The "C" is open to the south. The floor of the feature is uneven and rocky with some ash deposits. There is *pūkiawe* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 249 is a 6.40 x 4.0 m and 199 cm high C-shaped structure. Located on the Ke`āmoku lava flow, this structure incorporates a large accretionary lava ball as the eastern "wall" of the feature. A stacked boulder and cobble wall three to four courses high abuts the western side of the accretionary lava ball. The wall is faced on the west side. The "C" is open to the west. The floor is uneven and rocky. There is *`a`ali`i* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 250 is a 3.50 x 1.0 m and 30 cm high wall that abuts the base of the flow on its northern end. The wall extends to the south from the Ke`āmoku flow. It is constructed from *`a`ā* boulders stacked one to two courses high. There is much sand deposition around the feature especially on the western side. There is *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 251 is a 4.0 x 5.0 m and 72 cm high wall. This wall also abuts the base of the flow unlike Feature 250 this wall extends out from the flow to the east and slightly curves to the south. It is constructed from *`a`ā* boulders and cobbles stacked one to two courses high. The area surrounding the wall is a level matrix of ash and sand. There is *`a`ali`i, pūkiawe,* and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 252 is a 4 x 2.60 m and 70 cm high C-shaped structure. This feature is located on the Ke`āmoku lava flow. The "C" is open to the southwest. It is constructed from *`a`ā* boulders and cobbles that are stacked two to three courses high. The interior wall is well faced. The interior floor is level, clear, and ash-filled. There appears to be a trail leading from the entrance to the base of the flow. The trail was not recorded because it may be due to erosion. There is *`a`ali`i* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

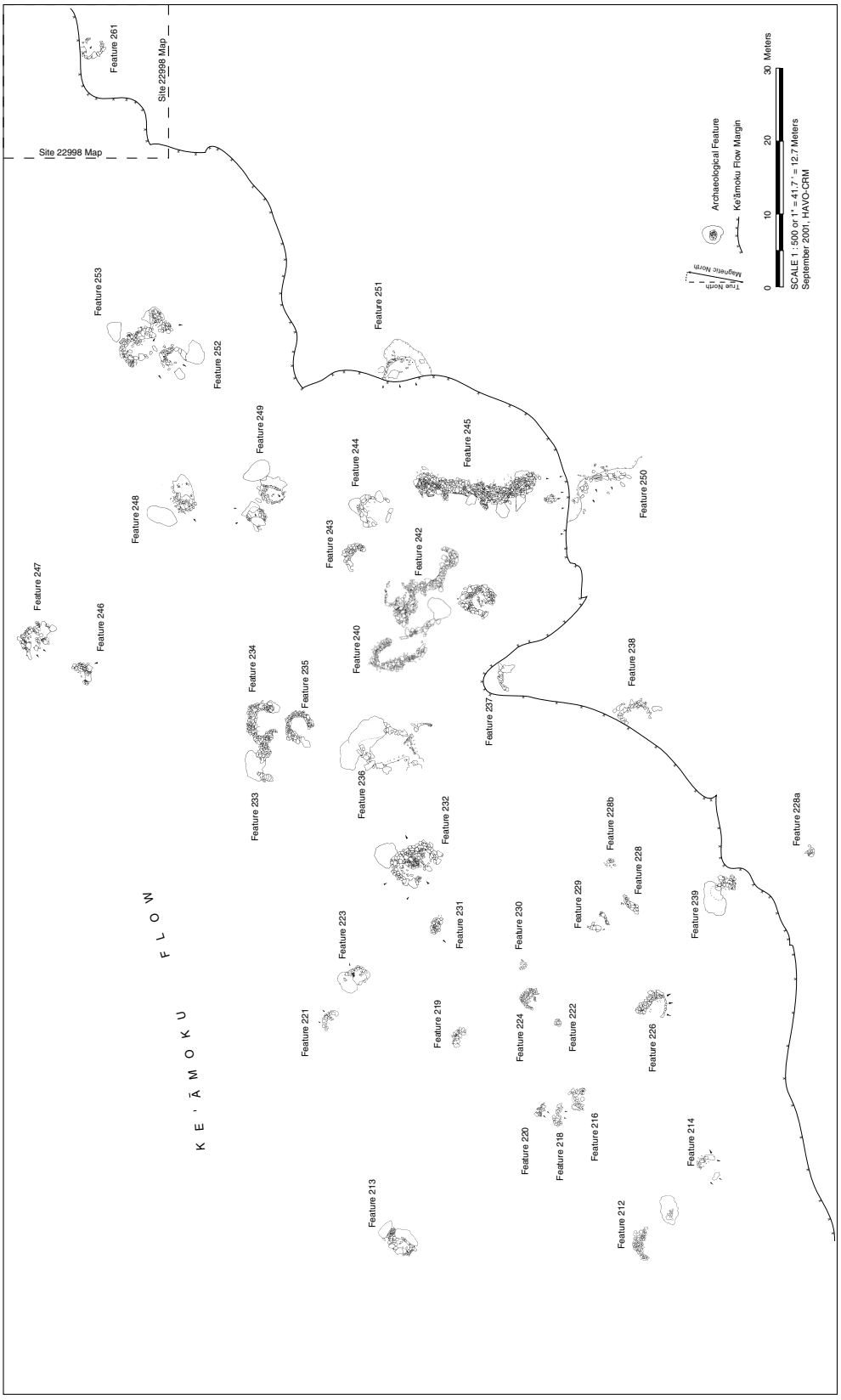

Figure 30. Site 22996 (excluding features 215, 217, 241 and 313).

Feature 253 is a 5 x 5.60 m and 123 cm high C-shape. Located on the Ke`āmoku lava flow this structure is an uneven wall that forms two side by side C-shaped structures. Both structures are open to the southwest. The northernmost C-shape is larger. Both structure walls are constructed from *`a`ā* boulders and cobbles that are stacked five to six courses high. The surface floors of both C-shapes are level, ash-filled, and have some loose rocks from wall collapse. There is *pūkiawe* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 313a & 313b is a small historic dump (313a) and associated terrace (313b). The dump consists of five complete amber colored glass liquor bottles scattered across an area approximately three square meters at the base of the Ke`āmoku flow. The bottles are located in an area of dense vegetation. None of the bottles were displaced or moved when they were located. Visual examination suggests the first bottle is a turn-in mold with an applied lip and flat base. The bottle is 28.5 cm long and has a base that is about 7.2 cm wide with no embossing. The second bottle is a one piece moderate kickup. It is 29.2 cm long with a 7.2 cm diameter base. It has a slightly bulbous neck with no embossing. The third bottle has an applied lip. It is 29.5 cm long but its base diameter is undetermined. The base of the fourth bottle was only partially visible. It had a rounded edge, and the base was slightly concave. The base was 7.5 cm in diameter and was embossed with "R & Co" and "42." The fifth bottle had a base diameter that was 7.5 cm and it was embossed with "SB & Co" and "29." The neck of the bottle was buried in the duff and we were not able see any diagnostic characteristics.

Feature 313b is a 3.2 x 1.1 m and 70 cm high terrace. The retaining wall of the structure is composed of small to large *`a`ā* boulders. The stone are stacked to create a faced wall. The terrace area is level and extended south approximately 2.0 m to the base of the *`a`ā* flow. Feature 313a is just to the west of the terrace edge.

SITE NO.: **22997**
FORMAL TYPE: Peter Lee Road
FUNCTION: Transportation
TOTAL AREA: 6734 meters
DESCRIPTION: The Peter Lee Road was built to service the community of Pāhala, in particular the hotel owned by entrepreneur Peter Lee at Punalu`u and visitors who stayed at the Volcano House. The Peter Lee Road was the first official road built in this area. It was completed in 1891 (Olson 1946:46). The road was nearly 24 miles

long and was first built to accommodate carriages and later modified for motorized vehicles. Only 4.18 miles of the road

This road cuts through the northern part of the project area and was likely responsible for stimulating many of the changes to the area that occurred after its construction. A 1921 USGS map shows a junction in the Peter Lee Road at the 3,363 foot elevation. The north spur of the road leads to a watershed and tanks at Kawikohoni. The maps suggests this spur ends near the Mauna Loa Trail. None of this spur road was identified during the current project. By 1927 the Peter Lee Road was replaced by the Ka`ū Road (Site 23034).

