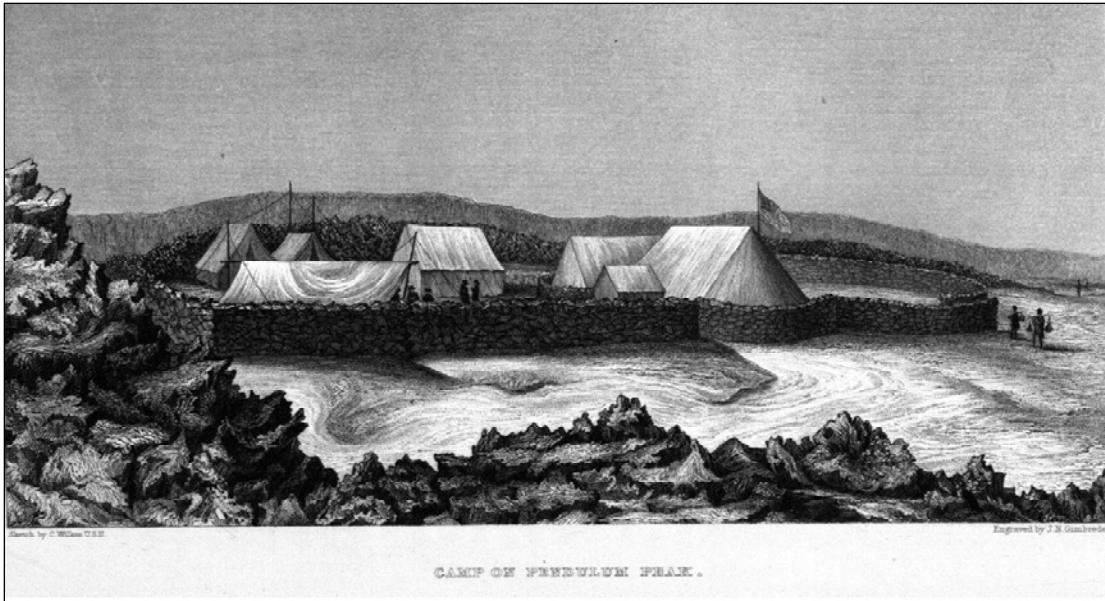


**“Giant of the Pacific”
Mauna Loa Reconnaissance 2003**



*Plan of encampment on Mauna Loa summit illustrated by C. Wilkes,
Engraved by N. Gimbredé (Wilkes 1845; vol. IV:155)*

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November, 2004

Executive Summary and Acknowledgements

The Mauna Loa Reconnaissance project was designed to generate archival and inventory/survey level recordation for previously known and unknown cultural resources within the high elevation zones (montane, sub-alpine, and alpine) of Mauna Loa. Field survey efforts included collecting GPS data at sites, preparing detailed site plan maps and feature descriptions, providing site assessment and National Register eligibility, and integrating the collected data into existing site data bases within the CRM Division at Hawaii Volcanoes National Park (HAVO). Project implementation included both pedestrian transects and aerial transects to accomplish field survey components and included both NPS and Research Corporation University of Hawaii (RCUH) personnel. Reconnaissance of remote alpine areas was needed to increase existing data on historic and archeological sites on Mauna Loa to allow park managers to better plan for future projects.

The reconnaissance report includes a project introduction; background sections including physical descriptions, cultural setting overview, and previous archeological studies; fieldwork sections describing methods, results, and feature and site summaries; and a section on conclusions and findings that provide site significance assessments and recommendations. The logistical demands of performing archeological reconnaissance work in remote, mountainous, high altitude terrain was identified during project implementation. The remote site locations and dense feature clusters observed during aerial reconnaissance flights presents the biggest challenge for completing site documentation. The current surveys were successful in identifying and recording portions of these resource areas and provide the much need baseline information and quantifiable data required by park managers to plan for future projects, to protect these sensitive areas, and to provide interpretive material for park employees and neighboring communities.

The current project significantly increased and synthesized existing data of the cultural resources located on Mauna Loa. Prior to this project, few archeological studies had been conducted above the 4,000 ft elevation. A total of 83 features were recorded as part of the current reconnaissance study and an additional 23 previously recorded features were incorporated with the current study. The combined features represent 15 discrete site areas distributed throughout the project area and reflect previously documented land usage patterns for the high elevation areas on Mauna Loa. The findings of the study identified new site locations and expanded our knowledge of previously known sites through both field investigations and archival research. The information generated during the study will be incorporated into project planning and public interpretation programs including Society for Hawaiian Archaeology conference presentations. Recommendations presented in the report include site protection and preservation measures, future survey methodology and proposed survey locations, and site monitoring through inter-departmental cooperation. The report represents the cooperative efforts of NPS and RCUH personnel and signifies completion of a multi-year, multi-phased park endeavor.

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I. Introduction

This report presents the results of archeological reconnaissance efforts conducted on the summit and upper elevations of Mauna Loa within Hawai'i Volcanoes National Park (HAVO), Hawai'i Island, State of Hawai'i (Figure 1). The study was conducted to identify cultural resources located in the remote, high altitude, alpine environment of Mauna Loa. Pre-contact era resource procurement of this high altitude environment has been previously documented (Moniz 2002, Glidden et al. 1999, et al. in press), and further research was aimed at expanding our current knowledge of the range of site types and site distributions within this remote section of HAVO. The current investigations include 1) archival research within the HAVO Cultural Resource Division libraries and files, 2) reconnaissance level field investigations of the summit area and upper elevations of Mauna Loa, and 3) a summary and synthesis of the information generated from these efforts. In addition, this report provides administration for the sites identified during the reconnaissance and provides National Register eligibility determinations and treatment recommendations for the archaeological sites identified during the reconnaissance.

Limited archeological studies have been conducted above the 4,600' elevation on Mauna Loa and additional surveys are critical for evaluating the cultural resources in the alpine, sub-alpine, and montane regions of the Park. In addition, no archeological investigations have been conducted within the newly acquired Kahuku Ranch extension of the Park. Known resources within Kahuku include lava tubes, excavated bird catching pits, trails, shrines, burials, and historic era cattle ranching infrastructure. One site, the Kahuku-Ainapo Trail, is currently being considered for listing on the National Register of Historic Places. However, in order to add this site to the register it, along with other cultural resources needs to be fully documented and inventoried. Further studies will aid Park managers in generating a basic archeological overview of the area and be able to provide quantifiable data that in turn will guide and design future cultural resource work.

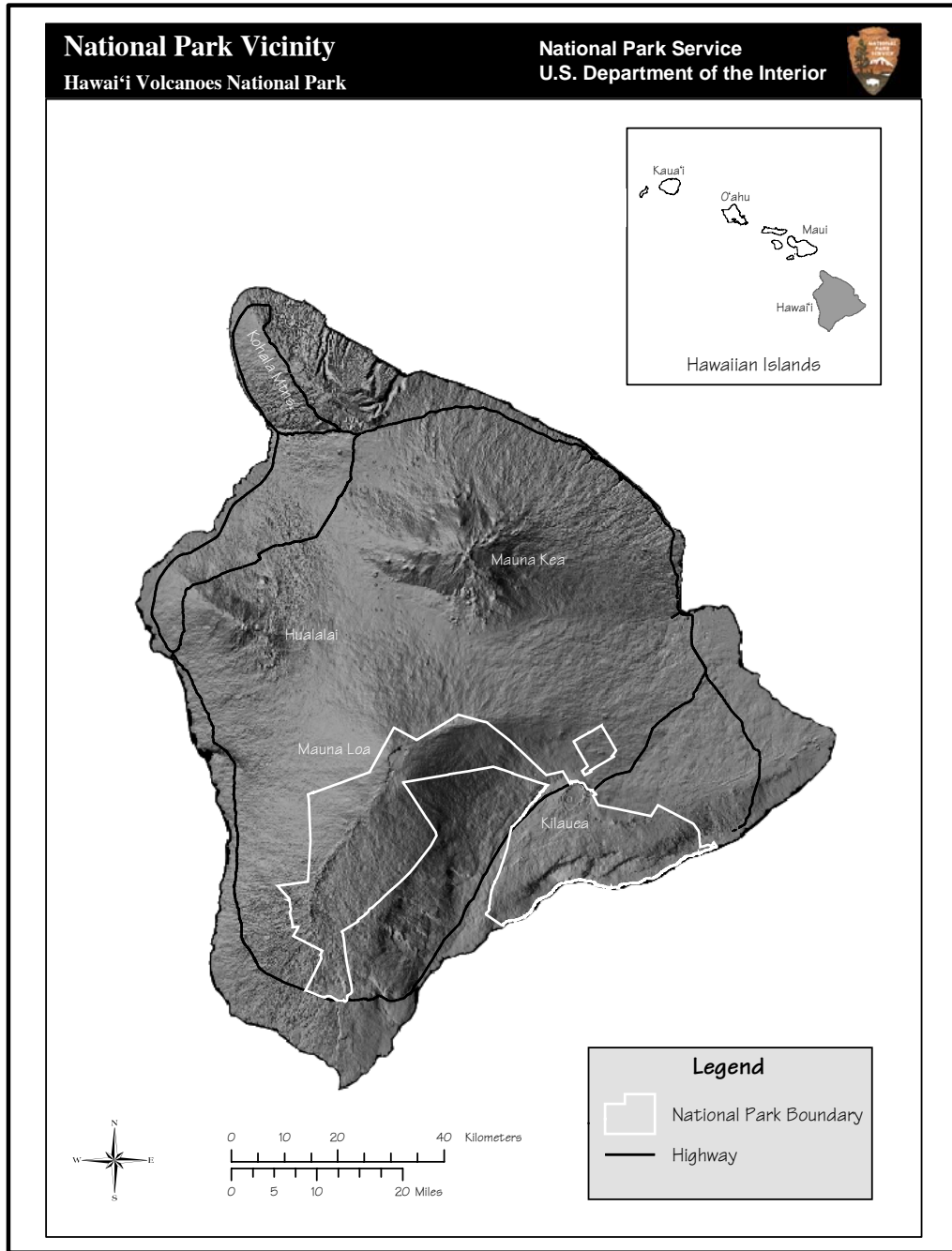


Figure 1. Hawaii Island and Hawai'i Volcanoes National Park location.

The current study was implemented in three separate phases: Phase I of the project consisted of a reconnaissance/survey conducted along existing known trails, the Wilkes Camp site, and on the southeastern slopes of Mauna Loa; Phase II consisted of aerial reconnaissance of the southeastern and southwestern slopes of Mauna Loa in addition to archival research; and Phase III consisted of final report

preparation. The findings presented below represent the collaborative efforts of the personnel within the Cultural Resource Management Division of HAVO and the completion of a multi-phased/year archeological investigation. The information generated from the study will provide the much needed baseline information that will better enable HAVO managers to plan and direct activities within these remote alpine reaches of the park as well as providing interpretive material for park employees, visitors, and the adjacent neighboring communities.

The reconnaissance report is divided into the following sections: I.) report introduction and the physical setting of the Mauna Loa Summit area and the eastern flank, II) an overview of the cultural context of the area, and III) previous archeological studies within the area. Section IV provides a discussion on field methodology and Section V presents conclusions, summaries, and recommendations generated from the current study. The information provided in these sections provides the necessary background information needed for both site boundary and National Register eligibility determinations.

A. Physical Description

Mauna Loa is a vast shield volcano whose summit rises 13,679' above the sea level; however, when measured to the base of the sea floor, the mountain totals some 31,000' in height—possibly the single largest mountain mass on earth. The volume of the mountain is estimated to be 10,000 cubic miles, nearly 100 times the volume of a volcano the size of Mt. St. Helens. The lava that comprises the volcano is mostly basaltic in composition, rich in iron and magnesium and poor in silica relative to other rock types (Juvik and Juvik 1998). The summit caldera, named Moku'āweoweo, is elliptical in shape and is 2.7 miles long by 1.6 miles wide and is nearly 600' deep in some areas. Two rift zones extend both southwest and northeast from the summit caldera area, and eruptions occur along both rift zones, within the caldera, and along the northern flanks of the volcano. Mauna Loa has erupted 39 times during the previous 160 years, with the three most recent eruptions occurring in 1950, 1975, and 1984.

The upper reaches of Mauna Loa consist of alpine terrain that extends from approximately the 8,500 foot elevation to the summit. The alpine environment consists mostly of barren lava flows, is situated above the inversion layer, and the climate is generally cool and dry. The annual rainfall is 20-28 inches, and one or two light snows, typically melting within a few days, occur in the winter. The mean air temperature is 43-48 degrees Fahrenheit with frequent nightly frost occurring in the winter months. Vegetation within the alpine environment is limited to small patches of stunted native shrubs, mostly *pukiawe* (*Styphelia tameiameia*) and *ohelo* (*Vaccinium reticulatum*). Grasses, sedges, lichens, and mosses comprise the rest of the plant life.

Mauna Loa exerts its presence on Hawai'i Island not only through its frequent eruptions (every 3-4 years on the average), but also by its sheer enormity. The mountain's vastness is deceived by its inaccessibility and is compounded by its gentle slopes (averaging only 6 degrees), both factors that led to gross underestimations by the early explorers that ventured to climb it. The barren and

featureless landscape makes distance estimations difficult, and when combined with the harsh climatic conditions and high altitudes, it presents a formidable alpine environment that tests the limits of strength and endurance for those who brave the ascent of the Mauna Loa, “Giant of the Pacific.”

1. Ahupua‘a of Kapapala

The Ahupua‘a of Kapapala encompasses the both the summit area and eastern flanks of Mauna Loa within Hawaii Volcanoes National Park (TMK’s: 3-4-4-016:002; 3-9-9-001:003; 3-3-8-001:006). This relatively large *ahupua‘a* extends from the coastline (Nāpu‘uonā‘elemākule to Keauhou Point) to the summit of Mauna Loa and Moku‘āweoweo Caldera (Figure 2). The large size of the *ahupua‘a* may be accounted for because the area contains limited natural resources within its boundaries: coastal resources most likely provided residences with rich marine resources; upland areas were rich in forest resources (e.g. forest birds, canoe material). However, the remaining portions of the *ahupua‘a* include the vast desert terrain of the Ka‘u desert and the barren slopes of Mauna Loa, both areas that appear devoid of critical, subsistence related resources required by traditional Hawaiians. The large boundaries of the *ahupua‘a* may have been delineated to partially compensate for the sparse resources of this region.

The Board of Commissions to Quiet Land Titles (Land Commission), established in 1845, received native testimony during the following decades to award fee simple ownership (Land Commission Awards) to the residents of the islands. The testimonies are invaluable in that many witnesses were born in the late eighteenth century. The elder residents of the region were able to convey to the commission information passed to them from their parents who may have lived during the pre-contact or early contact period (Tomanari-Tuggle 1996). Testimony given in 1873 to the commission (vol. A, No. 1) identified sandalwood as being an important resource within the Ahupua‘a of Kapapala:

When the people used to go after sandalwood the Alii of Kapapala Naihe and Aikanaka took it for Kaaumanu. The Kaalaala people went after sandalwood for their chief but the people of the 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.

Further testimony, received from J. Kaonohi, identified the famous bird catcher, Keaweehu, as an informant that provided specific boundary information concerning the resources of the region. His testimony states that “...Keaweehu said that the sandalwood belonged to Kapapala” and “the uwau and geese on the mountain all belonged to Kaalala, and the other birds belonged to Kapapala” (1873c).

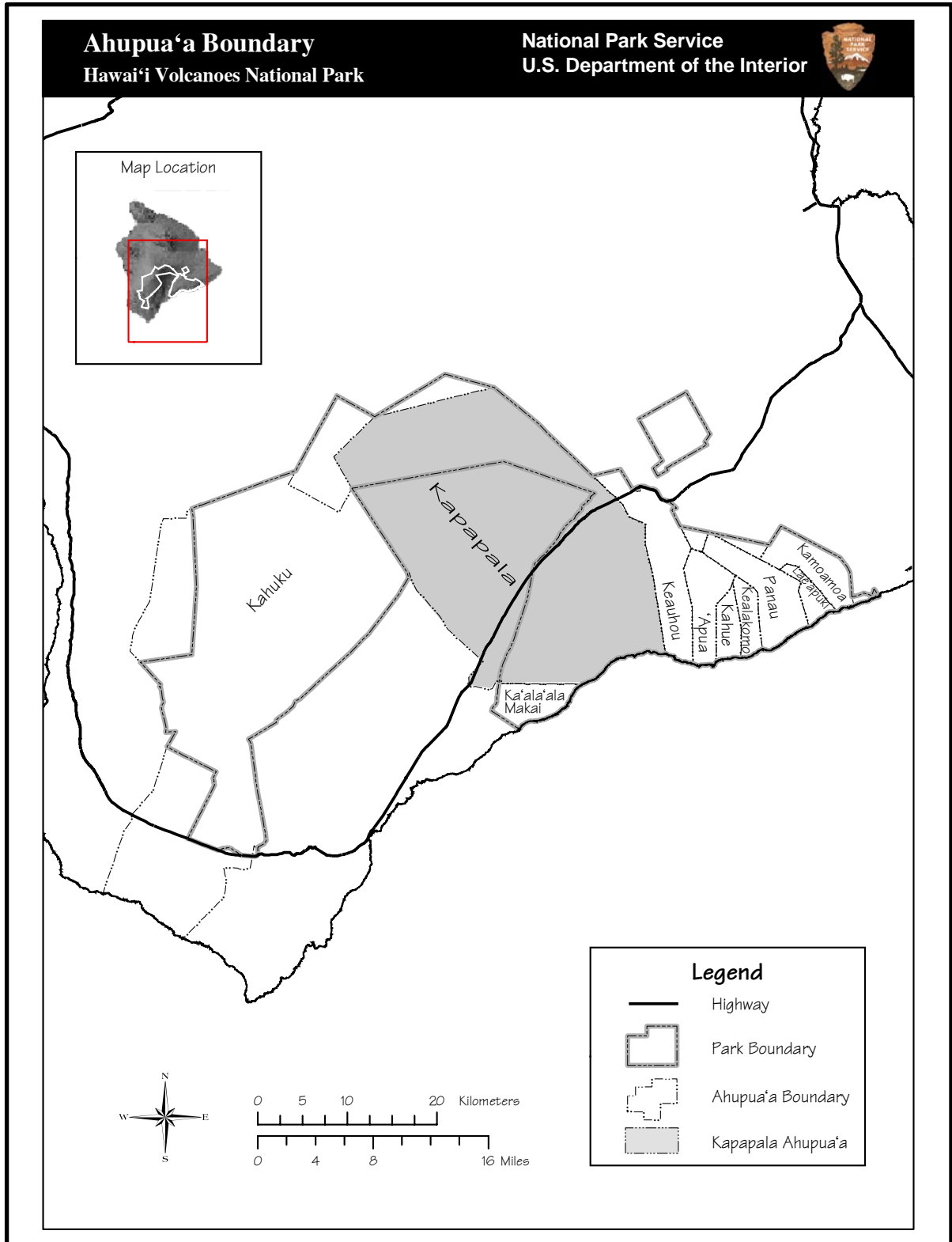


Figure 2. Ahupua'a of Kapapala.