SITE NO.: **22998**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.184 hectares
DESCRIPTION: This site consists of 16 features: three walls, one modified overhang, 10 C-shapes, one terrace, and one enclosure. This site complex consists of features that are built primarily on the Ke`āmoku lava flow.

Feature 254 is a 2 x 1.70 m and 135 cm high wall. It is located on the Ke`āmoku lava flow. The wall is oriented from the northwest to the southeast. It is constructed from *`a`ā* boulders and cobbles stacked from four to five courses high. The area surrounding the feature is rocky with some ash deposits. There is *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 255a & b is a 3.50 x 2 m and 165 cm high modified overhang and associated C-shape. It is located on the Ke`āmoku lava flow. The feature is a southern facing outcrop that has been excavated to create an overhang. A stacked boulder and cobble wall has been built above the opening of the overhang. The wall may provide additional protection from wind, sun, and rain. The interior and exterior surface floor of Feature 255a is level, cleared, and ash-filled.

Feature 255b is an associated C-shaped structure located just south of 255a. The "C" is open to the south. There is *`a`ali`i*, *pūkiawe*, and natal redtop growing on and around the feature. The feature is in fair condition.

Feature 256 is a 2 x 1.80 m and 76 cm high C-shape. It is located on the Ke`āmoku lava flow. The feature is a curved wall that is open to the south. It is constructed from basalt boulders and cobbles that are stacked three to six courses high. The floor is

level and ash-filled. There is some *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 257 is a 2.50 x 2.20 m and 162 cm high C-shaped structure. This feature is located on the Ke`āmoku lava flow. The "C" is open to the southwest. It is constructed from *`a`ā* boulders that are stacked from three to five courses high. The interior floor is uneven and rocky. There is *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 258 is a 2.80 x 2.0 m and 226 cm high terrace. Located on the Ke`āmoku lava flow, the feature is comprised of a level surface area that is retained on its southern end by a low wall (< 1.0 m high) constructed from *`a`ā* boulders and cobbles stacked three to four courses high. The terraced area is level and ash-filled. There is *`ōhi`a lehua, `a`ali`i,* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 259 is a 1.70 x 2.10 m and 96 cm high wall. It is located on the Ke`āmoku lava flow. The wall is highly collapsed and is oriented from southeast to northwest. It is constructed from *`a`ā* boulders and cobbles that are stacked from three to five courses high. There is *`ōhi`a lehua* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 260 is a C-shaped structure measuring 2.50 x 4.0 m and 106 cm high. The feature is located on the Ke`āmoku lava flow. The C-shaped wall is constructed from *`a`ā* boulders and cobbles that are stacked from four to six courses high. The "C" is open to the southwest. The wall encloses an uneven and rocky floor with some ash deposition. There is *pūkiawe* and *`a`ali`i* growing on and around the feature. The feature is in fair condition.

Feature 261 is a 2.0 x 2.50 m and 42 cm high C-shaped structure. The northern end of the feature abuts the base of the Ke`āmoku lava flow. The C-shaped wall is open to the east and is constructed from *`a`ā* small boulders and cobbles that are stacked from one to three courses high. There is *`a`ali`i, pūkiawe,* natal redtop, and molasses grass growing on and around the feature. The feature is in fair condition.

Feature 262 is a 1.75 x 0.25 m and 35 cm high wall. Oriented in a north/south alignment this wall is located on the p4o *pāhoehoe* flow. It is constructed of loosely stacked discontinuous *`a`ā* boulders. The feature is in poor condition.

Feature 263 is a 3.30 x 3 m and 150 cm high enclosure. The feature is located on the Ke`āmoku lava flow. It is a roughly rectangular

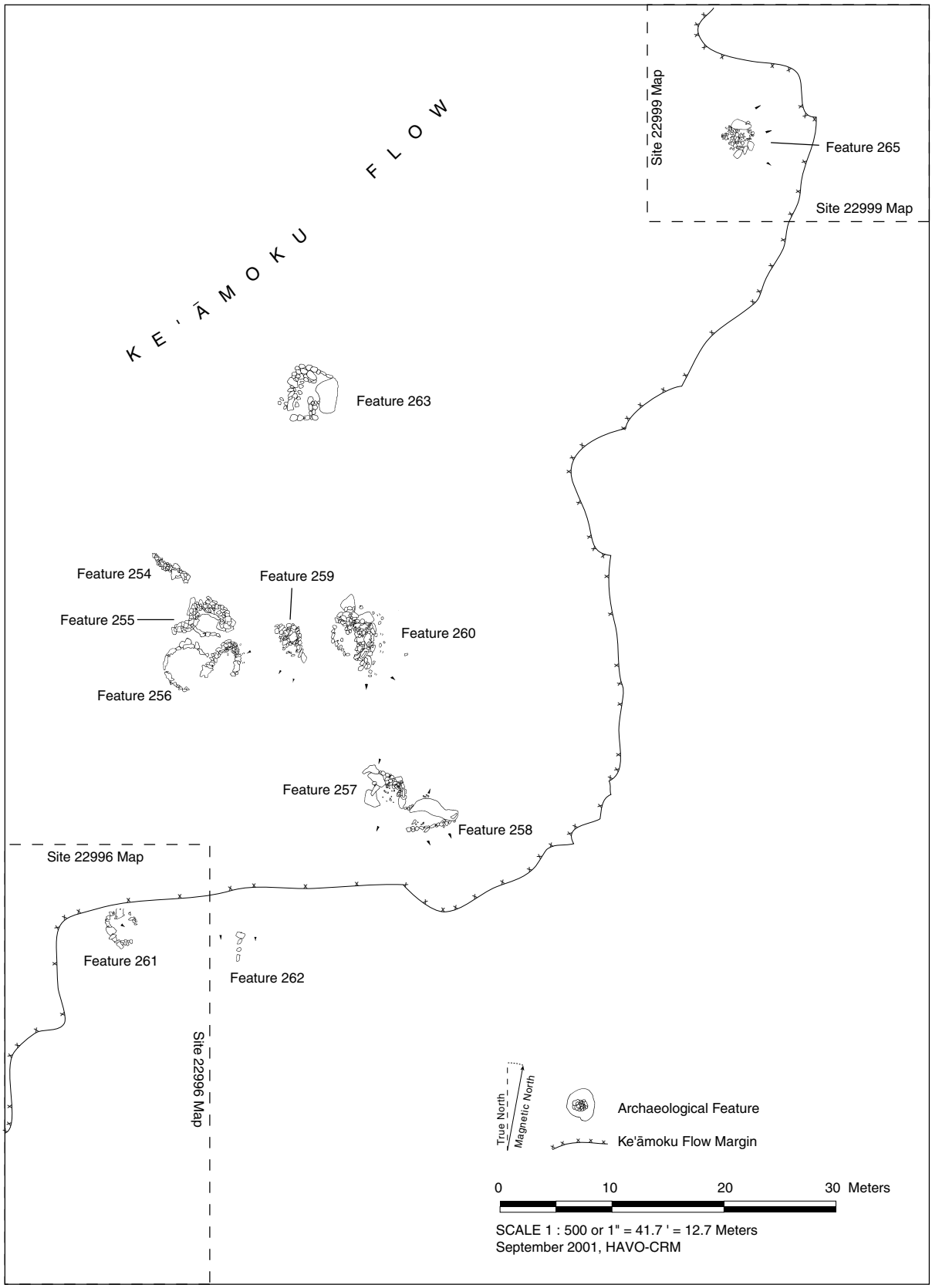

Figure 31. Site 22998 (excluding feature 318).

structure that is constructed from *ʻaʻā* boulders that are stacked from four to five courses high. The walls enclose a floor that is rocky and uneven with some ash deposition. There is some *ʻaʻali ʻi* growing on the feature. The feature is in fair condition.

Feature 318 is a C-shaped structure measuring 2.6 x 1.9 m and 39 cm high. The structure is a stacked wall located at the base of the southeast facing slope of the Keʻāmoku flow. Sand obscures part of the feature but *ʻaʻā* cobbles and a few small boulders are stacked one to three courses high. The "c" is open to the northwest. The interior area of the structure consists of a flat surface ash area with a few scattered cobbles.

Feature 98-121 is a 2 m wide by 40 cm high C-shaped structure. The feature opens to the east and is two courses high.

Feature 98-676 is a C-shaped structure. No other data was provided by Wulzen 1999.

Feature 98-679 is C-shaped structure. No descriptive data is provided by Wulzen (1999).

Feature 98-681 is a C-shaped structure. No other data was provided by Wulzen 1999.

SITE NO.: **22999**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.145 hectares
DESCRIPTION: This site consists of only three features: one C-shape, one terrace and a possible cupboard. The features that comprise this site are not contiguous.

Feature 264 is a C-shaped structure measuring 3.40 x 2.50 m and 101 cm high. It is located on the Keʻāmoku lava flow. The C-shaped wall is constructed from *ʻaʻā* boulders and cobbles that are stacked from four to five courses high. The "C" is open to the southwest. The walls of the structure encircles a rocky and uneven floor. There is a level terraced area on the southeastern side of the feature. There is *pūkiawe* growing around the feature. The feature is in fair condition.

Feature 265 is a 1.70 x 2 m and 146 cm high terrace. Located on the Keʻāmoku lava flow, a large boulder forms the northern side of the feature. The southwestern corner of the boulder is abutted by a well – defined faced rock wall constructed from *ʻaʻā* boulders and cobbles that are stacked from three to five courses high. The surface of the terrace is fairly even with some pebble

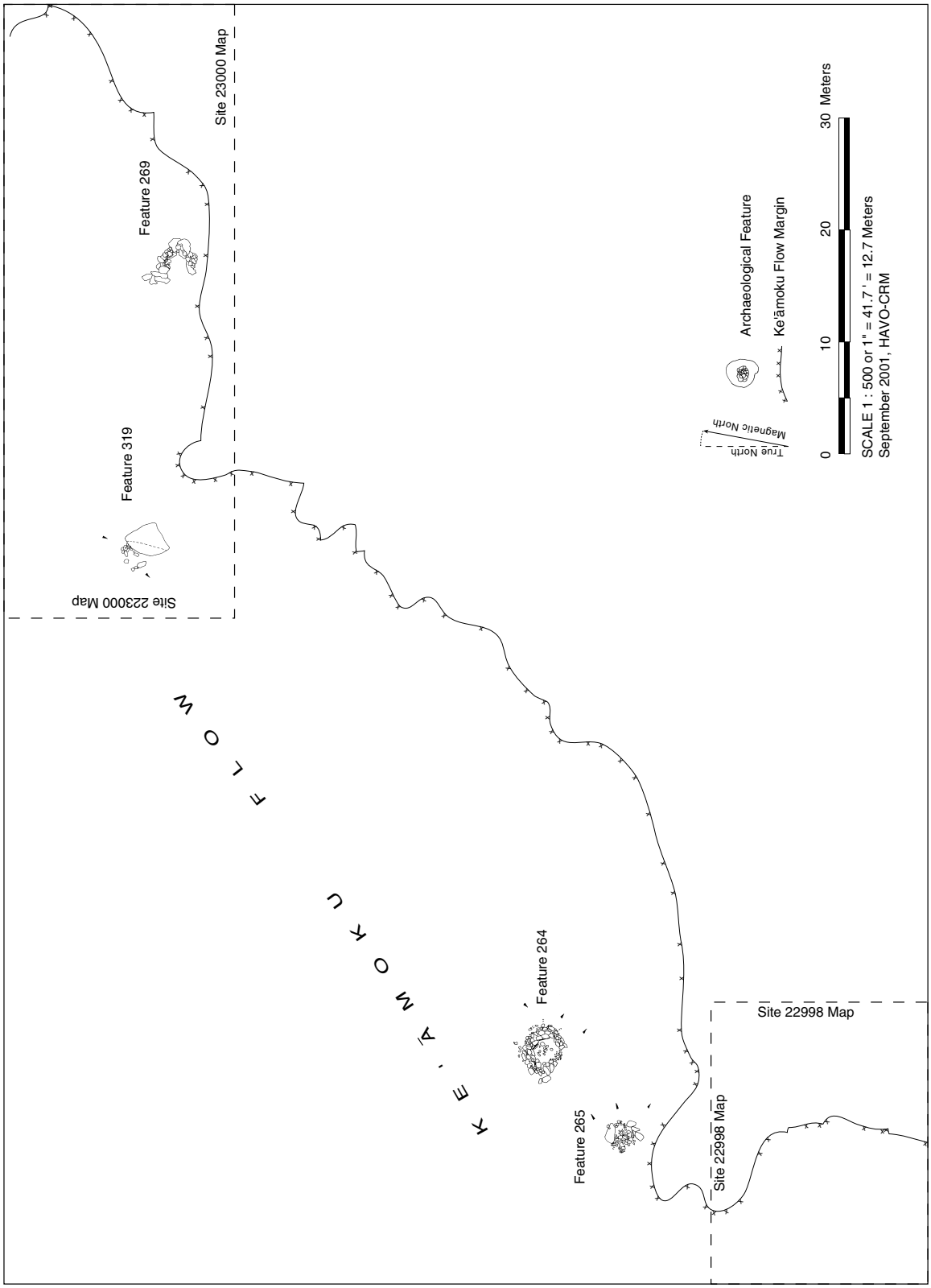

Figure 32. Site 22999.

sized deposit mixed amongst the ash. There is *pūkiawe* and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 98-690 is a cupboard. The feature is constructed of several stacked boulders and cobbles. The cupboard is 1 m x 0.5 m x 40 cm high.

SITE NO.: **23000**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 0.411 hectares
DESCRIPTION: This site consists of 15 features: one overhang, four enclosures, three C-shapes, one U-shape, one cave, one terrace, two rock piles, one mound and one lithic workshop. This large site complex consists primarily of features constructed on the Keʻāmoku flow. This is the last large (>10 features) site complex found along the Keʻāmoku flow.

Feature 269 is a C-shape measuring 2.60 x 3.10 m and 101 cm high. This feature is located on the Keʻāmoku lava flow. Constructed around a natural depression the structure walls are stacked *ʻaʻā* cobbles. The "C" is open to the west. There is natal redtop, *pūkiawe,* and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 270 is a 3.50 x 2.90 m and 200 cm high C-shaped structure. This feature is located on the Keʻāmoku lava flow. There is two large side by side boulders at the northeastern end of the feature. At least three smaller boulders have been stacked between the two boulders to bridge the gap. There is a stacked *ʻaʻā* boulder wall abutting the northwestern side of the northwestern boulder and another similar wall abutting the southeastern side of the southeastern boulder. Both walls are faced. The "C" is open to the southwest. The walls nearly encircle a level, ash-filled terraced area between the two walls. The terrace retaining wall is 50 cm high but not well-faced. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 271 is a 1.70 x 2 m and 120 cm high U-shaped structure. This feature is located on the Keʻāmoku lava flow. A large boulder forms the northeastern end of the feature. A stacked *ʻaʻā* boulder wall abuts the northwestern end of the boulder and extends to the southwest. A second parallel wall abuts the southeastern side of the boulder and also extends out to the southwest. The surface are between the two walls is level and

cobble – filled. There is some *ʻaʻaliʻi* growing around the feature. The feature is in fair condition.

Feature 272 is a 3.50 x 4.40 m and 200 cm high cave. This feature is located on the Keʻāmoku lava flow. A natural crevice beneath an accretionary lava ball has been modified to create a larger sheltered area. The base of this large rock has been undercut to expose a protected area beneath that is 2.0 x 1.5 m and 200 cm high. A stacked *ʻaʻā* boulder and cobble wall abuts the eastern side of a large *ʻaʻā* boulder and extends to the south to encircle the shelter area. There is *ʻaʻaliʻi* and *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 273 is a 3.50 x 2 m and 100 cm high enclosure. A natural berm west of Feature 272 has been modified to expose a level ash-filled area. This feature is described in feature 272's description above.

Feature 274 is a 2.30 x 1.50 m and 101 cm high enclosure. This feature is located on the Keʻāmoku lava flow. There is a large outcrop on the northern end of the feature that has been undercut at its southern base to create a slight sheltered overhang. The enclosure wall is constructed from *ʻaʻā* boulders and cobbles that are stacked from three to four courses high. The northeast and northwest ends of the wall abuts the southwestern and southeastern end to enclose a level ash-filled area. There is *pūkiawe* and *ʻōhiʻa lehua* growing around the feature. The feature is in fair condition.