Other ethnographic accounts identified the upper mountainous elevations as being used for canoe making and bird-catching. Although these accounts are generally geographically un-related to the current project area, similar environmental conditions most likely produced similar resources used by pre-contact Hawaiians. Ethnographic descriptions of the western flanks of Mauna Loa by early explorers and missionaries (Menzies 1907, Ledyard 1783, Ellis 1826) describe the practices associated with bird catching, and also refer to the upper slopes of Mauna Loa as being the principle source for the trees used for canoe construction. Ellis (1826) described the area surrounding Kilauea as a hot lava plain and where "...those who come to the mountains to procure wood for building, or to cut down trees and hollow them out for canoes, always cook their own food, whether animal or vegetable, by simply wrapping it in fern leaves, and burying it in the earth" (1823:248). Other regions of the island including Mauna Kea were used for similar resource procurement. In her study prepared for the Hakalau Forest Reserve, M. Tomonari-Tuggle (1996) provides Boundary Commission Testimony that identifies bird-catching and canoe making as being the two major activities of the high elevation forested area.

After the Mahele of 1848, the lands of Kapapala were retained as crown lands under Kauikeaouli (Kamehameha III). Upon his death, the title to the land was transferred to his successor, Kamehameha IV, who ruled the islands from 1854-1863. The land remained as crown lands until the overthrow of the Hawaii Monarchy in 1893.

2. The National Park Service

As a result of the 1916 Organic Act, the National Park Service was established, entrusting the parks with the responsibility "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 manner and by such means as will leave them unimpaired for the enjoyment of future generations." The volcanic landscape of Kilauea, the lava lake in Halemaumau crater, and the summit and slopes of Mauna Loa were attractive destinations for travelers and adventures during the early 1900s. Based on the popularity of the area and on its uniqueness, American businessmen lobbied congress to establish the area as a national park (Moniz-Nakamura 2003). Bills were introduced in 1911 and 1915 that would allow for the national park designation. A prominent scientist, Thomas A. Jaggar, was instrumental in establishing the Park; through his continued lobbying efforts, including revisions to the previously introduced bills, Hawaii National Park was established in 1916.

The initial park boundaries included the summit area of Mauna Loa, the Kilauea caldera area, and a connecting strip of land to join the two areas (Figure 3). The legislation also included Haleakala as part of the Park, and was later designated its own park in 1961. The newly formed park contained large portions of the Ahupua'a of Kapapala. Additional tracts were subsequently acquired under Executive Order 81 signed on October 29, 1920, and the deed (#3866) was formally transferred from the Territory of Hawai'i to the United States government on June 28, 1929 (Moniz-Nakamura 2003).

II. Cultural Setting Overview

Mauna Loa is one of five volcanic mountains located on the Island of Hawai‘i. The summit stands sentinel, along with Mauna Kea to the north, over the Island of Hawai‘i and the surrounding vast Pacific. Pre-contact Hawaiians regarded the mountain with sacredness; the summit was visited during eruptive phases to honor the volcano goddess Pele with chanted prayers and offerings. The following section examines the traditional Hawaiian perspective of the mountain, then follows with early European explorer accounts.

A. Legends

Pele is revered as the fire goddess who, according to legends, traveled from her home land (Tahiti) with her family to seek a new island home. The journey brought them to the Hawaiian Islands and after arriving in Nihoa, she sought to create new land by plunging her *o‘o* stick, Paoa, into the ground, the same as she used to do on her homeland. The island was deemed an unsuitable residence, and the family continued down the island chain towards Hawai‘i. While searching for their new home, Pele encountered struggles with opposing gods and goddesses: she battled against Na-maka-o-kaha‘i, the sea goddess, that sent the oceans to fill Pele’s pits and quench her fiery nature. During a battle with Namaka near Hana, Maui, Pele’s body was finally destroyed and she attained her spirit form. Pele arrived on the Island of Hawai‘i and sought to claim Mauna Kea, the home of Poliahu, the goddess of the snow-covered mountain who wears a white mantle of cold. After being vanquished from Mauna Kea, the family continued south to Mauna Loa and found their final resting spot atop the Long Mountain in Moku‘āweoweo and in the fiery pit of Halema‘uma‘u crater of Kilauea.

The mountain is Pele’s home. Hawaiians, in paying ceremonial respects to the goddess, ascended the mountain via a route established along the southern flank of the mountain known as the ‘Ainapo Trail. The method to ascend the mountain resembles modern mountaineering techniques of establishing a series of camp locations, each progressively higher (and smaller) than the previous. The method succeeds in its ability to supply higher camps with essential gear, food, water, and shelter from a previously established lower camp site. Porters are able to shuttle necessary provisions to higher camp locations in the morning, then return to a lower camp leaving key members of the expedition (and their attendant porters-builders) at the new camp. The process allows for a fewer number of porters to remain overnight at higher elevation camps. The success of this method stems from the sequential “siege” tactics of the proposed route and is aided through the necessary acclimatization required at high altitudes.

Russell Apple (1973) in his National Register Nomination form for the trail route described the Hawaiian approach to the summit:

Prehistoric Hawaiians laid out the Ainapo foot trail to assure availability of shelter, drinking water, and firewood between their

nearest permanent settlement, Kapapala village, and Mokuaweoweo, the summit crater. Kapapala village could be reached over easy-grade trails from the coastal Hawaiian settlements.

The arduous journey up the mountain required coordination of resources and staging; and each expedition was based from Kapapala village. The village served as the trail head and was described in early accounts (Douglas 1914) as having a chief's house, a school house, and supplied expeditions with the required stores needed to successfully scale the mountain. Most likely located near the present day Kapapala ranch headquarters, the trail ascended from Kapapala and extended up the southeastern flank, the shortest and steepest route to the summit. A series of camps were established along the trail route: Camp 1, consisting of a well and permanent, small thatched houses, was also utilized by canoe makers and bird catchers who occasioned the trail to gain access to high elevation resources. Apple continued to describe trail route logistics and key camp site areas:

Hawaiians utilized two key campsites on the Ainapo: one at the upper edge of the forest (Camp 2) and one further upslope within a large lava tube (Camp 3) in the barren area. Camp 2, a temporary village of thatched houses built for each royal trip to the top, was in an area of high grass with timber adjacent. Camp 2's altitude was approximately 6,500 feet above sea level, and furnished house timbers, firewood and grass for thatching and ground insulation (under sleeping mats) for the subsequent higher camps. Camp 3, in the large lava tube at about the 7,450-foot elevation, furnished potable, and unfrozen, water for its occupants. Camp 3's water was also carried downhill to supply Camp 2, the main camp, and trail headquarters. Fluids for drinking above Camp 3 came from coconuts, which are unspillable, remain liquid at subfreezing temperatures, and are easily transported. Food for the entire trail came from the numerous plantations of the Ka'u district.

The Hawaiians climbed Mauna Loa for both ceremonial and resource procurement purposes. They approached the mountain methodically and generally with slow deliberateness. The alpine environment proved difficult, and long distances to the summit demanded steady determination. In contrast, the first westerners to attempt the summit were driven by a need for continued exploration of the islands, by scientific rationale, and by curiosity to witness moving lava flows and fountains. Westerners climbed the mountain not as a ceremonial endeavor, and Hawaiian guides and porters protested their secular, unsanctioned ascents. Amid their protest, western explorers pursued Mauna Loa's summit and prized the achievement granted those who would stand on the "Giants of the Pacific."

B. First Mountain Ascents

The first attempts by westerners to ascend Mauna Loa date to 1779. In his article published in *The Journal of Hawaii History*, Walther M. Barnard (1991:53-67) recounts the first unsuccessful attempts to scale Mauna Loa, and chronicles subsequent, successful summit expeditions. A second article appearing in the same issue, *Measuring the Mountain: the United States Exploring Expedition on Mauna Loa, 1840-1841*, Roberta Sprague (1991:71-91) recounts the Expedition's trek up the mountain. Additional works by Barnard (1990, 1991) include a three volume treatise on the eruptions and explorations of Mauna Loa. In *Sea of Glory*, a recently published account of the U.S. Exploring Expedition, Nathaniel Philbrick (2003) relates the complete history of the Expedition's travels around the globe, from its inception to its conclusion. The book continues to narrate the subsequent trials and misfortune that befell the Expedition, sapping the due fame and accolades that should have been awarded to this monumental explorative undertaking. The information provided below is abstracted from these important works and from other source material.

1. John Ledyard

The first recorded attempt by westerners to climb Mauna Loa was made by John Ledyard, an American serving with Captain James Cook's third expedition. The climbing expedition departed from Kealahou Bay on January 26, 1779, and consisted of Ledyard, three shipmates, and Hawaiian attendants and guides. The route, initiating from Kealahou Bay, ascended through the low drylands, through the upper elevation plantations, and penetrated into the upland forests. The team spent the first night at a shelter occupied by an elderly man, his wife, and his daughter. The next day the team continued upslope, and aided by a compass, kept for a straight line toward the summit. Progress was estimated to be 15 miles on the second day, and on the second night the team bivouacked beneath the trunk of a fallen tree. On the third day, the team continued for an approximate five miles before encountering steeper terrain blocked by impenetrable thickets and undergrowth. The expedition abandoned their summit attempt and returned first to the fallen tree shelter, then proceeded the next day to the ship anchored in the bay. The team's estimated progress of approximately 35 miles inland was erroneous as the summit is roughly 20 miles east of Kealahou Bay.

2. Archibald Menzies

The second recorded attempt was conducted by Archibald Menzies (Figure 4), the acclaimed naturalist and botanist serving with Captain George Vancouver on the *Discovery*. Menzies first unsuccessful climb began on February 25, 1793, and commenced again from Kealahou Bay. The expedition consisted of shipmate John Stewart, one resident Englishman named John Smith, and several Hawaiian attendants. Their journey penetrated 16 miles (overestimated by Menzies) before encountering the same conditions that thwarted Ledyard. The team also aborted their summit goals and returned to the ship on March 1st.

Menzies' second attempt to ascend Mauna Loa began one year later, in January of 1794, where he again was accompanying Captain Vancouver. The second attempt was aimed at exploring the island interior and began with a successful ascent of Hualalai. From the summit the team descended down the southeastern flank toward the high plateau region situated between the two mountains. Seeing the summit and snowline of Mauna Loa, and judging them to be within their reach, Menzies proposed to ascend the summit from this northwestern approach. He selected the chief guide and twenty attendants to accompany him, while the remaining members of the expedition were ordered to the lower elevation plantations where they were to secure additional supplies and return to meet Menzies. The team again encountered dense vegetation (thickets and dense undergrowth) and rough terrain that effectively stopped their upward progress and forced their retreat back to Kealakekua Bay.



Figure 4. Portrait of Archibald Menzies (Hunt Institute for Botanical Documentation 2005).

The final and successful attempt by Menzies to climb Mauna Loa began not from the western side of the mountain, but rather from the established traditional route along the southern flank. In February 1794, Menzies secured advice and assistance from Kamehameha I on the best means of reaching of the summit. The king endorsed Menzies' summit expedition and supplied his team with guides, attendants, and transportation to the southern point of the island. From there, the team traveled inland for the next 2½ days before reaching the village of Kapapala. The following days were spent in a grueling effort (sped by Menzies determination) to reach the summit, and continued under the protest of the guides and porters; the final summit bid consisted of a dozen men and was fueled by meager rations consisting of few ship's biscuits, a bottle of rum, some chocolate, and a few coconuts. Menzies, accompanied by a midshipman and an unnamed Hawaiian, reached the southern edge of the caldera, descended into the crater, crossed it, and returned via the same route. After being revived at the southern crater rim by a few loyal team members who stayed behind with a few coconuts, the team continued down slope and wearily reached Camp 2 by 10:00 p.m. The success of the expedition included determining the summit elevation at 13,634', that when corrected for temperature, was equivalent to 13,564'. Menzies regretted not having other measuring instruments with him that would have determined which mountain, Mauna Loa or Mauna Kea, was taller.

The expedition's accomplishment are remarkable considering it was conducted in winter, the team was poorly equipped with inadequate gear (by modern standards), and that the scientific measurements were merely 113' off the accepted height of 13,677' ±. Other estimates of the mountain's height were generated by the Reverend

William Ellis who estimated the height to be 15,000-16,000' above sea level, while the missionary Joseph Goodrich, who climbed to the summit of Mauna Kea, estimated the mountain's height to be "upwards of 18,000 feet high."

3. David Douglas

After nearly four decades, Scottish botanist David Douglas was credited as being the next westerner to successfully ascend to the summit and view Mokuaweoweo crater. Arriving in Hilo in January, 1834, Douglas proceeded to hire guides, porters, and John Honoli'i, a native Hawaiian educated in Connecticut, who served as an interpreter and guide. After a hasty and successful summit trip to Mauna Kea, he quickly reorganized and established an encampment at Kilauea. From here, he continued to Kapapala where his party of 13 men continued toward the Mauna Loa summit. The party encountered poor climbing conditions that characterize the winter months and included heavy rains, mud, rough lava terrain, and finally deep snow at the summit. He and one companion, Calipo, traveled to the eastern rim of the caldera that he mistakenly identified as the summit. After taking barometric readings and temperature measurements, the team began the slow descent. Plagued by the high altitude, Douglas descended the mountain while suffering dehydration, hunger, intense cold, fatigue, and was gripped by violent pain and inflammation of the eyes. He later described the descent as being "even more fatiguing, dangerous, and distressing than the ascent had proved" (Douglas 1914).

4. M. Isidor Löwenstern

In 1839, scientist M. Isidor Löwenstern successfully reached the summit of Mauna Loa. Because of the severe alpine conditions, the expedition remained at the summit for only a few short hours before returning to lower altitudes. His descriptions and estimated distances of the summit caldera do not entirely agree with the actual conditions and dimensions. His observations were penned nearly a year after his ascent, and when combined with his lack of instrumentation, may account for the discrepancies.

Several reports, journal articles, and newspaper accounts were circulated that attributed the first successful summit ascent of Mauna Loa, in 1824, to an American missionary, Rev. Joseph Goodrich. These erroneous accounts possibly confounded several elements of Goodrich's tour of the Island of Hawaii, his descriptions of the four volcanic mountains, and his two successful trips up Mauna Kea and visits to Kilauea. Although multiple authors credit Goodrich with this accolade, Goodrich's own testimony, written in a letter in 1832, disclaims their erroneous accounts by stating:

As that mountain [Mauna Loa], as far as I can learn, has never been ascended by any person, I contemplate attempting the ascent, while making a tour of the island in January next. Should I succeed, and discover any thing worth notice, you may expect to hear from me by the next opportunity..." (Goodrich 1834).

It appears that Goodrich was unaware of Menzies successful climb, even though Goodrich played host to David Douglas and another botanist, James Macrae, both of whom were aware of Menzies feat. Other notions may discount Goodrich's alleged ascent, and Barnard (1991:60) notes that "it is questionable whether or not Goodrich actually did ascend Mauna Loa. If he did, it was presumably between January 1833 and January 1834, when Douglas made his ascent, or as last as 1835." It would seem that if Goodrich reached the summit during these years, then both climbing parties would have been intensely aware of each other's routes, resources, advances, and ultimate outcome of their respected expeditions. The lack of documentation that notes simultaneous expeditions to the summit of Mauna Loa may also further discredit the accounts of previous successful summit ascents prior to Douglas'.

5. U.S. Exploring Expedition

One of the most celebrated summit ascents, most notable for its scientific endeavors, was conducted by the U.S. Exploring Expedition, led by Lieutenant Charles Wilkes (Figure 5). The famed Expedition has been thoroughly documented in *Magnificent Voyagers* (Viola and Margolis eds. 1985), a comprehensive examination of the expedition. Numerous sources provide additional information and perhaps the most voluminous accounts of the Expedition come from Lt. Wilkes himself, who "prepared the five-volume *Narrative of the United States Exploring Expedition*, two scientific volumes on meteorology and hydrography, and two volumes of atlas of charts" (ibid). The culmination of the Expedition coincided with the establishment of the Smithsonian Institution and the Natural Museum of Natural History. These facilities eventually became the recipient of the Expedition's vast collections including over four thousand zoological specimens, over fifty thousand plant specimens, thousands of ethnographic artifacts, and gems, fossils, and corals collected throughout the four year voyage.