Feature 275 is a 1.50 x 2 m and 186 cm high enclosure. It is located northwest of Feature 274 and is associated with the same accretionary lava ball. The accretionary lava ball is located at the southeastern end of the enclosure wall. The accretionary lava ball has been undercut at its northwestern base to expose a shallow sheltered overhang. The enclosure wall is constructed from *ʻaʻā* boulders and cobbles that are stacked from two to three courses high. The northeast and southeast ends of he wall abuts the northwestern and north end of the outcrop to enclose an uneven rocky interior. There is *ʻōhiʻa lehua* and *ʻaʻaliʻi* growing on and around the feature. The feature is in fair condition.

Feature 276 is a 5 x 3.50 m and 108 cm high terrace. This feature is located on the Keʻāmoku lava flow. There is a large accretionary lava ball that forms the eastern end of the feature. A retaining wall constructed from *ʻaʻā* boulders and cobbles that are stacked two to three courses high abuts the southern end of the boulder and extends out to the west. The wall retains a level, terraced area to the north. There is *pūkiawe* and *ʻaʻaliʻi*

growing on and around the feature. The feature is in fair condition.

Feature 319 is a rock pile 0.65 x 0.28 m and 35 cm high. The structure consists of three small *ʻaʻā* boulders loosely stacked on a large accretionary lava ball at the top of an *ʻaʻā* toe.

Feature 320 is a 2.90 x 1.15 m and 184 cm high modified overhang. A large *ʻaʻā* bolder and large *ʻaʻā* accretionary lava ball form an overhang. The modifications occur between the boulders where small *ʻaʻā* boulders and cobbles fill the space thus completing the overhang area.

Feature 98-190 is a small rock pile. The structure sits on a 0.6 m high bedrock. "Piled" *ʻaʻā* rocks are placed on the bedrock.

Feature 98-192 is a C-shaped structure with an interior diameter of two meters. No other data are available.

Feature 98-682 is a mound. No other data are available.

Feature 98-686 is a 3.1 m x 1.2 m enclosure. No other data is available.

Feature 98-688 is a lithic workshop. The site consists of cores and flakes of dark dense basalt. The feature is 1 m in diameter.

SITE NO.: **23001**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 1.681 hectares
DESCRIPTION: This site consists of eight features: five C-shapes, one terrace, one mound, and one enclosure. Of these eight features, only one Feature, 277, is located on the Keʻāmoku flow; the remainder are on the p4o *pāhoehoe*.

Feature 266 is a C-shaped structure measuring 2.0 x 1.25 m and 30 cm high. This feature is located approximately 30 m to the south of the Keʻāmoku lava flow. It is a curved wall that opens the west. It is constructed from *ʻaʻā* boulders and cobbles that are stacked from two to three courses high. Most of the feature is buried under sand. There is some *ʻaʻaliʻi* growing around the feature. The feature is in good condition.

Feature 267 is a 4 x 4 m and 60 cm high C-shape. This feature is located approximately 60 m to the south of the base of the Keʻāmoku lava flow. It is a curved wall that is open to the southwest. The walls are constructed from *ʻaʻā* boulders and cobbles that are stacked three courses high. The feature is mostly covered with sand and is in fair condition. An associated wall

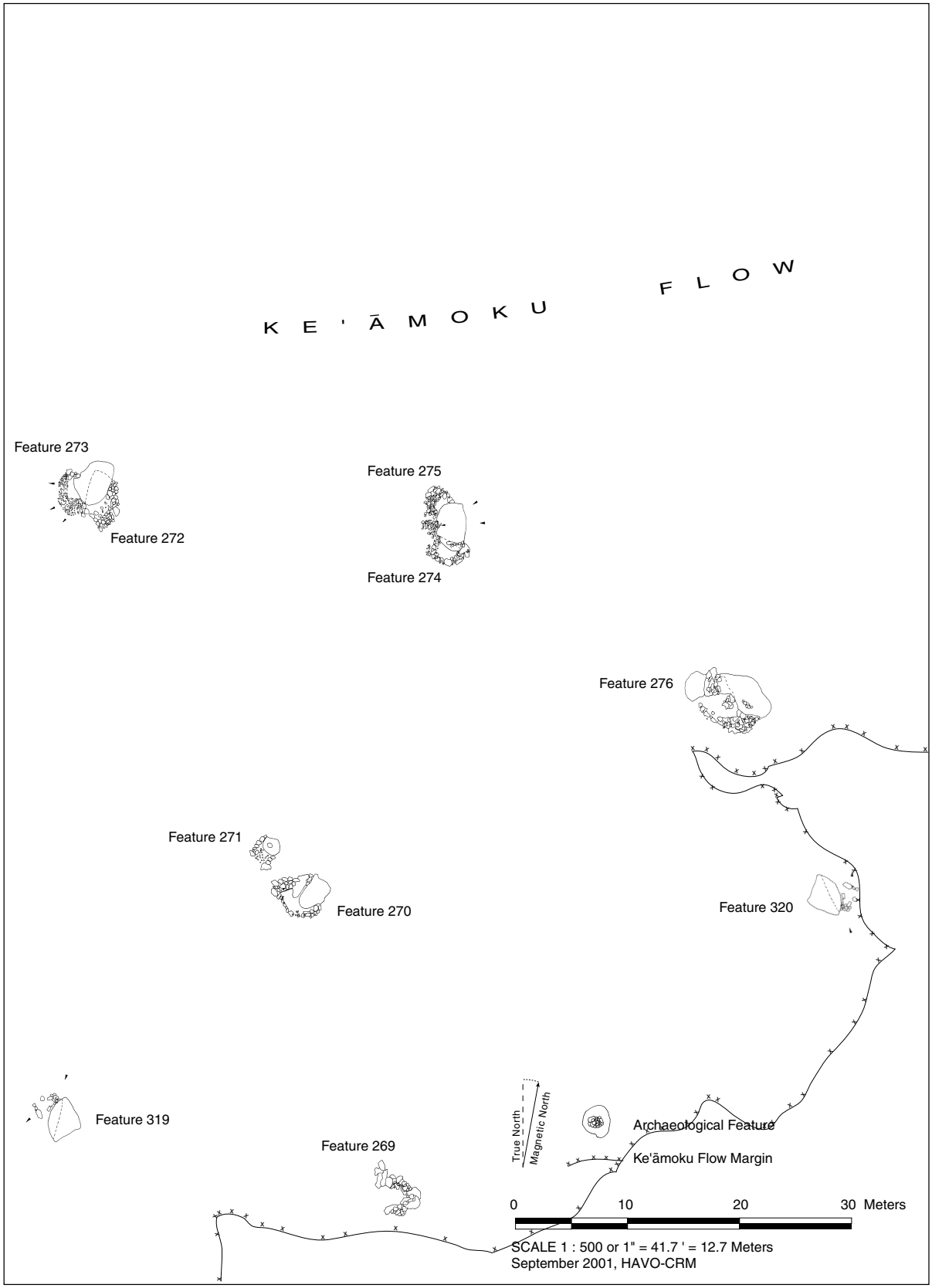

Figure 33. Site 23000.

located southwest of the structure is 2.5 x 0.5 m and 30 cm high. This wall may have once connected to the above-described C-shape but sand may now cover the adjoining wall segments.

Feature 277 is a 1.95 x 2.70 m and 130 cm high terrace. This feature is located near the base of the Keʻāmoku lava flow. It is a level, ash-filled terraced area retained by a stacked *ʻaʻā* wall (30 cm high) on its southwestern end. There is *pūkiawe* growing on and around the feature. The feature is in fair condition.

Feature 98-114 is a C-shaped structure constructed of piled *pāhoehoe* boulders. The interior of the feature is 3 m x 2.5 m and filled with sand.

Feature 98-115 is a C-shaped structure constructed of piled *pāhoehoe* boulders. The feature opens to the west and has an interior area that is 3 m x 2.5 m.

Feature 98-118 is a C-shaped structure that is 3 m wide and 50 cm high (three courses). The feature is open to the south and filled with sand.

Feature 98-186 is a mound constructed of boulders and cobbles built around an outcrop. The feature is 2.2 m wide and 6 cm high. Located in sand dunes on the Keʻāmoku flow.

Feature 98-267 is a 1.6 x 4.0 m and 50 cm high enclosure located at the south base of a tumulus. Much of the feature is filled with sand.

SITE NO.: **23002**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 6.791 hectares
DESCRIPTION: This site consists of 11 features: six C-shapes, four walls, and one enclosure. All but two of the features were recorded by Wulzen.

Feature 278 is a C-shape. No feature forms or data are available.

Feature 279 is a C-shape. No feature forms or data are available.

Feature 280 is a C-shape. No feature forms or data are available.

Feature 98-179 is described as a wall of over 20 boulders on level *pāhoehoe* bedrock, with two converging lines. The feature is 5 m x 2.5 m. One group of boulders is piled into a mound.

Feature 98-180 is an 6 m long wall that "bends off low tumulus to effectively form two enclosures" (Wulzen 1999).

Feature 98-181 is a C-shaped structure. The feature is composed of a large natural boulder at the base of the Ke`āmoku flow bounded by walls to the south and east. The south wall is 1 m x 1 m x 100 cm high. The east wall is 0.7 m long x 40 cm high. The interior area is 1.9 m x 1.1 m and opens to the southwest.

Feature 98-299 is a wall located at the base of the Ke`āmoku flow. No additional information is available.

Feature 98-622 is a C-shaped structure that extends off of the base of the Ke`āmoku flow. It is 310 to 30 cm high. The interior is filled with ash and measures 2.3 m (E/W) x 1.9 m.

Feature 98-623 is a C-shaped structure located on the Ke`āmoku flow. This structure is composed of a stacked wall that is 3.2 m to 50 cm high. The interior dimension is 2.7 m x 2.1 m.

Feature 98-759 is described solely as an enclosure located north of the Ka`ū-Volcano trail.

Feature 98-760 is a wall located off of the Ke`āmoku flow. No other information is available.

SITE NO.: **23003**
FORMAL TYPE: Complex
FUNCTION: Undetermined
TOTAL AREA: 33.115 hectares
DESCRIPTION: This site consists of four discontinuous features along the Ke`āmoku flow. Feature 98-683 is a questionable feature. From the extremely brief description provided by Wulzen (1999 upubl. ms.) it does not appear to be culturally modified. However, because the 2000 survey crew was unable to relocate it, the feature designation will be maintained.

Feature 98-110 is a mound composed of greater than 60 *`a`ā* boulders. The feature is 1.2 m in diameter on the Ke`āmoku flow. An `ōhi`a branch is stuck into the top (it is assumed) of the mound.

Feature 281 is a C-shape consisting of greater than nine boulders on a low tumulus. It is 3.2 meters long. No other data was provided.

Feature 98-599 consists of two walls. No structural or location data is provided.

Feature 98-683 is described as a single boulder on the *pāhoehoe* flow. Without any additional information on this feature it is questionable as to whether this is a true culturally modified or constructed feature.

SITE NO.: **23004**
FORMAL TYPE: Complex
FUNCTION: Habitation
TOTAL AREA: 80.908 hectares
DESCRIPTION: This site consists of four features: one enclosure, one wall and two C-shapes. All of these features are found in close association with the Ka‘ū-Volcano Trail (Site 22982).

Feature 98-510 is a C-shape that is 3 m x 80 cm high. The interior of the structure is 3 m x 2.3 m.

Feature 98-513 is a C-shaped structure that is partially collapsed. The structure is 2.8 m long and 40 cm high. Ash is trapped in the wall of the feature thus suggesting that it predates the 1790 explosive eruption.

Feature 98-560 is an enclosure located beside the *‘a‘ā* flow.

Feature 98-561 is a wall. Additional feature data is provided but difficult to interpret.

SITE NO.: **23005**
FORMAL TYPE: Mounds/Platform
FUNCTION: Markers
TOTAL AREA: 58.947 hectares
DESCRIPTION: This site is comprised of four features: three mounds and one platform. All of the features occur along the section of the Ka‘ū Road (Site 23034) and the Peter Lee Road (Site 22997) that overlap. The features likely served as road markers. Because we are unable to identify which road the features were first constructed for they are given their own site number.

Feature 98-551 is a mound that is comprised of greater than 30 cobbles stacked 0.45 m high and 1 m in diameter.

Feature 98-607 is a mound comprised of stacked boulders and cobbles. A wooden post is incorporated into the feature thus suggesting is may have been constructed or reused during the historic period.

Feature 98-613 is a platform. The only information provided is that is located at the base of an *‘a‘ā* ridge.

Feature 98-621 is a mound located 200 m northeast of mile post 32.9, 100 m east of Highway 11 at the base of old *ʻaʻā*.

SITE NO.: **23006**
FORMAL TYPE: Cave
FUNCTION: Habitation
TOTAL AREA: 48 square meters
DESCRIPTION: This site consists of a single cave. See description below.

Feature 98-32 is also known as Big ʻŌhiʻa Cave. Barbara Withrow formally identified this cave in 1987. Withrow was a Ph.D. Candidate doing research on the distribution and sourcing of adze material on Hawaiʻi Island. In her search for various sources for materials Withrow obtained a research permit from HAVO. Unnamed sources identified this cave as a potential location for lithic materials. Withrow located the cave, mapped it, and recorded basic information (Withrow 1987; HAVO Cave Files). No site number appeared to have been assigned to the cave at that or any later time. Wulzen revisited the cave in 1998 and was revisited again by the author in October 2001. Additional information was gathered in 2001 and added to the site form. A site number was also assigned at this time.

Wulzen (1998) described the site as containing lithics, wood, hearth, and pig bone. Withrow (HAVO Cave Files) describes the site as being 12 x 4 m and 100 cm high. A firepit/hearth is "located immediately inside the entrance and outlined on three sides with rock - approximately square in shape and 1 sq. m in area" (Withrow 1987). Withrow's report goes on to describe lithic debris on the cave floor and outside the entrance. She collected four of these surface artifacts for analysis. Sourcing of the material proved inconclusive (Withrow 1987).

SITE NO.: **23007**
FORMAL TYPE: Workshop, lithic
FUNCTION: Resource Procurement
TOTAL AREA: 64.536 hectares
DESCRIPTION: This site consists of eight features: one platform, six lithic workshops, and a cache of waterworn stones. The lithic workshops may be the outer extent of a large cluster of lithic block quarries identified in 2001 and surveyed in 2002 (Moniz Nakamura in prep).

Feature 98-31 is a lithic workshop. No dimensional data is provided for this feature. However, it is described as a "large