The Expedition represented the nation's first exploring and surveying expedition to the South Seas with a fleet consisting of six ships: the flagship *Vincennes*, commanded by Wilkes, the *Peacock*, the *Porpoise*, the supply ship *Relief*, and two additional schooners, the *Flying Fish* and the *Sea Gull*. Charged with the task of providing detailed charts and maps of the region for the American shipping industry, the Expedition attempted to confirm and expand upon the existing maps produced by the numerous whaling vessels detached to the Pacific. A total of 346 men, both naval personnel and civilians, named "Scientifics," comprised the first U.S. international scientific endeavor assigned with the task of expanding academic knowledge of the natural sciences. Ranking among the top successes of the journey, the Expedition is

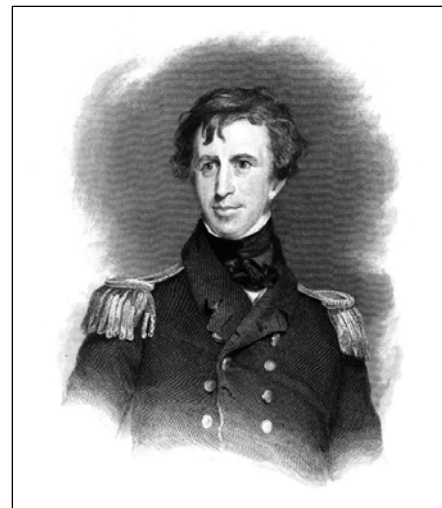


Figure 5. Portrait of Expedition leader Lieutenant Charles Wilkes (Wilkes 1845, vol. I).

credited with discovering the Antarctic continent, as well as producing nineteen volumes of reports and atlases confirming and elevating the nation's role in international discoveries and making significant developments in American sciences.

Departing from Hampton Roads in 1838, the fleet embarked upon a four year, around the world voyage. The Expedition sailed both coasts of South America, continued to the Samoa Islands, New South Wales, and skimmed along the coastline of Antarctica before visiting island groups in Fiji, and finally sailing to the Sandwich Islands. Departing from Hawaii, the Expedition explored the west coast of the United States and the Columbia River, then retraced their route back across the Pacific to the Philippine Islands, the Sulu Archipelago, Borneo, Singapore, Polynesia, then sailed around the Cape of Good Hope returning to New York in June, 1842.

In 1840, the flagship *Vincennes* arrived in Hilo, Hawaii, and preparations were initiated to reach Mauna Loa's summit, one of the many destinations in the Hawaiian Islands chosen by the Expedition. With the enlisted help of Dr. Gerrit Judd, a missionary stationed in Honolulu, Wilkes assembled the natives to serve as porters to carry the vast amount of scientific equipment, tents, portable houses, and food stores needed for the inland journey. The throng of porters stretched out across the landscape and Wilkes described the scene as consisting of

“...200 bearers of burdens, forty hogs, a bullock and bullock hunter, fifty bearers of poe (native food), twenty-five with calabashes...lame horses, which, instead of carrying their riders, were led by them; besides a large number of hangers-on, in the shape of mothers, wives, and children, equaling in number the bearers, all grumbling and complaining of their loads...”(Wilkes 1845; vol. IV:118)

The Expedition continued from Hilo and ascended into the damp forests surrounding the bay. They passed through Waiakea and the royal fish ponds where Wilkes dined on fresh water mullet, and covered eight miles to the division between the Hilo and Puna Districts. The team was allowed to rest during the evening and Wilkes utilized a thatched shelter to protect himself and his company from the heavy dew. With the cloud over Kilauea volcano to guide them, the team marched on to Olaa. During the trek, Wilkes became concerned with the native clothing that “consisted of the maro and a light piece of tapa-cloth, worn as a shawl, which, when working, was usually wrapped around their bodies.” Additional worries about their foot wear prompted Wilkes to provide the natives with raw-hide sandals “which they tie on their feet as boys do their skates.”

The cumbersome loads carried by the porters included scientific equipment that allowed Wilkes to execute his observations. One particular unwieldy piece of equipment consisted of a mortar canon that was to be used to conduct sound experiments in the rarified air at high altitude. The porters repeatedly tried to

abandon this load, a piece that "...had been a great pest to the natives, and they had made every endeavor to get rid of it." Because of the extensive equipment, Dr. Judd was ordered to send for 30 additional reserve porters to assist the party as soon as possible.

The next day, the team reached Kapuauhi, a small settlement of a few houses about 15 miles from Olaa. Again, Wilkes used one of the shelters for the evening because of threatening rain. Expedition leaders suffered an uncomfortable night within the shelter, named "Flea Hall," and decided "it taught us a lesson we remembered for some time, for all our blankets and clothes became infested with fleas, and those of the most voracious kind." Continuing along, with exposed lava country on their left and wooded forests on their right, they approached the open country that lie at Kilauea. Once the team breached the open lava plains, they were afforded their first full view of the mountain:

The next day was extremely fine, the atmosphere pure and clear...and this immense dome rose before us from a plain some twenty miles in breadth. I had not, until then, formed any adequate idea of its magnitude and height. The whole dome appeared of a bronze colour, and its uninterrupted smooth outline was relieved against the deep blue of a tropical sky (Wilkes 1845; vol. IV:122).

Upon realizing the scene, Wilkes further exclaimed that "I now, for the first time, felt the magnitude of the task I had undertaken."

Reaching Kilauea seemed at first anticlimactic, nothing more than "...a huge pit, black, ill-looking, and totally different from what I had expected." As the team neared the crater edge, and its interior was revealed, the sentiment changed radically to one of awe as the spectacular landscape unfolded beneath them. The far end of the crater illuminated the surrounding clouds a cherry red, and Wilkes deemed the sight "more glorious than any I had ever beheld, and the sight of it alone would have repaid for the trouble of coming thus far." The Expedition set up camp along the crater's edge, and as evening drew nearer, team members explored the region and descended to the base of the crater. The volcanic display, enhanced by the coming darkness, invoked a silence among both the party and the Hawaiians. After exploring the depths of the crater, the team retired, exhausted and fatigued, to their tents only to find "sleep impossible after the excitement of such a scene."

At daybreak, a small rebellion ensued where the *kanaka* leaders threatened to strike and upset the Expedition. The leaders demanded higher wages, believing they had the power to exploit Wilkes at this stage, and felt if their conditions were not met, they would effectively halt continued progress. Dr. Judd was able to identify the leaders of the strike, and expelled them from the camp and sent them away. Seeing the potential for further disruption, Wilkes sent for an additional 50 men from the ship with additional provisions to meet the team's needs.

Taking the next days to explore the crater region and to re-organize the expedition, Wilkes continued to take his weather, sound, and volcanic observations. On the

morning of the 18th, the team assembled to continue on their upward journey. Dr. Judd was issued orders to disperse the “hangers-on” that were continuously sapping the expedition’s limited resources. He succeeded in ridding the team of the wives and children of the porters. Preparations to be underway were concluded, and natives filled their calabashes with the condensed water found near the crater in small pools. The sailors, also instructed to secure more potable water, failed to include the water with their loads, believing that more would be encountered along the trail route. Their notion was partially founded by information provided to Wilkes that within about two miles, a partially carved canoe was located in the forest above and contained a good source of water. Upon reaching the canoe, Wilkes found that “...the natives, who had preceded us, after supplying themselves had emptied out the rest.”

The route from Kilauea extend west, then deviated southward over rough, unbroken aa terrain. Clambering over the “ancient flow” proved difficult, dangerous, and as Wilkes discovered, “there never was more difficult or unpleasant ground to travel over.” Their guide, Puhano of Puna, who accompanied both Douglas and Lowenstern to the summit, was presumably leading the Expedition to Kapapala and to the ‘Ainapo trail. However, Wilkes believed that Puhano was not familiar with the route, and decided to take the lead. Aided by a compass and by the mountains presence, Wilkes steered the party upward through a grassy beltway finally arriving at the upper tree line. Marking the new trail route, Wilkes has the natives blaze trees and brake tree braches to guide the remaining party along the trail, and finally had a series of fires ignited to direct the porters to the camp in the clouded over afternoon. The water supply shortage became acute at camp, and those natives who secured water at lower elevations were offering to sell the company water for as much as a half dollar per quart; in lieu of money, the natives received clothing and equipment for payment. The party’s increased advance up the mountain meant that team members would require critical supplies (e.g. water and food stores) to sustain them at higher altitudes.

The camp broke the next morning and lumbered upward in the cool, 48° mountain air. At 1:00 p.m., the team ascended completely beyond the tree line and encountered small shrubs and bushes and identified small sandal wood shrubs. Passing by numerous caves, their interiors were explored as possible water sources to restore their meager supply. Calabashes were placed at drip locations within the caves, but no substantial amounts were procured. In the late afternoon, the team was again enveloped in clouds and mist, and fires were restored to guide the way along the trail. Although the large number of attendants followed to the new camp area, no appreciable tread or trail route was discernable on the hardened, smooth pahoehoe ground surface.

The new encampment was named “Sunday Station” for the day in which they remained, and was calculated as being at 6,071’ in elevation, an elevation that placed the team above the inversion layer. Due to the extreme lack of water, to the team’s fatigue, and to the poor state of the one bullock, it was decided to kill and butcher the animal. Even at the relatively low altitude of 6,000’, the porters labored under their loads, and with provisions being consumed at alarming rates, the Expedition

leaders appeared discouraged. A native guide named Ragsdale appeared in camp that afternoon after being previously dispatched to Kapapala. He brought welcomed news that he obtained additional supplies including forty goats. He also brought with him two additional guides, one being a celebrated bird catcher named Keaweehu, who were both familiar with the mountain and had previously guided Lowenstern.

The guides knew where water sources were located (approximately 10 miles distant on the established 'Ainapo trail) and could transport water back to the Expedition by the afternoon. Wilkes was informed that the snow, if it was on the mountain, was still two days away from their current location. This water source was critical to the team, and Wilkes never imagined that the snow would not be present, and that this resource could possibly fail to supply their needs. However, the expedition now numbered nearly 300 persons total, and their supplies were limited to a few calabashes that contained five or six gallons of water. Their situation was compounded by their logistical errors, summarized by Wilkes (1845; vol. IV:135):

Old Keaweehu told us that we had taken the wrong road to the mountain, and Puhano was not at all acquainted with the right road,-- a fact we had long before discovered; that if we had come by way of Palapala [Kapapala], he would have been able to conduct us by a route we should have found water every few miles.

It should be mentioned here that the erroneous route taken by Wilkes was likely not as far from the established route as has been previously suggested. The estimated ten mile difference is most likely an exaggeration and may have been suggested by the guides themselves as a means to emphasize their ability to correct (via supplies and guide skills) the wayward expedition. A Geographic Information System (GIS) analysis, based on Wilkes' journal entries of known geographic locations and geologic formations, illustrates that the estimated travel route was approximately 4-5 miles east of the established 'Āinapō Trail (Figure 6). Wilkes' specific mention of departing west from Kilauea Crater and continuing along a westerly route suggests that the team crossed the rough, aa terrain of the Keomoku Flow that courses along through Kau Desert (Wilkes 1845; vol. IV:131)

Our route was taken at first and for a few miles in a due west line, for the top of Mauna Loa, over the extensive plain surrounding the volcano; it then deviated to the southward, over an ancient lava-bed [Keomoku Flow], very much broken, that appeared never to have been traversed before. We now became for the first time acquainted with clinkers. To describe these, it is merely necessary to say, they are like the scoria from a foundry, only instead of being the size of the fist, they are from one to ten feet square, and armed on all sides with sharp points; they are for the most part loose, and what makes them still more dangerous, is that a great deal of the vitreous lava is among them. Of the origin of the immense masses and the extent, I shall have occasion to speak hereafter; suffice it for the present to say, there never was more difficult or unpleasant ground to travel over.

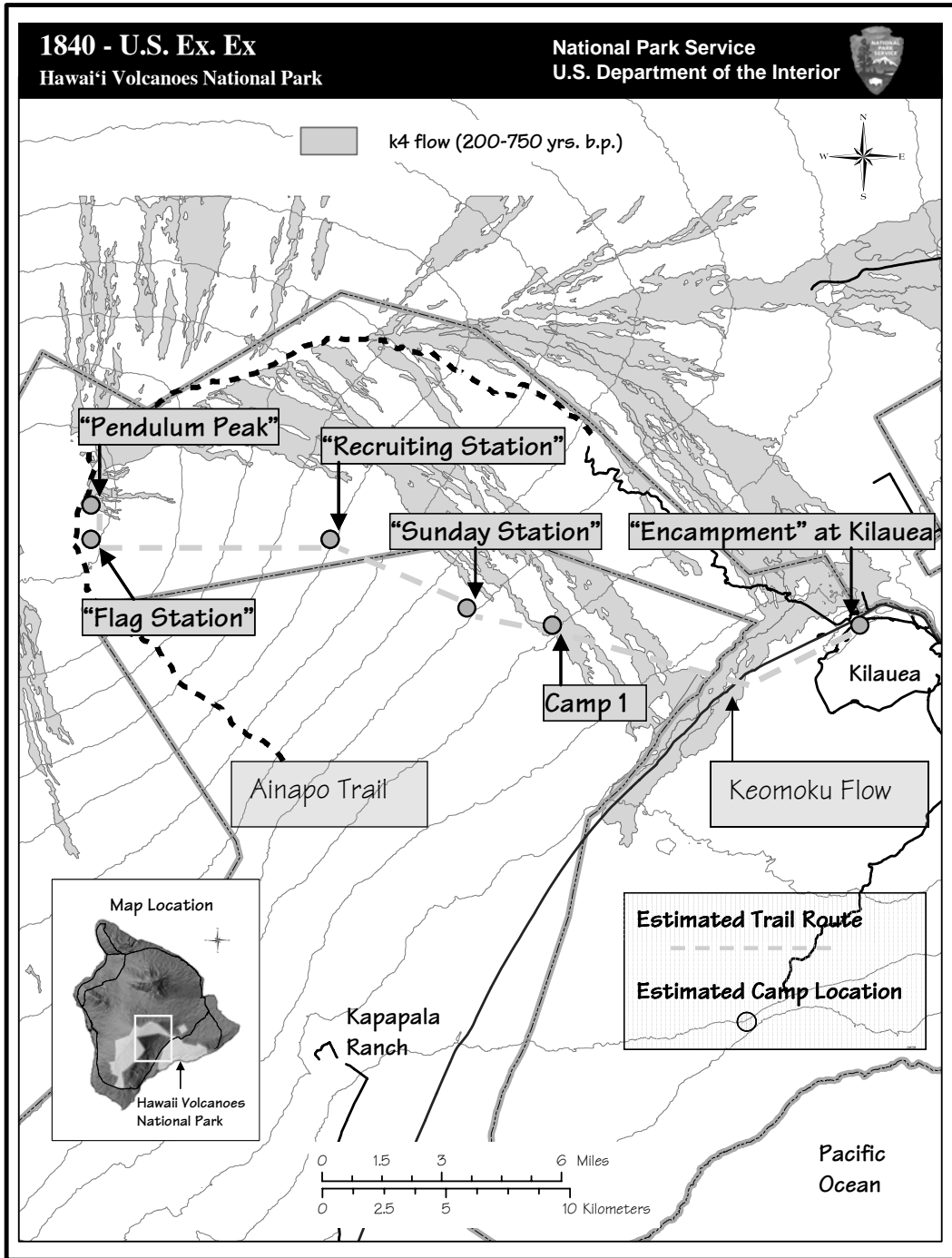


Figure 6. Estimated Expedition route showing distance from the established Ainapo Trail.

The suggested ten mile error places the estimated route along the eastern boundary of the National Park Boundary in heavily wooded terrain. This suggested route is not probable considering that the expedition's trail initiated from Kilauea Crater in a westerly line for "a few miles". That the Expedition eventually regained course on the correct trail (evidenced by the camp remains left by Löwenstern) is an indication that the team had never veered that far from the preferred 'Āinapō Trail. Later requests made by Wilkes for additional men and supplies were all directed to ascend the mountain by the established 'Āinapō Trail route.

The following day, Sunday, was spent, at the request of the natives, as a day of rest. Wilkes was anxious to determine the status of the snowline at higher elevations and ordered a lieutenant to assemble some attendants for a reconnaissance. The natives refused to participate, and the mission was not executed. The remaining day was spent taking continued observations, and by late that afternoon, the guides returned with fifteen gallons of water to restore their desperately depleted supply. More important, the team now knew that a water source was available and was within their reach. Fuel became a concern as they were now at the upper reaches of this valuable resource; they were still two to three days and 8,000 vertical feet from their summit goal.

The team set out early on the morning of the 21st, and as they progressed towards higher elevations, they began encountering the effects of the higher altitude. As they labored upward, the bright mid-day sun beat down on the black lava surface intensifying fatigue and thirsts among the expedition. Dr. Judd volunteered to scout the upper elevations and ascertain if there was snow present, and if so, how much further up the mountain it was. The remaining party was "listless" and wearing from the alpine conditions. Wilkes also felt the effects, and during a rest break he "...enjoyed as sound an hour's sleep on the hard lava as I have ever had." After the break, they continued for two miles to a large cave formation that provided a suitable camp location sufficiently far from the Sunday Station camp. The camp was named the "Recruiting Station" because as the team progressed higher, the attendants who became sick or wounded were sent to the cave that served as a hospital.