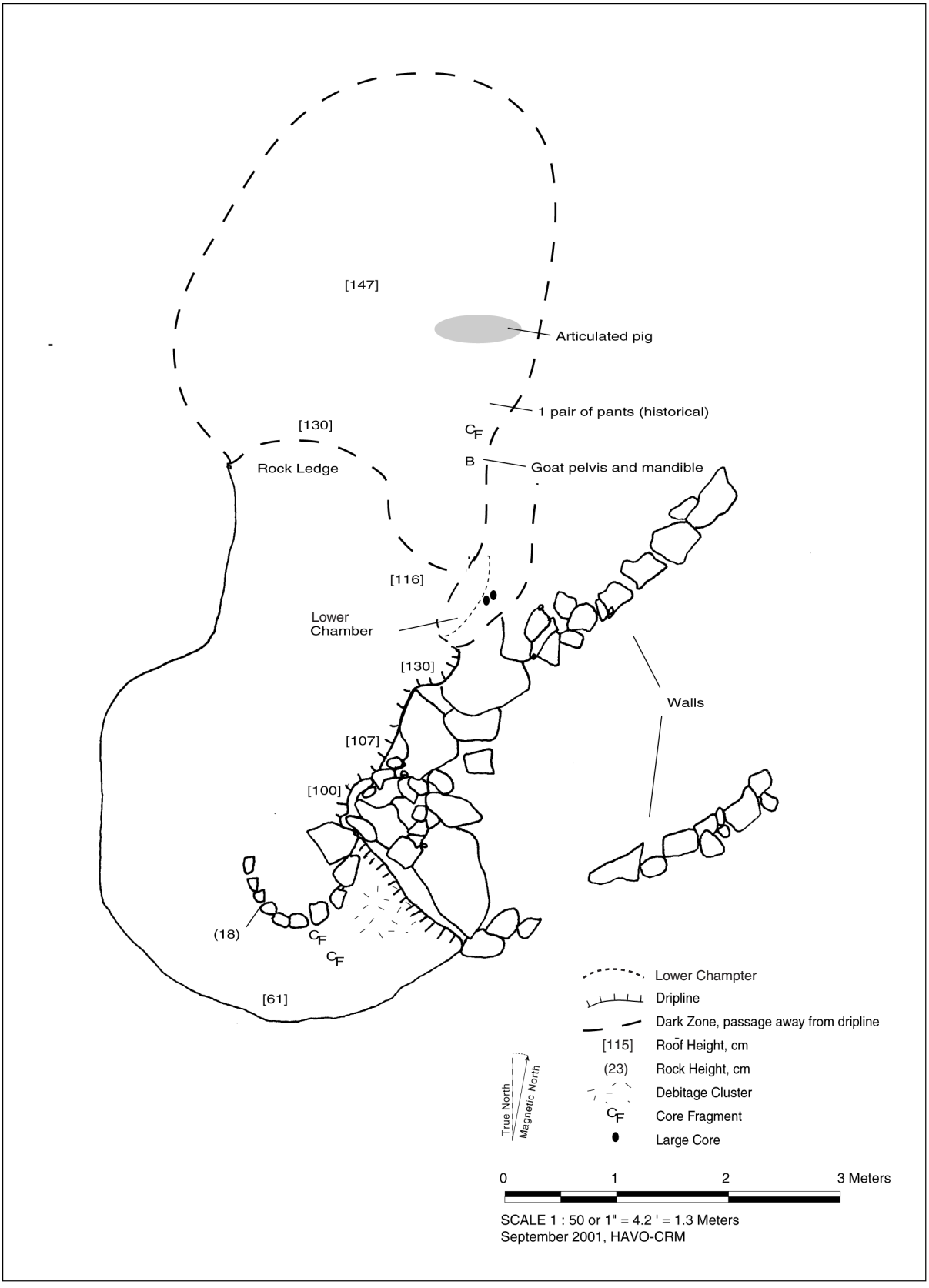

Figure 34. Site 23006.

area downslope of HVO" where "pale green fine basalt (was) scavenged for good flakes."

Feature 98-33 is a cache of three waterworn cobbles in a hole, southwest of HVO, 80 m southeast of (the) Crater Rim Road, 20 m from HVO road.

Feature 98-78 is a platform.

Feature 98-515 is a small 4 m x 2m lithic workshop. The feature is located 8 m east of Crater Rim road and is comprised of a reduced dense basalt boulder and blade flakes.

Feature 98-516 is also a lithic workshop 5 m x 3 m wide that has several cores and possible tools. The cores are believed to have likely been scavenged from a nearby wash.

Feature 98-517 is a small (4 m diameter) lithic workshop that contains greater than 100 fine grained basalt flakes. The flakes could have possibly come from a single boulder.

Feature 98-518 is a lithic workshop that is comprised primarily of a loose boulder located on a ridge. Greater than 150 flakes, mostly small, can be found besides an anvil rock. There has been some fluvial movement in the area.

Feature 98-519 is also a lithic workshop approximately 3.5 m x 2 m. The feature consists of parent rock core, flakes and an adze preform.

SITE NO.: **23008**
FORMAL TYPE: Cave
FUNCTION: Habitation
TOTAL AREA: 5.277 hectares
DESCRIPTION: This site is a single cave feature identified in 1998 by Wulzen. See description below.

Feature 98-567 is a cave located 35 m west of Crater Rim road. The entrance to the cave is 1.2 m wide by 170 cm high. The sole cultural modifications associated with this cave are some rocks inside which appear to be placed.

SITE NO.: **23009**
FORMAL TYPE: Cave
FUNCTION: Habitation, possible
TOTAL AREA: 5.277 hectares
DESCRIPTION: This site consists of a single cave. No information was provided by Wulzen (1999). The cave needs to be revisited and formally recorded.

Feature 98-568 is a cave located 10 m east of Highway 11 near the Kīlauea Military Camp (KMC) baseball field. No reference to cultural material or modifications have been described for this feature.

SITE NO.: **23010**
FORMAL TYPE: Quarry, Volcanic Glass
FUNCTION: Resource Procurement
TOTAL AREA: undetermined
DESCRIPTION: This site consists of a single feature. See description below.

Feature 98-763 is a volcanic glass quarry located besides the Mauna Iki Trail. No additional information is available.

SITE NO.: **23011**
FORMAL TYPE: Complex
FUNCTION: Undetermined
TOTAL AREA: 2.121 hectares
DESCRIPTION: This site consists of four features: one C-shape, one mound, a single wall and a single enclosure. Due to the paucity of features in the area and the limited survey the function of this site is undetermined.

Feature 98-415 is a C-shaped structure located at the foot of the Keʻāmoku flow. The interior of the structure is 2.5 m x 2.0 m. The east wall is 120 to 60 cm high. The feature is open to the northwest.

Feature 98-416 is a mound comprised of three boulders and 12 cobbles on an outcrop at the base of the Keʻāmoku lava flow.

Feature 98-471 is a small enclosure. The interior is 1.4 m in diameter.

Feature 98-486 is a 3.2 m long and 30 cm high wall.

SITE NO.: **23012**
FORMAL TYPE: Complex
FUNCTION: Resource Procurement
TOTAL AREA: 1.625 hectares
DESCRIPTION: This site consists of four features: two volcanic glass quarries, an enclosure and a wall. The site is located just east of HAVO's Footprints interpretive trail.

Feature 98-166 is a small volcanic glass quarry located on the south side of a tumulus.

Feature 98-167 is an enclosure located on the south side of a tumulus. The interior is 2.2 m x 1.9 m and 40 cm high.

Feature 98-168 is a 2.2 m long x 45 cm high wall. Approximately two to four courses high. There is a small overhang to the south of the wall.

Feature 98-169 is a small volcanic glass quarry. The feature is 4 m x 2 m in area located at the north base of a tumulus.

SITE NO.: **23013**
FORMAL TYPE: Complex
FUNCTION: Undetermined
TOTAL AREA: 3.345 hectares
DESCRIPTION: This site consists of seven features: four enclosures, a C-shape, and a terrace. The site is located along and just southwest of HAVO's Footprints interpretive trail.

Feature 98-443 is an enclosure. The description of the feature is not very clear. The feature is described as being "mostly defined by alignment, some stacking, forms 2.5 m diameter circle."

Feature 98-444 is a wall.

Feature 98-445 is a semicircular enclosure that is four m long and one meter high.

Feature 98-446 is a rough C-shape. The interior of the structure is 1.8 m x 2.3 m.

Feature 98-448 is an enclosure. The description of the feature is not clear.

Feature 98-470 is a possible enclosure, identified by Wulzen as a possible shrine. Black basalt is dug out of the north side of the Ke`āmoku flow forming a protected space. Red gravel is found

on the floor as well as glass fragments, and basalt flakes. The interior is 2.2 m x 0.6 m.

Feature 98-488 is a 1.5 m x 40 cm high terrace. The interior of the feature is 1.5 m x 0.6 m. Sand and ash deposits are approximately 0.3 m deep.

Feature 98-489 is a wall, located a the base of the Ke`āmoku flow. The wall is 3 m long and 100 cm high and is now filled with ash and sand.

SITE NO.: **23014**
FORMAL TYPE: Quarry, volcanic glass
FUNCTION: Resource Procurement
TOTAL AREA: 0.255 hectares
DESCRIPTION: This site consists of a single volcanic glass quarry located very close to the existing Footprints Shelter.

Feature 98-490 is a small volcanic glass quarry located on the southeast side of a large tumulus.

SITE NO.: **23015**
FORMAL TYPE: Complex
FUNCTION: Ranching, Habitation
TOTAL AREA: 11.901 hectares
DESCRIPTION: This site consists of 29 features: seven mounds, six C-shapes, seven walls, one historic petroglyph, three enclosures, two terraces, one platform, two modified overhangs. This cluster of features is located at the base of the Ke`āmoku lava flow. The presence of the corrals and historic petroglyph suggest some of these features may be historic in nature. This site is bisected by Ka`ū-Volcano Trail (Site 22982).

Feature 98-14 is described officially as a mound, but in the text description it is referred also to as a wall segment that is located 2 m to the base of the Ke`āmoku flow. These two formal designations do not match and need to be clarified. The feature is constructed of more than 30 boulders piled to 90 cm high.

Feature 98-16 is a C-shaped structure that is open to the south. The interior of the feature is 1.8 m x 1.0 m x 40 cm high.

Feature 98-17 is a 2.2 m x 1.3 m x 50 cm high C-shaped structure. No additional information is available at this time.

Feature 98-20 is formally described as a wall. Functionally, it is described as a corral located at the base of the Ke`āmoku flow around a small depression.

Feature 98-21 is a historic petroglyph consisting of historic lettering. One possible precontract petroglyph, which may be a foot was identified near Feature 98-20. No description of the letters is given.

Feature 98-401 is an enclosure. Likely a historic corral, this feature is located west of the Ka`ū-Volcano Trail (Site 22982). The feature is 9.0 m x 8.0 m x 1.0 to 2.0 meters high.

Feature 98-402 is an enclosure that is approximately 4.0 m in diameter.

Feature 98-413 is a mound, possibly associated with the Ka`ū-Volcano Trail extension.

Feature 98-417 is a C-shaped structure open to the south.

Feature 98-418 is a terrace. The terrace wall is 3.5 m long and 50 cm high.

Feature 98-419 is two walls. The east wall is 2.0 m long (1-4 courses high). Its west wall is 1.25 m long.

Feature 98-424 is a faced wall 3.0 m long x 110 cm high. The interior has cobble pavement.

Feature 98-425 is a group of four mounds located on the south side of the Ke`āmoku lava flow. One mound is a boulder with rocks piled 130 cm high. Two of the mounds are also boulders with rocks piled 180 cm high. The fourth mound is built on the ground surface.

Feature 98-426 is a 3.2 m x 30 cm high wall. No other data is available.

Feature 98-427 is a 4.0 m x 35 cm high terrace.

Feature 98-428 is an wall located at the base of the Ke`āmoku flow. The feature is 2.8 m long x 20 cm high.

Feature 98-429 is a L-shaped wall approximately 3.0 m long x 1.0 m wide.

Feature 98-430 is identified as a platform. The feature is described as having two 1.5 m x 0.6 – 0.8 m wide faced walls joined with fill. Wulzen (1999) suggests the features may represent two burials.

Feature 98-431 is a 1.0 m x 1.0 m mound located on an outcrop.

Feature 98-432 is a C-shaped structure located on the top of the Ke`āmoku flow. The feature has a wall height of 1.8 m and an interior dimension of 1.0 m x 0.65 m.

Feature 98-433 is a "slightly rubbled" C-shaped structure open to the south. The interior of the feature is 1.25 m x 1.0 m. The description of the feature also suggests there is a cleared area (perhaps in the interior of the feature) and a low mound associated with the feature, all of which are on top of the Ke`āmoku lava flow.

Feature 98-434 is a wall approximately 3.5 m long x 160 cm high. The wall is described as being a "half C-shape" (Wulzen 1999).

Feature 98-439 is an enclosure that has an interior area of 1.6 m x 1.3 m.

Feature 98-459 is a modified overhang. The shelter consists of a upright semi-circular boulder with *`a`ā* cobbles piled on top of it. The interior of the shelter is 1.5 m wide. No roof height is provided.

Feature 98-460 is a modified overhang consisting of a large boulder that is balanced on smaller boulders. The structure contains a wall on the east. The interior of the structure is 3.0 m x 2.5 m x 50 cm high.

Feature 98-461 is a C-shaped structure described as two large boulders that anchor the northwest corner of a rectangular structure. The rectangular structure appears to suggest this feature is an enclosure or perhaps a platform but there is not enough data to support this interpretation.

SITE NO.: **23016**
FORMAL TYPE: Complex
FUNCTION: Resource Procurement, Habitation
TOTAL AREA: 10.507 hectares
DESCRIPTION: This site consists of twelve features: one wall, four enclosures, five volcanic glass quarries, and two C-shapes. Located south/southwest of Site 23015, this site is located near the Ka`ū-Volcano Trail (Site 22982).

Feature 98-475 is a 3.0 m x 1.0 m x 60 cm high enclosure. This feature exhibits some quarrying on the western end of the tumulus it butts up against.

Feature 98-476 is described as four interlocking enclosures located on the north side of a tumulus. Enclosure A is 3.5 m wide. Enclosure B is rectangular and has an interior dimension of 4.2 m x 3.0 m x 50 cm high. Enclosure C is 2.5 m wide and has rubbled walls. Enclosure D has an interior dimension of 3.0 m long.

Feature 98-477 is a quarry comprised of several small piles of volcanic glass.

Feature 98-478 is another quarry that consists of both red and blue volcanic glass, some of which is piled in alignments.

Feature 98-479 is a volcanic glass quarry where greater than 200 boulders and cobbles have been removed from an adjacent tumulus.

Feature 98-480 is identified as a volcanic glass quarry but the description states that it is a rubble alignment, possibly a quarry.

Feature 98-481 consists of two small C-shaped structures exhibiting some quarrying.

Feature 98-482 is a volcanic glass quarry located on the northwest side of a tumulus. No other data is available.

SITE NO.: **23017**
FORMAL TYPE: Complex
FUNCTION: Resource Procurement
TOTAL AREA: 18.214 hectares
DESCRIPTION: This site is comprised of eleven features: eight volcanic glass quarries, two enclosures, and one terrace. Located southeast of Site 23015, Site 23017 is located at the base of the Ke`āmoku lava flow.

Feature 98-13 is a volcanic glass workshop spread over 45.0 m x 15.0 m in several concentrations.

Feature 98-17 is a C-shaped structure.

Feature 98-18 is an enclosure located on the southeast side of a *pu'u* (hill, mound). The feature is described as a single wall, approximately 3.0 m long. The wall connects outcrops in front of a 250 cm high outcrop. Some lithic activity present in the area.

Feature 98-19 is a volcanic glass quarry that covers an area approximately 20.0 m x 10. 0 m. Also associated with this feature is a 2.5 m x 60 cm high wall.

Feature 98-405 is a terrace. The feature extends from a boulder overhang. The terrace wall is 2.2 m long x 60 cm high with an interior dimension of 2.1 m x 1.5 m.

Feature 98-406 is a volcanic glass quarry located on the south side of a tumulus. The quarry is spread across an area 15.0 m x 8.0 m. Some stones are piles in alignments.

Feature 98-407 is another volcanic glass quarry located on the east side of a tumulus. The outcrop is slightly modified with rocks piled on the upper edge.

Feature 98-408 is a volcanic glass quarry located on both the north and south sides of an upright tumulus.

Feature 98-409 is a 4.0 m x 5.0 m wide volcanic glass quarry located on the south side of a tumulus.

Feature 98-410 is a small, 5.0 m x 3.0 m volcanic glass quarry located on the east side of a tumulus.

Feature 98-411 is a volcanic glass quarry. The quarry is located on a low tumulus and is approximately 20.0 m in diameter.

Feature 98-412 is a 12.0 m long x 10.0 m wide enclosure located on the south side of an outcrop.

SITE NO.: **23018**
FORMAL TYPE: Cave
FUNCTION: Habitation
TOTAL AREA: 2.521 hectares
DESCRIPTION: This site is a single cave. The cave may not be cultural in nature. See description below.

Feature 98-484 is described as a "crack with cave" (Wulzen 1999) reported by Jim Martin. The feature is located on the south side of the Ke`āmoku flow. No information on associated surface modifications, surface deposits or the potential for subsurface deposits is provided.

SITE NO.: **23019**
FORMAL TYPE: Complex
FUNCTION: Undetermined
TOTAL AREA: 1.826 hectares
DESCRIPTION: This site is comprised of a small (three) cluster of features located at the southeast tip of the Ke`āmoku lava flow. The site is near the edge of the Mauna Iki lava flow which may have covered adjacent features in the area.

Feature 98-1 is a C-shaped structure open towards the Ke`āmoku flow.