Camp was established, and as the evening progressed fires were lit to signal Dr. Judd on his safe return to camp. After arriving in camp, the leaders were pleased to see that he returned with a small snow ball and assured them that snow was present (though melting fast) and was located approximately four hours hiking time upslope, roughly equidistant from their current camp and the summit.

The guides were leading the expedition on a gradual western course to realign them closer to the traditional 'Āinapo trail route. The next day, guide Keaweehu pointed out some burned wood fragments and indicated it was a previous camp location of Löwenstern. Wilkes, along with guide, twelve porters, and seven of his own men, trekked upward toward the summit. By mid-afternoon, the temperatures had dropped to 25°, and as the porters were not equipped for the cold, were suffering from exposure. To their relief, Wilkes located a suitable wind break and ordered the

porters to cache their loads and return to the Recruiting Station. Upon seeing natives down-climbing without their loads, other porters along the trail dropped their gear and retreated along with twelve attendants. The result was a chaotic retreat, where scientific gear, instruments, tents, boxes, portable houses, and calabashes were strewn across the landscape.

Conditions worsened, and a coming storm threatened to isolate the remaining nine-member party at high elevations without adequate provisions. All members were suffering from headaches and fever (mountain sickness), and the temperature continued to drop to 18°. Wilkes set about improvising a temporary shelter building a circular wall of aa clinkers and spreading a canvass covering over the top of the wall. After constructing the shelter, they made a small fire to prepare a meager dinner and made tea for the ill men. Three of the men had, without permission, retreated back down the trail to search for Wilkes' tent. Discovering the men's absence, Wilkes constructed a lantern from a cotton shirt and a calabash, to direct the men back to camp in the darkness. The "lighthouse" worked, and the men, retuning on their hands and knees, rejoined the party.

Temperatures continued to drop during the night, and snow fall was steady. The thermometer had dropped to 15°, and the elevation revealed by barometric reading was 13,190'. The high elevation camp location coupled with the worsening conditions made sleep difficult. At 4:00 a.m., snow accumulation on the canvass covering caused its collapse and partially destroyed their wall. The men clamored out from under the heap and spent the next hour clearing the circular enclosure of snow and rebuilt the shelter. The unfortunate episode caused more hardship for the men, and Wilkes noted that "I need scarcely say, I passed a most uncomfortable night."

When morning broke, the violent storm abated and a few men searched the trail for more provisions. They located a calabash with supplies and enjoyed a warm breakfast complete with tea that effectively revived and restored the wearied party. The company set off toward the summit and left a flag at the camp spot, named "Flag Station."

By mid-day, the party continued toward the summit. They reached the edge of the crater after two hours walking through snow one foot deep, and again fought against occasional snow squalls and driving winds. Finding a suitable campsite 60' from the edge of the crater, Wilkes started setting up camp while the remaining men returned, via a guide, to Flag Station, leaving Wilkes with his servants at the summit. One tent was erected and secured by cordage to blocky lava cobbles. The wind picked up during the night to gale forces, and succeeded in tearing holes in the tent.

Again, the next day broke clear, but the men exhausted all of their matches and were unable to start a fire. They all returned to their tent and blankets, and by 11:00 a.m., Dr. Judd arrived and informed Wilkes that crewman Longley had been missing for the previous two days and nights. Suspecting that he may have perished, a search

party set out to locate the missing crewman. Three days later, he was located lying alongside the trail route in a hole with his hat, pea-jacket, and mittens on, with his water flask around his neck in the same fashion when he had disappeared. When found, he complained that “some persons had driven him out of his house,” and though he was lying next to the trail, he was unable to summon aid. Wilkes expressed that the possibility of becoming disoriented on the upper slopes of Mauna Loa

“...might, at first view, appear strange that anyone could be lost on a bare mountain side, with nothing to impede sight; but, shut out the lower country, and one would be very much at a loss in which direction to go; ...so many spots resemble each other, that even an accurate observer might soon become bewildered” (Wilkes 1845: vol IV: 142)

The state of the expedition further down the mountain at Recruiting Station was not much better. Dr. Judd reported that most of the natives had deserted before reaching Recruitment Station and that boxes and equipment were still scattered along the trail; that Ragsdale and his forty goats had not yet arrived; and the supplies from the ship were still en route. Porters again refused to aid the party unless repaid at “exorbitant prices.” The limited provisions would have to sustain the party until the ship supplies arrived, possibly in one day or two at the most. A fire was started, and after a good breakfast, the small summit party examined the area for a suitable campsite along this eastern edge of the summit crater. It was determined that Wilkes, by accident or luck, had already chosen the best location the previous day, and that the current camp location was the most suitable.

On Christmas day, more stormy weather and freezing temperatures set in at the summit caldera. The remaining crew had limited fire wood and used it to heat a small amount of chocolate. Instruments began to arrive, and observations were taken while other crewmen and attendants began securing the tents as tightly as possible. Others began erecting a stone wall to encircle their camp and protect the camp from the gale force winds. Individual tents were to be further protected by individual walls that extended in height to the eaves of the tent. A plan of the camp was later prepared in a woodcut drawing presented in Wilkes journals (Wilkes 1845; vol IV:145) (Figure 7).

By the 26th, boxes began arriving at the stations. However, provisions were still lacking forcing reduced rations for the men. The crewmen who had ferried the supplies also had worn through their boots and suffered from the high altitudes. Water was sent down the mountain to supply the lower stations and was exchanged for wood for fuel to supply the upper ones. The weather again that night blew hurricane-like from the southwest and rent several tents and collapsed two others; the crewmen remained under the fallen tents and confessed to being more comfortable in the bundled tents. Temperatures dropped to 17° inside their tents, and the water bags kept under pillows froze during the night.

Wilkes determined to examine the conditions of the provisions and men at the lower camps. On the 26th, as Wilkes and Dr. Judd ventured down slope, they met with Lieutenant Alden, who was directed to establish another station between Recruitment Station and summit near the 11,800' elevation. Establishing a camp at that interval would allow porters to shuttle loads to the summit and return to this lower camp in one day's time. Wilkes found the sailors suffered from mountain sickness including vomiting, diarrhea, and several had worn through their shoes and suffered from bloodied and bruised feet. Their poor condition—unshaven with dirty, ragged clothes--was in contrast to their normal ship cleanliness and orderliness. Wilkes spoke with the men to raise their morale while Dr. Judd attended to their illnesses. Afterwards, the crewmen “set about mending their shoes and making sandals; and by the next day, many were transporting small loads up the mountain side.”

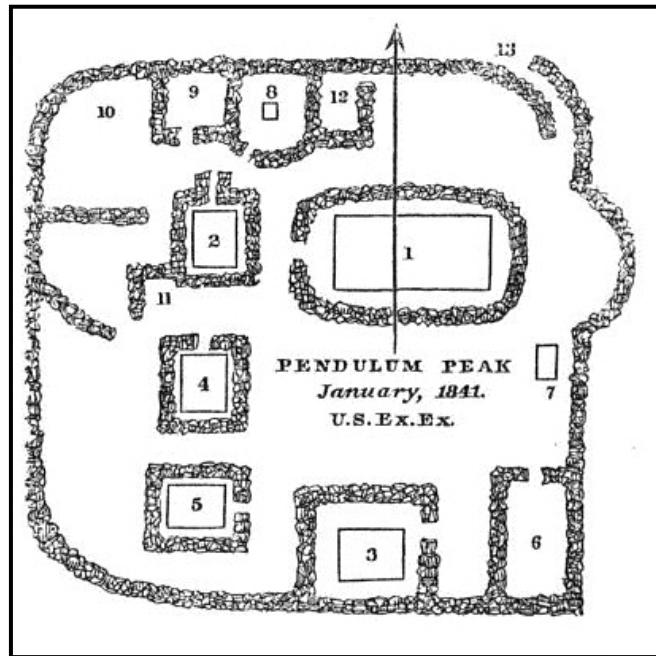


Figure 7. Wilkes’ woodcut of the camp at Pendulum Peak (1. Pendulum house. 2. Captain Wilkes’ tent. 3. Officers’ tent. 4, 5, and 6. Men’s quarters. 7. Magnetic house. 8. Observatory. 9. Store-house. 10. Wood-house. 11. Kitchen. 12 Thermometer and barometer house. 13. Entrance.) (Wilkes 1845; vol. IV:155).

The pair arrived at Recruitment Station by 4:00 in the afternoon and noted the sharp contrast in the temperatures at this lower elevation. The large cave location provided a dry, warm environment for the sick and wounded. Dr. Judd and his assistants continued attending to the men, several of whom secured a large turtle shell from the natives, and after inscribing their names, secured it to a pole at the cave entrance. After passing a relatively comfortable night at the station, Wilkes returned to the summit, accompanied by Seaman J.G. Clake, both laden with provisions. Flags were set at intervals along the trail route to better guide the porters and to avert further accidents; Longley was mostly recovered from his mishap and was transported back to the ship.

Arriving at the summit camp that afternoon, it took Wilkes six hours of hard walking to pass through the newly established stations and reach the caldera. Wall construction continued at camp, and the tents were further secured. Portions of the pendulum had arrived at the summit, and the chronometers were checked for their accuracy; the apparatuses were in good condition and Wilkes rejoiced at their accuracy. The wall constructed around the encampment proved effective as temperatures again fell to 17° during the night.

The next day dawned with fine weather, and the company set about taking more observations. It was decided to abandon the intermediate Flag Station, and porters and crewmen would either remain at the summit camp or return to an established lower camp (Lieutenant Alden's camp at 11,800' or Recruitment Station). The maneuver was executed believing that the men had "recruited" (acclimatized) to the cold, high altitude alpine conditions and could now shuttle loads between the camps and stay at either the upper or lower camp.

The following day (29th), the summit party received news that the crewmen had arrived from the ship and had provisions sufficient for sixty days for as many men. The feat succeeded in guaranteeing the Expedition's success, and Wilkes proudly stated, "I now felt that through our own perseverance we should succeed in obtaining our wishes, for with this supply we could remain sufficiently long to effect my object in visiting the mountain." Camp improvements and observations continued throughout the clear day: temperatures observed in the shade at noon were 47°, while those made in the sun were 70°. Alden, reporting from Recruitment Station, complained that the men were still shoeless after wearing through two pairs. Orders were dispatched to the ship for additional shoes and rawhide sandals, and the Reverend Titas Coan reluctantly concurred to the request (it being Sunday) and sent the natives along on the urgent mission.

The next days were clear and warm with mid-day temperatures rising to 92° in the sun and 55° in the shade. Wilkes and Dr. Judd encountered the guide and bird-catcher, Keaweehu (Figure 8), at the summit and enjoined him for conversation. During the meeting, Wilkes was taken with the peculiar appearance of the man and ordered a "camera lucida sketch of him, as he sat wrapped in his tapa."



Figure 8. Portrait of Keaweehu (Wilkes 1845; vol. IV: 161).

Pains were taken over the next days to insulate the pendulum house and to build protective walls surrounding each tent. During these preparations, other expedition members continued to explore the crater region and the base of the caldera. Once base camp was established and provisioned, the men were better able to conduct their observations and examine the summit region. At night the crew was treated to

the unique spectacle of the sunset from the summit, where the towering Mauna Loa casts its shadow across the expansive cloud layer spread across the Pacific waters.

This evening, at sunset, we had a beautiful appearance of the shadow of the mountain, dome shaped, projected on the eastern sky: the colour of a light amethyst at the edges, increasing in intensity to a dark purple in the centre; it was as distinct as possible, and the vast dome seemed to rest on the distant horizon (Wilkes 1845; vol IV:152)

Experiments and observations continued to consume the party's activities. The men were continually subjected to the effects of the high altitude, and Wilkes found that "On examination, it was found that our pulses varied during the day, and were very easily excited." They still suffered from headaches and associated mountain-sickness symptoms. Wilkes sent for additional grass to insulate the pendulum house floor and walls, and Dr. Judd constructed a crude stove within the tent to enable crewmen to warm their hands while taking readings. However, wood was in short supply, and each day's ration amounted to three sticks of wood; water still froze inside the tent when placed only a few feet from the heat source.

On January 8th, another storm was setting in from the southwest and disrupted their observations. The wind destroyed three thermometers and broke one of the barometers. Wilkes had sufficient supplies to repair the broken equipment, and by the next morning the violent wind let up, enabling observations to continue. The storm cycle continued, and on the 10th, gale force winds howled and snow blanketed the summit area. By the evening, the snow had stopped, temperatures dropped to 16°, yet the wind continued to blast the mountain. The conditions were described by Wilkes as a "...perfect hurricane. I thought the pendulum-house in great danger; it rocked to and fro, appearing at times to be lifted from the ground, and several of its staples were drawn out. Not a person in the camp could sleep until towards daylight, when the gale began to abate."

Sound experiments were conducted on the 11th, and by that night the pendulum experiments were concluded. Wilkes set out the 12th to perform triangulation, and with Dr. Judd headed south to circumnavigate the crater. The snow mantle covering the summit increased the difficulty of their route by concealing cracks and fissures, some of which contained steam vents that were measured to be 169°. While Dr. Judd mended their worn rawhide sandals, Wilkes made a sketch (Figure 9) of the crater when viewed from the south with Mauna



Figure 9. Sketch of Mokuaweoweo (Wilkes 1845; vol. IV:170).

Kea in the background. Reaching the western side of the crater, the snow cover was thinning, and the coastal hills could be seen in the distance. Wilkes, in describing the summit scene, noted that the calm conditions at the summit invoked “a deathlike stillness...which I dreaded to break, even by making a remark to my companions upon the splendour of the scene before us. The sight was surpassingly grand.”

The summit afforded the small crew vistas of Maui, the Kohala mountains, Hualalai, and Mauna Kea, all enveloped at their base by a contiguous cloud layer. The grandeur of the expanse again allowed Wilkes to phrase his observations in more poetic verse:

All the features were so blended into each other by the mist, as to exhibit a tone of harmony that could hardly be conceived, considering the variety of the forms, characters, and distances of the objects, and which seemed to blend earth, sea, and sky into one. I can never hope again to witness so sublime a scene, to gaze on which excited such feelings...(Wilkes 1845:vol. IV:160)

From the summit, Wilkes was eager to determine which mountain, Mauna Loa or Mauna Kea, was taller. They had already determined that Mauna Loa was higher in elevation, by approximately three hundred feet, than had previously been estimated. Their summit calculations placed Mauna Kea higher by one hundred and ninety three feet above their location, a measurement that is off by only 74 feet from the current accepted values. Having completed their measurements, the crew raced along the northern edge of the caldera in a hurried attempt to return to camp before nightfall, avoiding a possible open bivouac at the summit. They succeeded in reaching camp by nightfall, wearied and exhausted from their caldera excursion.

It was during their summit observations that minor symptoms of snow blindness affected Wilkes and others of the crew exhibited by what Wilkes described as “excessive irritation and inflammation of the eyes and eyelids” producing a feeling that “cobwebs had passed over my face and eyes.” Dr. Judd administered to the men, but Wilkes did not respond to the treatments and “...felt forcibly the horror of probable blindness.” They spent one last painful night atop the summit where temperatures dropped to 17°. Planning to depart the summit the next day, Wilkes, in his worsened state, was consoled by the events knowing “...every part of the objects of my ascent of Mauna Loa had been fully accomplished.”

The next day, the 13th, preparations were under way to disassemble the camp and leave the summit area. Some of the crewmen were left behind to finish any remaining observations. Wilkes ordered the men to incise the words “Pendulum Peak, January 1841” on a lava rock within the walled structure to commemorate their achievements. “U.S. Ex. Ex.” was added by the men to assure that future passer-bys would not mistake who had visited and camped at the crater location.

Wilkes and his party descended the mountain, camping once en route to Sunday Station. They arrived at Kilauea the next day and camped along Waldron Ledge on the southern edge of the crater. The team had since spent 28 days away from Kilauea, and had spent a total of 20 days at the summit. The last of the expedition members joined their party on the 17th, and the entire company marched their way towards Hilo reaching the *Vincennes* on January 23rd.

The Expedition succeeded not only in its endeavor to reach the summit of Mauna Loa, but also generated the first maps of the summit caldera and provided geologic and botanical observations at the high summit altitude. Wilkes excluded their primary geologist, James Dana, who was assigned to the *Peacock*, from this portion of the Expedition. The action reveals Wilkes' self-serving ambitions and desires to claim the achievements made upon Mauna Loa for himself (Philbrik 2003). However, the driven success of the Expedition can be credited to the same determined ambition of a leader who faced the adversities, disasters, and shortcomings of the nation's first global scientific expedition, ultimately succeeding in unprecedented global exploration.

6. Titus Coan

During the following decade, one Hilo resident, Reverend Titus Coan, continued to monitor the volcanic activity of both Kilauea and Mauna Loa. In 1843 and 1849, Mauna Loa erupted along the northern flanks and at the summit. The 1843 eruption sent lava toward the saddle region between Mauna Loa and Mauna Kea in two separate branches, one spreading toward Hilo and the other toward Waimea. Coan enlisted the help of another Hilo resident, Mr. Paris, along with seven native porters, to accompany him on his expedition to view the eruption. To view the northern flank eruption, Coan blazed a new route up the mountain that initiated from Hilo rather than the established routes near Kilauea. The blazed trail utilized dry stream beds as primary routes to navigate through the densely vegetated lowlands. After a grueling five day/four night expedition, Coan and Mr. Paris, along with two of the porters, reached the edge of the summit caldera late on the afternoon of the fifth day. The party quickly retreated back down the mountain in an attempt to reach their established camp before nightfall. Aided by a quarter moon, clear skies, and by the orange glare emitted from the eruption, the exhausted party reached their camp shortly before 11:00 p.m.

Titus Coan's commitment to reporting volcanic activities continued throughout the following decades. The famed geologist James Dana (1890) of the Wilkes expedition specifically praised the efforts of Reverend Titus Coan for this commitment and wrote:

After 1849, Rev. Titus Coan became the chronicler of the Hawaiian volcanoes; and very much is due him for his laborious excursions and his many accounts of the volcanic changes in progress and of the great eruptions of Kilauea and Mount Loa. The larger part of his communications on the subject appeared in the volumes of the

“American Journal,” the last in the year 1882. He also published notes on some of the eruptions in his “Life on Hawaii,” 1882. Accounts from other observers also many of Mr. Coan’s appeared also in the daily newspapers of Honolulu...

Rev. Coan continued his observations and made two more summit ascents to view active eruptions in 1852. He maintained correspondence with James Dwight Dana throughout the following years until his death in 1882 (at the age of 81), the same year his autobiography, *Life in Hawaii*, was published.

7. Sawkins and Grist

A decade after the U.S. Exploring Expeditions ascent, two intrepid travelers ascended Mauna Loa in August of 1851 to view an active summit eruption. The pair of climbers consisted of James Gay Sawkins, an English artist with interests in mineralogy, geology, and agriculture and his partner Mr. Franklin R. Grist, a Yale graduate. Their successful summit ascent signaled a new era of exploration on the mountain where ascents to view active lava flows became more routine and were conducted primarily for scientific observation.

The art historian David W. Forbes presents a biographical account of Sawkins in *Encounters with Paradise: Views of Hawaii and its People, 1778-1941*, and the following is abstracted from this portrait. James Gay Sawkins was born in 1806 in Yeovil, Dorset, England and emigrated to America with his family when he was fourteen. After settling in Baltimore, he established himself as an itinerant artist and art teacher specializing in portrait miniatures on ivory. He traveled to Boston, Cincinnati, and New Orleans, and Mexico. He lived in Cuba for 10 years, and after being deported for antigovernment activities, he stayed briefly in South American and California before traveling to Hawaii.

Sawkins arrived in Honolulu in 1850 and remained in the islands for the next two years. He continued doing portraits and produced a large number of water colors (Figure 10). One of the first portraits commissioned after his arrival in Honolulu was for Laura Fish Judd, wife of the missionary Gerrit P. Judd, and their five year old daughter Julie. He also vested his energies in geological pursuits and investigations of the mountains in both Maui and Hawaii. During these excursions, Sawkins was able to use water colors to capture the surrounding landscapes and vistas of remote mountainous locations as well as depicting local town scenes and character.

Sawkins’ geologic investigations led him to conduct an expedition to the summit of Mauna Loa to view recent summit eruption activity. The summit excursion was reported upon in several journals including Sawkins’ own account (1855) that was report to the Royal Geographical Society in London describing the geology of the mountain. The report unfortunately omitted critical information concerning his route up the mountain, but does provide insight into portions of his journey by describing the scene at Kilauea and mentioning the use of local guides (1855:193):

The lava of the basin presents the appearance of black satin, and is so fragile as to crumble under the feet, and being dangerous, the guide, who generally possesses less courage or more prudence than others, dissuades the visitor from looking into the molten lake to see it boiling, cracking and flowing...

Other reports concerning their expedition was reported in a letter from Titus Coan to the Rev. C. S. Lyman and was published in the American Journal of Science (1852, v.63):

Two gentlemen, Mr. Sawkins, an English artist, and a Mr. Grist, graduate of Yale, left Hilo ten days ago for Kilauea and Mauna Loa, and they are, probably, on the summit of the mountain to-day. Their object is to visit and sketch the late eruption, and from thence make a direct descent to Kailua or Kaawaloa. I expect to hear from them in a few days, and hope for something more definite when they shall have reported.

Additional accounts of Sawkins' ascent are provided by the French scientist Jules Remy (1892) where he mentions the accuracy of the artist's paintings and noted similar conditions during his own ascent:

On leaving the grove, we had to tread on thick gramineous plants (*aira?*), inconvenient and troublesome for walking, that carpeted the ground for a remarkable large zone decorated with handsome forked *koa*, sometimes solitary, sometimes in groups, with emerald green foliage. [The painter] Sawkins caught the character of this landscape well and accurately reproduced its physiognomy in one of his paintings.

Sawkins left the Hawaiian Islands in 1852 to pursue career opportunities in geology in Australia. He later returned to England, via the United States, where he was appointed by the British government to conduct geological surveys in British Guiana, Trinidad, and Jamaica. He served as a geologist until his death in London in 1878 at the age of 72.

Figure 10. James Gay Sawkins' watercolor during ascent of MaunaLoa, ca. 1851 (National Library of Australia, nla.pic-an3020240-v).



8. Brenchley and Remy

The French scientists Jules Remy, accompanied by an English adventurer named Julius Brenchley, successfully reached Mauna Loa's summit in summer of 1853. The pair enlisted the aid of a native guide, Naipoaloha, and three porters, Keoni, Kaiana, and Kauhai. The guide had boasted of knowing the mountain and claimed he made three previous ascents: one with Lt. Wilkes, one with Dr. Judd (who was part of Wilkes' expedition), and one with a Mr. Wilcox (who actually never reached the summit). During the ascent, Remy suspected that his guide knew less of the route than he purported, and took over the lead aided by a compass. When the party returned to Kilauea, the guide confessed that he had only served as a porter.

The success of their ascent relied upon their small contingent of porters that would in-turn allow for a speedy, alpine style ascent. They were well supplied, including water, and Remy described their provisions that would supply the team for five days: the inclusion of additional shoes indicates familiarity with at least the rugged island terrain if not previous ascents (in Summers 1988:39):

...we now have ten pounds of slat beef, and as much of ham, fourteen Columbia River smoked salmon, nine boxes of various preserves, sixty pounds of *paiai* taro, twelve pounds of bread, a case of crackers, two bottles of cognac, three bottles of syrup, many cakes of tobacco, some cigars, and decanter of a drug which the Yankees extolled the virtues and which they call pain killer. Add to this wool blankets and five pairs of shoes for each person.

The "light weight" expedition departed from Kilauea and traveled west, presumably toward Kapapala, but then veered right, and may have followed Wilkes' previous route. After an early morning start, the mountain became visible, and once again inspired awe by its pure massiveness (in Summers 1988:40-41):

Maunaloa rose before us in the west, its head uncovered, its flank cut at midslope by a white stratus which ran off onto the sky at the north and south, as if to make us measure all the better the size of the colossus and the magnitude of our task.

After a series of open bivouacs, and accompanied by nearly constant protest from their porters, their team reached the summit on June 17. The summer ascent allowed the team to discover a water cave near the summit to replenish their meager supply of water. However, the other provisions were nearly all consumed, and the combination drove the team to a brief reconnaissance of the summit area before making a late afternoon retreat. While coursing along the southern edge of the crater, the team may have left the only remnant marker of their travels (Summers 1988:49):

"...proceeded to a scanty meal—crackers, sardines—and, halving with our men, we emptied a bottle of cognac. After having inserted a penciled note into the empty bottle, we placed the latter on a pile of rocks, conspicuous, with the sardine tin, containing a pocket edition of Horace, (*Parisiis, e typographiâ regiâ 1773*), enveloped in a silk neckerchief...

These articles may mark the only remains of their expedition. The “conspicuous” placement of the cognac bottle most likely guaranteed their likely discovery and their removal by subsequent climbers. After descending in haste, the team reached the Ka‘u desert and discovered an established trail route that Remy noted as being “the royal route from Kau to Hilo,” as well as noting the soil conditions including the lapilli deposits from the 1790 Kilauea eruptions. The team retired to the Kilauea shelter for the night, where the porter Kauhahi expressed the hardships of the climb by exclaiming, “When I have children, I will tell them; never ascend Maunaloa, not even for a thousand dollars.”

C. Late Nineteenth Century Climbs

Mauna Loa, with repeated eruptive activity throughout the latter half of the century, was continuously ascended to view summit eruptions and to continue exploration of massive mountain. These ascents varied from further scientific endeavors to establishing new routes, including an ascent from the west by William Brigham, who was later named Director of the Bernice Pauahi Bishop Museum. Other recorded ascents include those by the Reverend Titus Coan of Hilo, and the ascents made to view the 1859 eruptions that sent flows along the northwest flank by Coan, as well as Professors R. C. Haskell and W. D. Alexander of Oahu, the Rev. Lorenzo Lyons, and W. L. Green.

Three climbers, J. L. Wisley, Charles Hall, and M. Worman, reached Moku‘āweoweo during the 1865-1866 eruptions via a route along the northwest flank along the previous 1859 flows. The ascent was noted by C. H. Hitchcock who claimed the trio reached and descended into the figure eight shaped crater.

The catastrophic eruption of 1868 was well documented by D. H. Hitchcock, by travelers aboard the schooner *Oddfellow*, the Rev. S. E. Bishop, F. S. Lyman and H. M. Whitney, Dr. Hillebrand, and the Reverend Coan. The witnesses to these events remarked on the severity of the eruptions, earthquakes, and subsequent tsunami that contributed to the destruction of coastal villages along the southeastern side of the island.

The first ascent of Mauna Loa using pack animals occurred in January, 1870. Smoke and steam were visible at the summit, and three men, Judge David H. Hitchcock, Dr. Hans Berag, and Lord Charles Hervey, secured mules and, departing from Kapapala, continued to the summit crater. Their feat helped in establishing a new method for ascending Mauna Loa, one used by nearly all later expeditions; three years later, the second women to ascend Mauna Loa (the first preceded by only a few months), Isabella L. Bird (1875), accompanied by the geologist W. L. Green, conquered the slopes aided by “four superb mules, and two good pack-horses”

Numerous parties continued to ascend the mountain during the remaining decades of the Nineteenth century, mostly via the established ‘Ainapo Trail route. The use of pack animals facilitated their efforts and partially eased demanding logistical

requirements, yet the lack of suitable feed, unreliable water sources, and the rough lava surfaces that cut the mule's legs still produced taxing conditions for climbing parties. The high alpine environment continued to exert its dominance on all summit parties: no one could escape the freezing nighttime temperatures, fierce winds, driving mist, low clouds, rain, and raging blizzards; searing day time heat, scorching thirst, altitude sickness, extreme fatigue, and exposure; or the dangers associated with summit conditions including fountain eruptions, active flows, fragile cones, crumbling and collapsing crater edges, cracks, fissures, steam vents, and ubiquitous, jagged aa flows. These conditions are permanent fixtures of the summit region. Those who embarked on summit expeditions experienced a breadth of conditions, where some were fortunate to experience relative calm and favorable conditions; others suffered from the full brunt of high altitude alpine ascents. The harsh summit conditions on Mauna Loa proved difficult for each expedition reaching the summit caldera. The high altitude conditions afflicted each party with a troubling combination of scarce of resource and extreme remoteness. In the early twentieth century, the combined efforts of a preeminent geologist and a successful businessman succeeded in increasing accessibility to the mountain and improving accommodations for those who ventured into this remote, alien alpine world.

1. Thomas.A. Jaggar and Lorrin A. Thurston

Thomas A. Jaggar was the son of an Episcopalian Bishop and was raised in Philadelphia, Pennsylvania. He earned three degrees from Harvard University in geology, and later taught as a professor at Harvard and at M.I.T. He traveled and studied in Europe, and devoted his life to understanding volcanic processes and geophysics. In the early 1900s, while serving as head of the geology department at M.I.T., Jaggar came to realize the need for an established American Observatory staffed with trained personnel to constantly observe volcanic conditions. Scientists were usually summoned to various locations during eruptive phases, only researchers would often arrive at the site after the eruption has ceased. Helping to establish Hawaii National Park and the Hawaiian Volcano Observatory (HVO), Thomas A. Jaggar, Jr. proved to be an inventive leader who successfully directed the operations at the observatory for nearly three decades (Figure 11). Through his tenure at the park, he profoundly advanced and expanded the knowledge base of the burgeoning science of volcanism. The Harvard graduate and M.I.T. professor succeeding in creating a world class facility directed at improving our understanding of geologic processes, and Kīlauea provided the best venue to facilitate these ambitions.



Figure 11. Photo of Thomas A. Jaggar (*photo courtesy of the National Park Service, Hawaii Volcanoes National Park*).

Lorrin A. Thurston, lawyer, businessman, and newspaper publisher, was the grandson of New England missionaries. Educated at Columbia University, he served in both elected and appointed positions for the Kingdom of Hawaii. Being instrumental in the 1893 overthrow of the Hawaiian Monarchy, he continued to participate in politics in Washington D.C. and participated in provisional and territorial governmental activities. He enjoyed entertaining guests at his Volcano House located near the rim of Kīlauea caldera, and was enthralled with the volcanoes on the island. His powerful political positions combined with his prominent standing in the community (Honolulu Advertiser publisher) contributed to his ability to aid Jagger in creating a national park and spearheading the construction of the Hawaiian Volcano Observatory.

Jagger, Thurston, HVO staff, and military personnel sought to create a new route up the eastern flank of Mauna Loa to its summit. The new route was to depart nearer to the Kilauea caldera to aid scientists and researchers in reaching the summit, rather than departing via the Kapapala trailhead. The proposed route extended north from Kilauea and the Hawaiian Volcano Observatory and ascended to Pu‘u ‘Ula‘ula at the 10,000’ elevation. Logistical concerns and possible trail restrictions on the existing Ainapo Trail drove Jagger to create a new route and to construct better summit accommodations. As Jagger noted in his speech to the annual meeting of Hawaiian Volcano Research Association in 1915 (Jagger 1915):

Mauna Loa is a vast desert waste without water and rising to an immense height. Every expedition to the summit exhausts the energies of the men and animals employed and the animals are frequently crippled and have their legs cut through by the rough block lava. Consequently the ranchers will not rent good animals at any price and as there is no shelter on the summit, little water, no feed, violent winds and low temperatures, the men who can with difficulty be induced to go and act as guides or packers object to remaining overnight.

Jagger received approval to construct the new trail route and preliminary surveys were conducted in August, 1915, followed by additional surveys by Jagger, Thurston, and Lieutenant Philoon of the 25th Infantry. Water tanks were transported up the mountain to provide support for the construction efforts. Segregated enlisted men of Company E of the 25th Infantry Division established the trail route from the Bird Park area to Pu‘u ‘Ula‘ula and constructed a cabin at the remote location, referred to today as the Red Hill rest house. The route was further extended along the northeast rift zone of Mauna Loa to the crater and summit region; however, the lack of shelter at the summit prompted the modification of a crack formation at the northern edge of the crater to provide for shelter from the winter alpine conditions at the summit. “Jagger’s Cave” consisted of a crack in the lava that was roofed over with corrugated metal sheets and was constructed in 1920. The shelter was situated

adjacent to a second crack that provided water, frozen during the winter months, for the crude shelter location (Apple 1973).

Jaggard had lobbied for the construction of a summit shelter in his 1922 Weekly Bulletin for the Hawaiian Observatory by stating:

No one has ever seen a Mauna Loa eruption at the start, because the start is always at the summit region. We want to see the next one start and the only way to organize for it is to prepare a good trail, a house and suitable supplies at the summit. The preparation would be worth the \$5000 if only for the photographs and moving pictures that may be taken.

The trail segment between Pu‘u Ula‘ula was further improved by National Park trail crews in 1930, and the crews also improved sections below the Red Hill rest house. A seismograph was installed along the trail, and in 1935 and 1936 Civilian Conservation Corp (CCC) work crews constructed the Mauna Loa truck trail that paralleled the Mauna Loa trail and provided scientists with vehicle access to the 7,000 foot elevation. Finally, the National Park Service constructed a summit shelter cabin on the eastern side of Moku‘āweoweo in 1934. Additional projects to improve visitor facilities within the park included construction of an octagonal shelter at the end of the Mauna Loa truck trail. The stone structure, built in 1937, resulted from the park’s intensive planning efforts conducted during this time and is referred today as the Mauna Loa Observation Shelter.

The culmination of the improved summit access from Kilauea resulted in the eventual disuse of the ‘Ainapo Trail. Visitors and scientists used the newly constructed access route, and maintenance and improvement efforts were directed toward this route. Eventual deterioration of the ‘Ainapo trail resulted from the lack of maintenance, and to the fact that the trail route courses through privately owned ranch lands that discourage public usage. A second trail currently in use accesses the summit region via the north. The trail ascends from the Mauna Loa Observatory stationed at the 11,150’ elevation and became accessible in 1963 after the established Kulani road (used to access the facility) was connected to the current Saddle Road alignment. The trail provides access to the summit via a shorter, 3.8 mile trail, but the route is steeper than other approaches and does not allow for adequate acclimatization if pursued without stops. The trail route segments currently in use within Hawaii Volcanoes National Park are illustrated below in Figure 12; the National Park Service map shows locations for the Mauna Loa Trail, the short segment of the ‘Ainapo Trail located within the park boundaries, and the Mauna Loa Observatory Trail that accesses the summit region from the north.