Feature 98-2 is an enclosure. The feature is circular, constructed of loosely piled slabs. The interior is only 1.2 m wide.

Feature 98-3 is a wall located around a shallow ash-filled depression.

SITE NO.: **23020**
FORMAL TYPE: Undetermined
FUNCTION: Undetermined
TOTAL AREA: 0.181 hectares
DESCRIPTION: This site is comprised of two wall features. Detailed structural information is lacking as well as information on potentially associated structures. The site is near the Ka`ū-Volcano Trail (Site 22982).

Feature 98-5 is an alignment of piled stones. It has been designated as a wall, however, no other information is provided.

Feature 98-474 is a 1.6 x 0.5 m and 25 cm high wall. The alignment is composed of three rows of rock on top of a tumulus.

SITE NO.: **23021**
FORMAL TYPE: Old Puna Ka`ū Trail and Associated Features
FUNCTION: Transportation
TOTAL AREA: 43.061 hectares
DESCRIPTION: This site is comprised of a segment of trail system identified in the field and six associated mounds. The mounds were likely used as trail markers. The location of this trail matches nearly perfectly with the location of a trail identified on a digitized 1907 map as the "Old Puna Ka`ū Trail." Therefore, the author is confident that the section of trail identified by Wulzen in 1998 is the remnant of this trail system.

The Old Puna Ka`ū Trail appears to link with the Āinapo Trail which is a trail that leads to the summit of Mauna Loa.

Feature 98-314 is a mound located east of the Puna Ka`ū Trail. No other data is provided.

Feature 98-315 is the feature number assigned to the Puna Ka`ū Trail. No physical description of the trail is provided by Wulzen (1999 unpub. ms.). However, GPS data suggests at least 1000 m (0.6 miles) of the trail was identified in the field.

Feature 98-316 is a mound. The feature appears to represent three "piles" located on top of a tumulus (Wulzen 1999).

Feature 98-317 is a mound consisting of two loose "piles" of stone.

Feature 98-522 is a mound. No structural information is provided.

Feature 98-778 is a mound with more than 12 boulders and cobbles piled on an *ʻaʻā* outcrop.

Feature 98-779 is a larger mound constructed of more than 40 boulders and cobbles on the edge of an old *ʻaʻā* lava flow.

SITE NO.: **23022**
FORMAL TYPE: Complex
FUNCTION: Resource Procurement/Marker/Habitation
TOTAL AREA: 293.267 hectares
DESCRIPTION: This site consists of nine features: one modified outcrop, one terrace, one volcanic glass quarry, an enclosure, two walls and three lithic quarries. The site is comprised of a disparate group of features located just south of the Old Puna Ka`ū Trail (Site 23021).

Feature 98-23 is identified as a modified outcrop. The feature consists of a large tumulus that has an excavated tube beneath it. The feature is walled up and may include some mounds.

Feature 98-24 is a mound. The feature is comprised of two "piles" (of stone) located on the top of a tumulus.

Feature 98-523 is a 1.2 x 0.5 m and 30 cm high terrace located on the north side of a *pu'u*. The terrace floor is filled with ash.

Feature 98-524 is a small volcanic glass quarry.

Feature 98-525 is identified only as an enclosure located on the south side of a tumulus.

Feature 98-526 is a lithic workshop. Cores and flakes are scattered on the *pāhoehoe* and several boulders and cobbles are scattered around. No quarry is located near the workshop. It is not known if this workshop is a volcanic glass or basalt workshop.

Feature 98-527 is a wall located on the *pāhoehoe* surface flow.

Feature 98-761 is a lithic workshop. The workshop is comprised of five flakes from a core of dense black basalt that may be volcanic glass. The workshop is located on the east side of a large dune area.

Feature 98-762, like Feature 98-761 is a lithic workshop. Cores, chunks, and flakes from dense black basalt were identified at this feature.

SITE NO.: **23023**
FORMAL TYPE: Cave
FUNCTION: Habitation
TOTAL AREA: Undetermined
DESCRIPTION: This site consists of a single cave. See brief description below.

Feature 98-528 is described as a cave located inside a tumulus with a mound constructed on top (of the tumulus).

SITE NO.: **23024**
FORMAL TYPE: Cave
FUNCTION: Habitation
TOTAL AREA: 72 square meters
DESCRIPTION: This site consists of a single cave. See description below.

Feature 98-319 is a 9.0 x 8.0 m and 130 cm high cave. The shelter is described as a lava bubble that opens to the west. The shelter is associated with two loosely piled walls on both outer edges.

SITE NO.: **23032**
FORMAL TYPE: Halfway House Trail
FUNCTION: Transportation
TOTAL LENGTH: 733 meters
DESCRIPTION: This site consists of a segment of trail that forks into two parallel trail segments. The right fork is 733 m (0.5 mi.) long while the left fork is only 340 m (0.2 mi.) long. Both trail segments lead toward the Ka`ū Halfway House. The Ka`ū Halfway House was a rest station constructed for visitors who were traveling from Hilo to

Ka`ū in the late nineteenth and early twentieth century. Because of its apparent association with the Halfway House, the trail has been so named. The Halfway House Trail diverges to the west from the Ka`ū Volcano Trail (Site 22982) near the base of the Ke`āmoku lava flow.

Feature 98-472 is the temporary field number assigned to the trail segment identified as the Halfway House Trail. No physical description of this trail system was provided by Wulzen (1999 unpubl. ms.).

SITE NO.: **23033**
FORMAL TYPE: Ke`āmoku Cross Trail
FUNCTION: Transportation
TOTAL LENGTH: 630 meters
DESCRIPTION: This site consists of five features: one trail segment, two rock piles, and two mounds. The trail (see description below) crossed the Ke`āmoku lava flow just south of the beginning of the largest concentration of structures that have been identified along the lava flow. The Ke`āmoku Cross Trail is unlike most of the other trails (except the Old Puna Ka`ū Trail) because lies in an east/west direction. The rock piles and mounds likely served as trail markers for travelers who used it.

Feature 306 is a loosely stacked rock pile. The structure is 0.85 x 0.45 m and 26 cm high. Comprised of three *`a`ā* boulders loosely stacked on one another, the rock pile is located at the east head of the Ke`āmoku Cross Trail on the Ke`āmoku flow.

Feature 307 is the Ke`āmoku Cross Trail. This trail is approximately 630 meters long. It begins at the edge of the Ke`āmoku flow in one of the furthest recesses of the flow. The trail makes it possible to easily cross the rough *`a`ā* Ke`āmoku flow at its shortest width. The trail bed consists of cleared and leveled areas, and slab-like *`a`ā* small boulder stepping stones intermittent across the trail bed. At least two terraces with fairly level surfaces have been built across a trough in the flow. One of the terraces is nicely raised and curb-lined on the east and west edges. The trail intersects Highway 11 at about the 36.5 mile marker where the current overhead power lines cross the highway. The trail continues on the north side of the highway.

Feature 310 is a rock pile that is approximately 0.9 x 0.52 m and 27 cm high. The structure is a stacked feature comprised of six *`a`ā* cobbles on an accretionary lava ball. The rock pile is collapsed but its location along the trail route strongly suggest it once functioned as a trail marker.

Feature 312 is a nicely stacked mound located along the Ke`āmoku Cross Trail. The mound is 0.5 x 0.4 m and 28 cm high. Constructed of five *'a'ā* cobbles the structure is located on top of a small *'a'ā* boulder.

Feature 321 is a 0.48 x 0.41 m and 47 cm high mound. Located less than 11 meters west of the Ke`āmoku Cross Trail. This structure is pyramidal in shape and composed of large *'a'ā* cobbles stacked on a natural *'a'ā* outcrop.

SITE NO.: **23034**
FORMAL TYPE: Ka`ū Road
FUNCTION: Transportation
TOTAL LENGTH: 3,195 meters
DESCRIPTION: This site consists of a single road segment. See description below.

Feature 75 is a 3,195 m (1.99 mi.) segment of the Ka`ū Road. This road replaced the Peter Lee Road (Site 22997) by 1927. The Ka`ū Road was built by the Territory of Hawai`i and paralleled much of the then existing Peter Lee Road (Site 22997). Today, only a small section of the Ka`ū Road remains, as the existing Māmalahoa Highway now covers much of the same route.