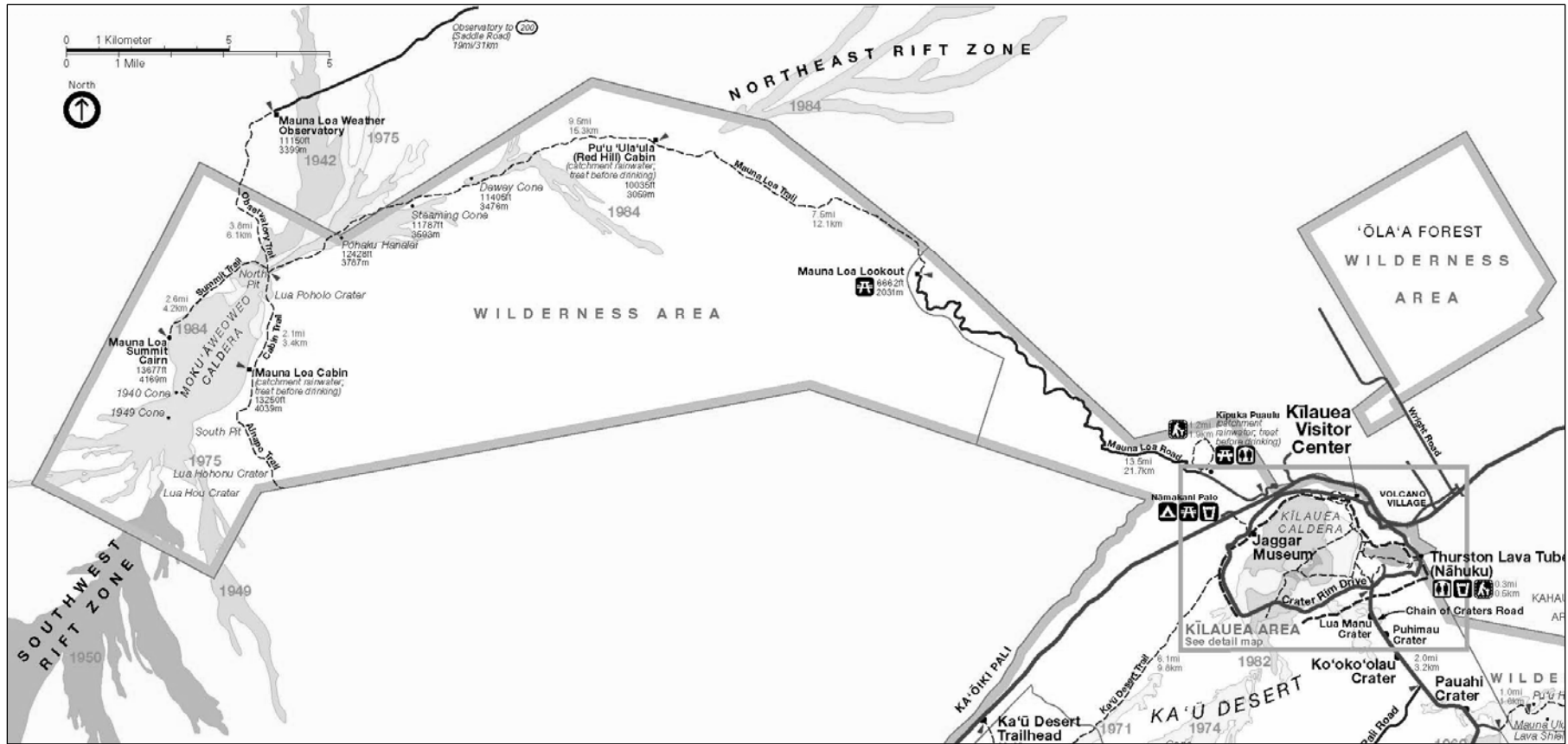


Figure 12. Hawaii Volcanoes National Park map showing current Mauna Loa Trail, geologic features, and backcountry camp locations.

III. Previous Archeological Studies

Few archeological studies have been conducted in the remote alpine areas of Mauna Loa within HAVO. Pre-contact use of the area appears limited to resource procurement including bird-catching and canoe construction. Ceremonial activity most likely occurred during eruptive phases of both Kilauea and Mauna Loa as homage to the goddess Pele. Barnard (1991), in discussing Pre-Contact use of Mauna Loa, speculates as to the extent of traditional Hawaiian use (1991:17):

Did Hawaiians reach the summit of Mauna Loa prior to the first known successful ascent by Archibald Menzies of the Vancouver Expedition in 1794? At present there appears to be no definite answer. There are no known native artifacts or adz[e] quarries atop Mauna Loa (as do occur near the summits of Mauna Kea, Kilauea, and Haleakala), nor is there concrete evidence that prehistoric eruptions attracted Hawaiians to the edge of Mokuaweoweo, the summit caldera, to give homage to, or propitiate, the fire goddess Pele. Certainly the Hawaiian maintained some upslope trails and camps, but even native guides employed in the earliest Caucasian expeditions appeared to be on unfamiliar ground near the summit, and the natives accompanying Menzies were convinced they would die from the cold if they proceeded further.

It is likely that Hawaiians reached the summit in pre-contact times, but because of the limited resources (e.g. lack of adze quarry) the purpose for ascents would not have been as necessary as in other high elevation environments. The frequency and duration of trips to the upper elevations would have likewise been limited. The previously mentioned resources relating to both bird-catching and canoe building are both situated in lower forested zones and do not extend into the sub-alpine and alpine landscapes.

Limited archeological studies on the upper slopes of Mauna Loa have revealed a widely dispersed scatter of archeological features that include trail routes, historic era camps, excavated pits, quarries, cairns (*ahu*), ceremonial shrines, and lava tube habitation sites.

Russell A. Apple, serving as Pacific Historian for the National Park Service, prepared the National Register nomination forms for both the Wilkes campsite and the 'Ainapo trail in 1973. In addition to the National Register forms, he prepared comprehensive articles that included a series of reports on the U.S. Exploring Expedition for the Hawaii Tribune Herald, a report on the 'Ainapo and Mauna Loa trails (Apple 1973), and a report on Thomas A. Jaggar and the Hawaiian Volcano Observatory (Apple 1985). These documents provided detailed syntheses of the persons and events surrounding these valued historic sites, and significantly contribute to the interpretation of these sites within Hawaii Volcanoes National Park.

A field investigation was conducted in the fall of 1976 by Michael Pietruszewsky, Associate Professor of Anthropology, University of Hawaii (Manoa). The work resulted from the discovery of human remains within a partially collapsed lava blister by Hawaii Volcano Observatory personnel in late August, 1976. The site is located approximately 1.5 miles south/southwest of the summit cabin, is near to the southeast edge of the caldera, and is roughly .5 mile from the south pit. It consists of two sets of remains and three artifacts: a rectangular-shaped metallic object (possible axe head), a small knife, and one long wooden stick that was severely weathered and split through its entire length. Study of the remains revealed both individuals to be male, one middle-aged (35-45) and one younger, fully mature adult (aged 20-25) (Pietruszewsky 1976). The positioning of the remains suggested the two were embraced in the low shelter with the elder male sheltering the younger. The presence of historic-era artifacts firmly places the site in the post-contact era; the remains may represent an ill-fated high altitude expedition where the two were forced to seek crude shelter, eventually succumbing to the elements.

The two sets of remains (with associated historic-era artifacts) located at the summit region represents the possible dire outcomes of high altitude mountain summits. The pair may represent two of the hundreds of porters that participated in the U.S. Exploring Expedition's ambitious summit ascent. A passage from Titus Coan (1882:67), who assisted with the Expedition, noted that "Parties of natives thus employed needed to be recruited often on account of fatigue and exhaustion, and for the lack of shoes and warm clothing to endure the hard travel and the rains, cold, and snows of the mountains. Some died of cold."

In a letter to the *Pacific Archaeologist*, Ranger Fink (1976), who inspected the site along with Dr. Pietruszewsky, Superintendent Bob Barbee, and Chief Naturalist Dale Thompson, noted "...perhaps, they were but two of the hundreds of porters hired by the Wilkes Expedition in 1841. They were but two of the scores of near naked men who carried their loads to the caldera edge. As the weather worsened many porters abandoned their loads and deserted. Perhaps these two deserted—perhaps they carried their loads honorably, were lost, and assumed to have deserted..."

In 1988, a reconnaissance of the summit area and specifically the Wilkes Campsite was conducted by Dr. Patrick C. McCoy, Hawaii County Archaeologist. The reconnaissance effort consisted of mapping the campsite and providing feature descriptions and dimensions for each structure. The results of the investigation (maps, notes, photocopies of slides photographs) are currently on file at the HAVO CRM office.

More recent work includes an archeological survey (Rivoli 1999) of the summit region of Mauna Loa. The survey focused on obtaining locational information (GPS coordinates) of the Wilkes campsite and 'Ainapo trail, both sites listed on the National Register of Historic Places. A total of fifteen features were identified during the survey, and all except for one were located within 50 meters of the current Summit Cabin shelter. Feature 8 is located 271 meters from the cabin and therefore was not associated with the Wilkes Camp site based on proximity. Of the remaining fourteen features, eight were correlated with pre-existing maps and were positively associated with the Wilkes site, and the remaining six were not

definitively included with the site based on the lack of definitive correlation with existing campsite maps. Recommendations provided in the report include increased interpretation of the historic sites, and re-routing the existing trail alignment that bisects the camp site to a new location that avoids the area.

Because of the limited development within this remote portion of Hawaii Volcanoes National Park, few archeological surveys, conducted as part of the Section 106 clearance procedure of the National Historic Preservation Act (NHPA), have been performed on the upper reaches of Mauna Loa. Existing improvements (trails and shelter cabins) were installed before enabling legislation that requires archaeological investigation prior to construction. The inventories that have occurred as a result of NHPA Sect. 106 actions are presented below in Table 1. The scope of these projects was generally limited to fence line construction, fence line replacement, enclosure construction for endangered species (e.g. silversword), and predator and ungulate control fence lines. Additional projects include cyclic maintenance for the Mauna Loa Strip Road and Red Hill cabin, and the installation of tilt-meters along the southwest rift zone of Mauna Loa.

Table 1. Sect. 106 Clearance Projects.

<i>Year</i>	<i>Project</i>	<i>Findings</i>
1972	Park-wide Fence line Installation	No Cultural Resources Located
1985	Resurface 9.88 mi. Mauna Loa Strip Road	No Cultural Resources Located
1988	Heli-spot Construction at Puaula	No Cultural Resources Located
1990	Fence-line Construction, Kapapala Boundary	No Cultural Resources Located
1991	Re-open Spur and Six Tanks Roads	No Cultural Resources Located
1996	Widen Mauna Loa Fuel Breaks	No Cultural Resources Located
1996	Construct Silversword Exclosures	Two Features: Cave, Ahu
1997	Construct Mauna Loa Fence	Cave (non-cultural)
1998	Construct Silversword Exclosures	Two Features: Cave, Mound
1998	Construct Mauna Loa Fence	No Cultural Resources Located
1999	Replace Kapapala Fence line	Two Features: Quarry, Trail
2000	Mauna Loa Road Replacement	No Cultural Resources Located
2001	Outplant Silversword/Maunu Loa	No Cultural Resources Located
2002	Construct Predator Exclosure Fence	23 New Features: Trail, Isolates
2003	Replace Manua Loa Drift Fence	17 New Features
2003	Reintroduce Silversword	1 New Feature: Trail
2003	Install Tilt-meters, Southwest Rift	No Cultural Resources Located
2004	Replace Fence/Peter Lee Road and Kipuka Ki Sections	Four New Features: Alignment, Lava Tube, Road/trail

A clearance project conducted in 2002 (Moniz) examined high altitude terrain from roughly the 7,000-9,000' elevations. Survey transects were linear and followed a proposed predator control fence. A total of 23 new features were identified in addition to a trail route and three artifacts. An additional 11 features (excavated pits) were recorded by biological technicians conducting Petrel surveys in the area; these

features were not formally recorded (feature descriptions/dimensions) but were identified by type along with their locations (UTM coordinates). The majority of features identified during the compliance survey (n=11) consist of excavated pits, described as:

Holes where humans broke into the flat pahoehoe flow and removed the boulders and cobbles. Removal of the rocks exposed the spaces between the surface and the underlying flow. The excavators either tossed the rocks out of the pit in a haphazard fashion or stacked them along one or more of the edges (Moniz-Nakamura 2002:4).

The functional interpretation of the excavated pits on Mauna Loa has been discussed (Glidden et al. 1997, Hu et al. in press, Moniz 1997, 1999, Moniz et al. 1998) and is generally accepted that the pits were used to enhance habitat for the Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*). The birds, especially nestlings, were “considered a great delicacy and *kapu* to all but the chiefs” (Tomonari-Tuggle 1996). Pit modification may have increased their ability to capture these birds as well as enhancing the bird’s nesting habitat. Other alternative functional interpretations include use as quarries for building material, for abrader material, and excavation for agricultural pursuits (Glidden et al. 1997). These interpretations can be partially dismissed because of several factors: the lack of structural features at high altitudes eliminates their use for construction purposes; the material type found is generally not quality abrader material; and the high altitude combined with the lack of arable soils does not facilitate crop procurement. The presence of an active breeding colony of Dark-rumped Petrels at this location, and their continued use of the pits to nest and rear their young, lends credibility to their suggested use as resource extraction for these pelagic sea birds.

Documented archeological sites located at the summit region and eastern flanks of Mauna Loa are presented in Table 2 below and are illustrated in Figure 13; identified sites are presented with either a State Inventory of Historic Places (SIHP) designation or with a List of Classified Structures (LCS) identification number. The sites represent historic era modifications and traditional Hawaiian transportation routes; two of the sites have been nominated to and are listed on the National Register of Historic Places.

Table 2. Archeological Sites on Mauna Loa.

<i>Site No./LCS Designation</i>	<i>Site Name</i>	<i>NRHP Status*</i>
SIHP 50-10-50-5501	‘Āinapō Trail	L
SIHP 50-10-41-5504	Mauna Loa Trail	DOE
SIHP 50-10-51-5507	Wilkes Campsite	L
LCS ID 005844	Red Hill Rest House	NL/E
LCS ID 058266	Mauna Loa Observation Shelter	NL/E
LCS ID 058267	Mauna Loa Truck Trail	NL/E
	Seismograph Vault	
LCS ID 058268	Red Hill Pit Toilets	NL/E
LCS ID 058269	Summit Rest House	NL/E
LCS ID 058430	Mauna Loa Truck Trail	NL/E

* L = Listed, NL/E = Not Listed/Eligible, DOE = Determination of Eligibility

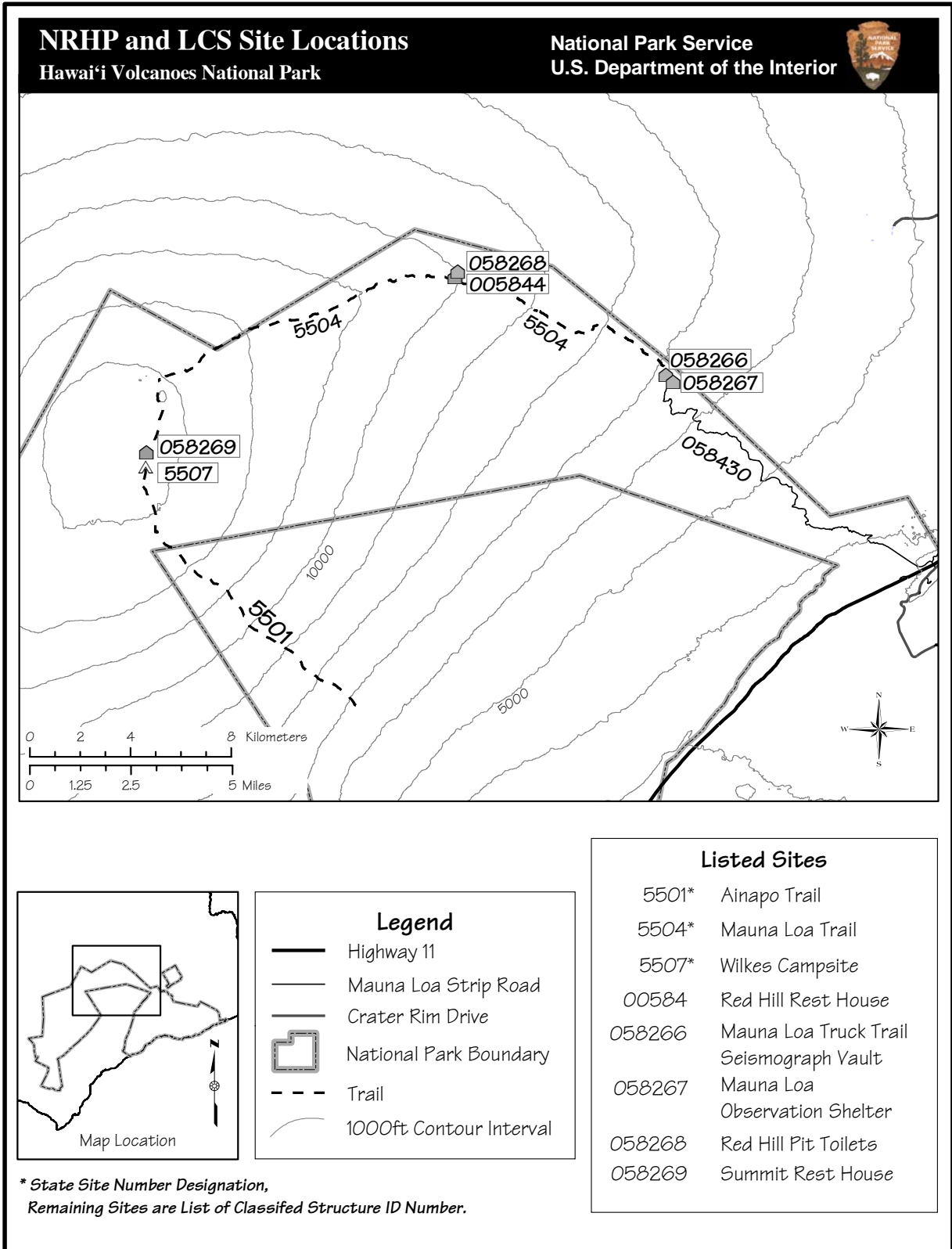


Figure 13. National Register and List of Classified Structure sites previously recorded within the current project area.

1. NRHP and LCS Site Descriptions

A search of the Park's archives revealed a total of nine sites previously recorded on the upper reaches of Mauna Loa. The sites (see Table 2 above) range from trail routes (both pre-contact and historic-era trails), and historic-era modifications: two sites are listed on the National Register of Historic Places, one site was nominated to the Register and its current status is Determination of Eligibility, and the remaining six sites are all listed within the Parks List of Classified Structures database and each are eligible for listing on the National Register. The sites are described and illustrated below.

SIHP 50-10-50-5501 consists of the 'Āinapō Trail and was listed on the NRHP on August 30, 1974. The trail route is described within the nomination form as being:

A narrow, single-file, twisting, and occasionally slightly abraded trail over fields of cooled, hard, tough lavas; some fields being rough and scoriaceous and other smooth and billowy; above 11,600-foot elevation; leading up the broad southeast flank of Mauna Loa volcano to and along the east side of Mokuaweoweo, the major summit crater.

The trail portions included within the nomination form include the summit section located within the national park and a section that extends from the 12,560' park boundary to the roughly 11,600' elevation. Trail segments below the 11,000' elevation were not included in the nomination based on the trail's deteriorated condition due to nearly 100 years of cattle ranching activities on the adjacent land parcels bordering the park.

SIHP 50-10-41-5504 consists of the Mauna Loa Trail and was nominated to the National register in August, 1973. The trail was not listed on the Register at that time and the current Determination of Eligibility status remains for the site. The original nomination appears to have included both the Red Hill Shelter and Jaggar's Cave. The nominated trail segment extends from the 6,650'-13,200' elevations, and its 1973 condition was described as:

A single-file foot and horse trail, approximately 19-miles long starting at the end of the paved road at the Hui-o-Pele shelter at the 6,650-foot elevation; proceeding uphill 9 miles to the Red Hill Shelter at the 10,000 foot elevation; then proceeding uphill an additional 10 miles to Jaggar's Cave at the 13,000 foot elevation; twisting over fields of cooled, hard pahoehoe and aa lavas. Intermittently, and in places infrequent, stacks of loose lava boulders line its sides as trail markers. Occasional carved posts give altitude marks.

Earlier trail alignments, starting in 1915, initiated from the Volcano House near Kilauea caldera. Subsequent improvements, including CCC construction efforts and

installation of phone lines extending to Jaggar's Cave, continued throughout the next decades eventually resulting in the paved Mauna Loa Strip Road and the 19 mile trail to summit cabin of Mauna Loa.

SIHP 50-10-51-5507 consists of the Wilkes Campsite and was listed on the NRHP on August 30, 1974. The site represents the only known physical remains in the Pacific of the U.S. Exploration Expedition's four-year global scientific mission. The 1974 nomination describes the site as:

An area adjacent to the east rim of the summit crater of Mauna Loa volcano, at an altitude of 13,240 feet above sea level; surface of pahoehoe lava, with piled and scattered lava boulders, with evidence of rearrangement by man.

The original campsite consisted of an enclosure wall that encircled twelve discrete areas, each with its own shelter wall (Figure 14). The frequent seismic activity at the summit location combined with high altitude alpine conditions (severe wind, snow, freeze/thaw episodes) have reduced the site's features to the scattered rubble remains noted in the nomination form. In addition, the Summit Rest House is located immediately adjacent to the campsite, increasing the number of visitors to the summit region and possibly increasing impacts to the site.

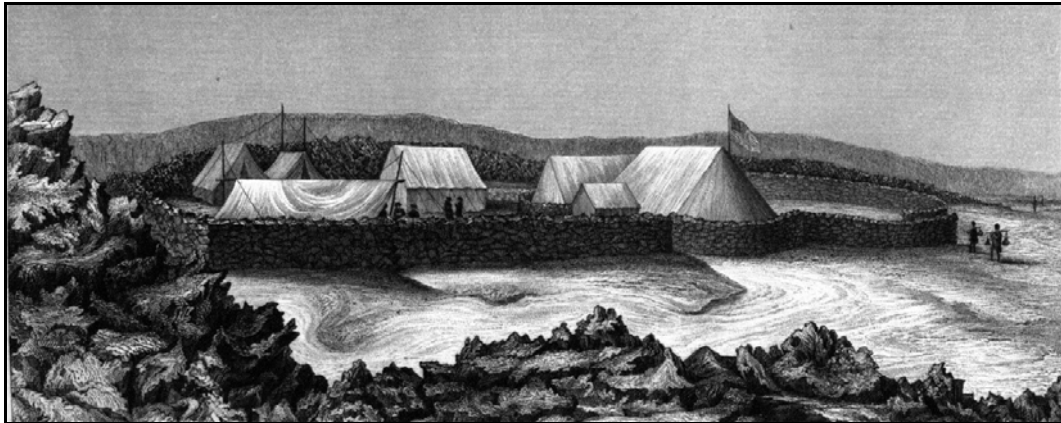


Figure 14. Campsite on “Pendulum Peak” illustrated by C. Wilkes U.S.N. and engraved by J.N. Gimbrede (Wilkes 1845, vol. IV:155).

LCS ID 005844 consists of the Red Hill Rest House and is currently listed in the List of Classified Structures within HAVO and is eligible for listing on the National Register of Historic Places. The LCS report indicates the shelter was constructed in 1924 and describes the structure as a “Shelter built by Coast & Geodetic Survey for their research parties.” The entry erroneously ascribes both the year of construction and the parties responsible for constructing the shelter. The National Register nomination form for the Mauna Loa Trail provides information concerning the Red Hill shelter and states that the shelter was constructed in 1915 and was “Built by Company E, 25th Infantry Division, U.S. Army, with funds (\$1,200?) provided for materials by Hawaiian Volcano Research Association.” The building was described as consisting of 3 rooms with 10 wooden bunks, had a tar-paper roof, was equipped with a wooden water tank, and provided stable accommodations for 12 horses (Figure 15).



Figure 15. LCS ID 005844, Red Hill Rest House (photo ca. 1952) (photo courtesy of the National Park Service, Hawaii Volcanoes National Park).

LCS ID 058266 consists of the Mauna Loa Observation Shelter and is currently listed in the List of Classified Structures within HAVO and is eligible for listing on the National Register of Historic Places. The LCS report describes the building as being “Built in rustic style adapted for HAVO in response to local climate, building traditions & available mats [materials].” Additional information notes that the shelter “Illustrates development of visitor facilities at the park resulting from intensive planning and construction efforts in parks 1916-1942.” The building is cited as being built in 1937 and although the shelter was constructed through the Civilian Conservation Corps efforts, this appears to be omitted from the LCS entry.

The shelter is an octagonal structure measuring 16'-4" in diameter with 7' sides and is constructed from lava rock masonry with overhanging eaves and a conical roof (Figure 16). The shelter remains in good condition and is currently used as an interpretive kiosk for visitors exploring the upper reaches of the Mauna Loa road.



Figure 16. LCS ID 05862, Mauna Loa Observation Shelter during construction (ca. 1937) (photo courtesy of the National Park Service, Hawaii Volcanoes National Park).

LCS ID 058267 consists of the Mauna Loa Truck Trail Seismograph Vault located at the top of the Mauna Loa Strip Road. The feature is listed on the List of Classified Structures within HAVO and is eligible for listing on the National Register. The structure's significance "Illustrates scientific research into volcanic activity and earthquakes conducted at HAVO, premier site for volcanology. Design followed tenets of park Rustic architecture." The vault is a roughly 117 sq. ft. 1 story structure built into the existing hillside with a concrete foundation and walls with square cut lava rock veneer (Figure 17). The roof is reinforced concrete, and wing walls flank the wooden doorway, and the structure is listed as being in good condition.



Figure 17. Mauna Loa Truck Trail Seismograph Vault LCS ID 058267, view to northeast.

LCS ID 058268 consists of the Red Hill Pit Toilets and is currently listed in the List of Classified Structures within HAVO and is eligible for listing on the National Register of Historic Places. The LCS entry form states that the structure "Illustrates development of visitor facilities at HAVO. One of two outhouses built during one of many NPS efforts to repair Red Hill Rest House." The structure is 4' x 6' rectangular building with a corrugated metal shed-roof. The exterior is 1" x 12" vertical siding with two doors, each with ceramic doorknobs, and the structure is described as being in good condition.

LCS ID 058269 consists of the Mauna Loa Summit Rest House and is currently listed in the List of Classified Structures within HAVO and is eligible for listing on the National Register of Historic Places. The LCS entry form notes that the structure was "Built in style developed for HAVO in response to local climate, building traditions and available materials...with funds donated by Hui O Pele organization." The funds were requested by the park's Superintendent and the group donated \$2,500 for the summit rest house structure (Jackson 1972). The shelter was constructed in 1934 and consisted of a 30' x 16' wood frame structure with corrugated metal siding and roofing, and the gable roof included rain gutters for water collection (Figure 18-20).

Summit eruptions in 1940 threatened the shelter, and the structure was subsequently dismantled and relocated to a safer location where it was reconstructed. Because of the extreme weather conditions at the summit, the cabin required frequent maintenance, and in 1956 it was proposed to 1) raze and rebuild the shelter at the end of Mauna Loa Road, 2) repair it and have the Hui O Pele group maintain it, or 3) abandon the cabin (ibid). The USGS voiced its concerns about the need to keep the shelter at the summit, and it was decided to retain the structure at its current location. Today the cabin is enjoyed by recreational hikers and is utilized by park personnel.



Figure 18. Labor crews preparing loads at Red Hill Rest House for construction of the Summit Rest House (ca. 1934) (photo courtesy of the National Park Service, Hawaii Volcanoes National Park).



Figure 19. Unloading cabin material at summit (photo courtesy of the National Park Service, Hawaii Volcanoes National Park).

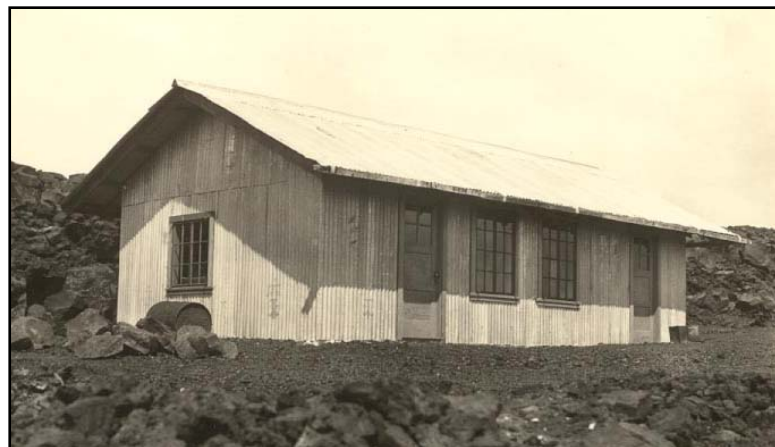


Figure 20. LCS ID 058269, Summit Rest House (ca. 1934) in its original location (photo courtesy of the National Park Service, Hawaii Volcanoes National Park).

LCS ID 058430 consists of the Mauna Loa Truck Trail that is currently listed in the List of Classified Structures within HAVO and is eligible for listing on the National Register of Historic Places. The LCS entry notes that the road “is associated with the early park development...for fire protection and to facilitate patrol of the volcano during eruptions.” The Mauna Loa Trail National Register nomination form states that “The trail between the Volcano House and Bird Park, across savannahs and through ohia forests for four miles, was widened for automobiles by July 1923, realigned and improved in 1933, and realigned again in 1960.”

Frances Jackson (1972) chronicled the park’s administrative history and developments and noted:

“...the CCC began construction of a truck trail to the 7000 foot elevation on September 20, 1935. This 10 mile trail was completed on September 30, 1936. Again, there is no mention of which, if any, road alignment was used. The trail was for administrative purposes—not public use—and provided access to the seismograph at 7000 feet.

Additional accounts of the road are provided by Apple (1973) who states “The trail from Bird Park, near the Volcano House at Kilauea, to the 7,000-foot elevation was paralleled by the Mauna Loa ‘truck trail,’ rough and with no turnouts, in 1935 and 1936 to provide scientists with vehicle access to a seismograph” (see Figure 21). The description also indicates that the trail has since been paved over and is currently open to the public. Portions of the original road still remain intact while the majority of the road alignment was subsequently overlain and paved and is currently known as the Mauna Loa Strip Road.



Figure 21. CCC construction of the Mauna Loa “truck trail” that provided improved access to the seismograph located at the 6,650’ elevation (ca. 1935-1936) (photo courtesy of the National Park Service, Hawaii Volcanoes National Park).

Jaggar’s Cave (no LCS ID NO.) The site known as “Jaggar’s Cave” is located along the northern rim of Moku’aweoweo. Although the site has not been formally recorded, it has been documented within the literature concerning the Mauna Loa summit region and its historical importance is directly related to the continued pursuit by the Hawaiian Volcano Observatory to further the field of volcanology. The structure is situated in an easily accessed area and its location is well know

(depicted on the 1966 USGS Mauna Loa quadrangle, see Figure 22). The site, built in the 1920s, is still used today by recreational hikers (personal observation), and it does not appear within the park's List of Classified Structures or within state records. The site was formally recorded during the current reconnaissance.

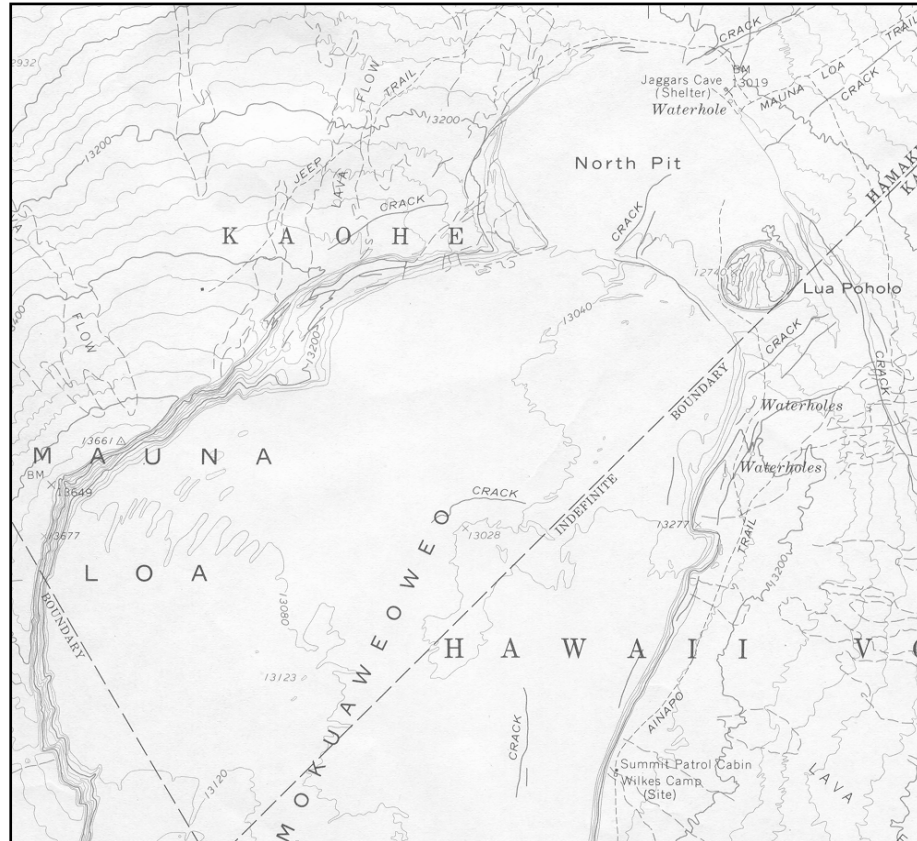


Figure 22. Portion of the 1966 USGS Mauna Loa 7.5' quadrangle showing the location of "Jaggars Cave" at the North Pit caldera edge (note: map also provides the location of Wilkes Camp, shown in the lower right corner of the map).

IV. Fieldwork

The fieldwork conducted for the Mauna Loa Reconnaissance was implemented in two phases. Phase I was conducted in October and November, 2003, and consisted of a systematic transect survey from the 7,500-9,000' elevations. Additional investigations included examining the eastern portions of the summit caldera, specifically the Wilkes camp location. The second phase, Phase II, was conducted from August 23-24, 2004 and consisted primarily of aerial reconnaissance efforts directed at identifying surface archeological features (including trail routes) at high altitudes on Mauna Loa.

A. Methods

Survey reconnaissance was conducted from the 7,500-9,000' elevations during the fall of 2003. The pedestrian survey consisted of establishing transect lines at roughly 250' elevation intervals, where on the Mauna Loa's averaged 6% slope equals approximately a 650-750 meter interval. Transects were oriented southwest/northeast, or perpendicular to the existing slope, and extend approximately 1.0 kilometer on either side of the Mauna Loa Trail. A total of three surveyors were spaced at 20 meter intervals creating a 60 meter wide survey corridor. Additional transects, oriented parallel with the existing slope, served to connect the terminal ends of the contour transects. Existing trail routes (Mauna Loa Trail) were surveyed during the course of the reconnaissance; surveyors were spaced along both sides of the trail routes to identify those features located immediately adjacent to the trail route.

Transect locations were chosen to examine specifically the surface of a pahoehoe flow (K2 flow) that dates to 1,500-3,000 years b.p. (Figure 23). The flow was previously identified as providing suitable habitat for the Hawaiian Dark-rumped Petrel, and several active nesting colonies are present on this flow. Previous surveys in the area identified modified pits excavated within this flow, but no systematic surveys have been performed at higher elevations. Flows types within the K2 series include both aa and pahoehoe flow material that are intermixed and create a mosaic of finger projections across the slope. Transects locations that encountered rougher aa flows were either terminated at these interface changes (pahoehoe to aa flows) or where possible, transects extended across the aa flows, and continued along the smaller fingers of pahoehoe. Likewise, transects located on the eastern side of the Mauna Loa Trail at the lower elevations (7,500-8,000') were shortened by the National Park boundary.

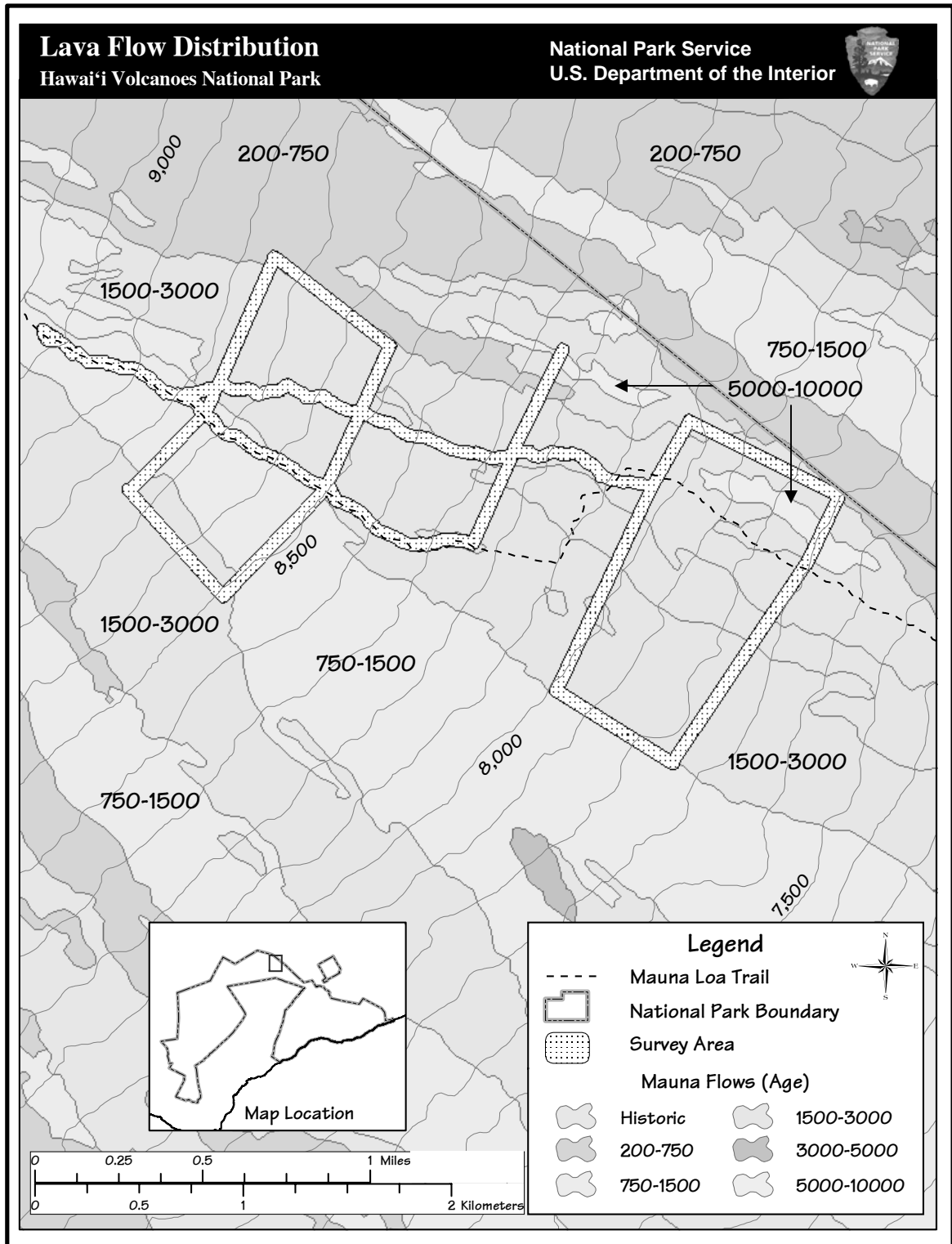


Figure 23. Mauna Loa flow distribution and transect locations.

Features identified during the survey were each assigned a temporary field number and were marked with surveyor's tape. Feature descriptions were completed for each feature using the Hawaii Volcanoes National Park Side Data Record form that includes feature type, dimensions, condition, and complete description. Digital photographs were taken and GPS data was collected at each site using a handheld Garmin III+ GPS unit (Universal Transverse Mercator (UTM) North American Datum (NAD) 1983). Completed site descriptions, feature record forms, photos and photo logs, and GIS data base information are on file at Hawaii Volcanoes National Park, Cultural Resource Management Division.

The summit portion of the reconnaissance consisted of surveys conducted along existing trail routes and along the eastern edge of the caldera including the Wilkes Camp location. Transects were oriented parallel with trail routes with surveyors spaced 20 meters on either side of the trail. Surveyors ascended via the Mauna Loa Observatory Trail located on the northern flank of the mountain. Numerous features were observed along the trail route; however, the features most likely represent modern era activity (Mauna Loa Observatory facility and summit trail established in 1957), and the feature's locations are outside of the park's jurisdiction. Air support from the Park's contractor helicopter contributed to the survey efforts by airlifting survey equipment and camping provisions to the summit cabin location.

Survey efforts at the summit region focused on producing accurate maps and feature descriptions for the National Register listed Wilkes Campsite. These efforts supplemented the previous summit survey conducted by Rivoli (1999), where their survey efforts included acquiring GPS locational information for the 'Ainapo Trail segments located at the summit within the Park's boundary.

Aerial reconnaissance was implemented through the Park's contract helicopter and was directed at both the southwestern (Kahuku extension) and the southeastern slopes of Mauna Loa. Transects were established based on known resource areas (trails) and on specific lava flow types with specific ages. Transects were oriented to provide a sample coverage of these areas. Two trail locations are illustrated on the 1920 USGS Mauna Loa quadrangle (1:62,500 scale) (Figure 24) and their locations were verified during the aerial reconnaissance. UTM locations were collected at these trail sites as well as the features (platforms, caves, excavated pits, walled enclosures) that are situated adjacent to the trail.

The actual flight path was guided by the established flight plan allowing for modifications to the plan based on both fuel and elevation limitations (see Figure 25 for actual flight path). UTM locations were collected at feature concentration areas and digital photographs were taken for selected features. The Park's contract helicopter pilot, David Okita, was also consulted during the flight about known resource areas; his familiarity with the high elevation terrain of Mauna Loa was invaluable and results from his 10 years of service to the Park during which he developed an extensive knowledge base of HAVO and the upper slopes of Mauna Loa.

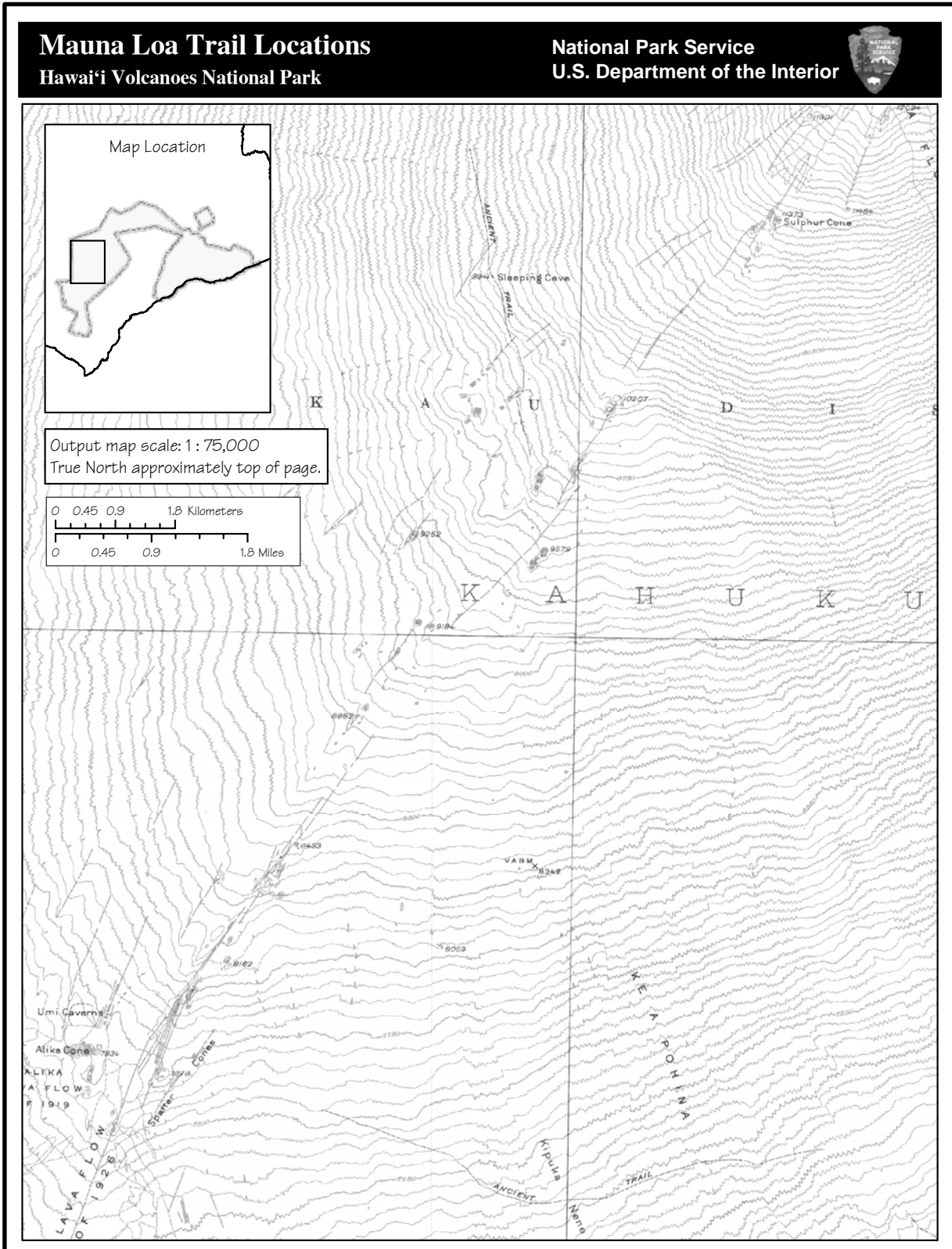


Figure 24. Portion of 1928 U.S.G.S. (1:62,500 scale) Mauna Loa map showing Kahuku, Kau District. Map illustrates "ancient trail" locations in the upper central and lower central portions of the map. (Note: Umi Caverns illustrated in lower left corner of map).

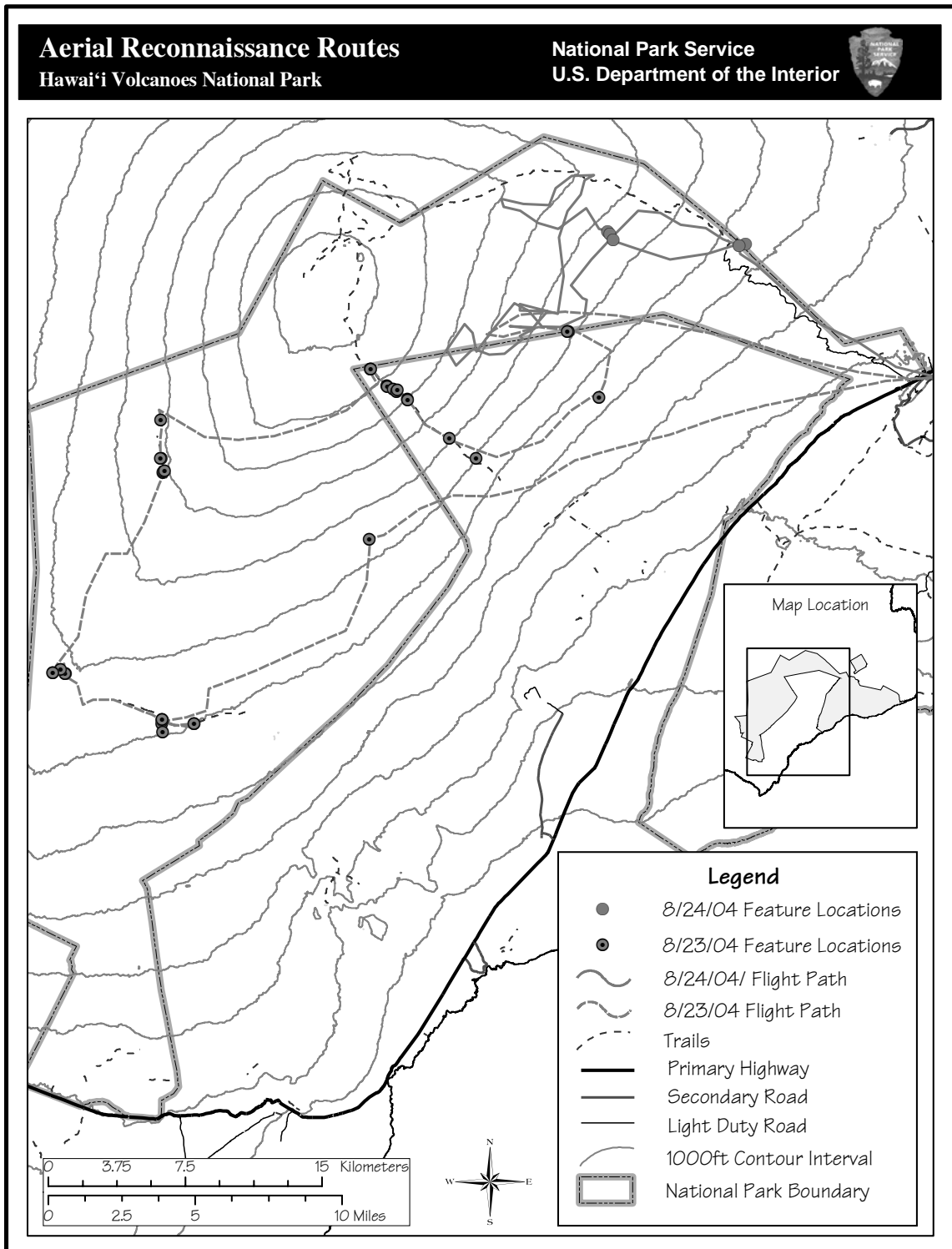


Figure 25. Aerial reconnaissance flight paths and identified feature locations.

B. Results

A total of fifteen new sites comprised of 83 individual features were identified during the current survey efforts and include two temporary habitation complexes (SIHP Sites 24335 and 24347); five resource procurement complexes (SIHP Sites 24336, 24337, 24340, 24341, and 24342); two single excavated pit sites (SIHP Sites 24343 and 24344); one cairn site (SIHP Site 24345); one rock shelter site (SIHP Site 24346); one cave site (SIHP Site 24349); and one historic-era camp site (SIHP Site 24348). The feature types are distributed throughout the project area and their locations are shown in Figure 26 and each is described below.

The remaining two site designations were assigned to 23 features and three artifacts that were previously identified during the 2002 Petrel Fence Survey (Project Review 2002-024). The two sites, assigned SIHP 24338 and 24339, were included with the current survey efforts based on feature proximity, similarity in feature types, and similarity in feature construction. Although these features were previously documented, including National Register eligibility determination recommendations, this report provides additional administrative support by assigning State Inventory of Historic Places site numbers to the previously identified features. One trail route and two caves were also identified during the Section 106 clearance survey: the trail is a previous alignment of the Mauna Loa Trail (Site 5504) and will be incorporated in this site; the caves lacked cultural modifications or components and were not assigned HAVO feature numbers.

Two previously recorded sites, the Mauna Loa Trail (Site 5504) and Wilkes Camp (Site 5507) have been extensively documented with Site 5507 listed on the National Register of Historic Places and Site 5504 determined Eligible. Fifteen features identified during the current reconnaissance and the previous 2002 Petrel Fence Survey (Moniz 2002) correlate with these previously recorded sites. Their feature descriptions are presented below within the site designations for each of these two sites.

An additional 10 features identified as human modified pits (excavated pits) were recorded by the Park's biological personnel working on petrel recovery efforts within the Park. The features were not formally recorded with feature descriptions and dimensions and their locations were recorded using handheld GPS units. Although the features lack detailed recording information, their spatial location contributes to the current survey by helping to identify resource procurement areas. The excavated pits were not assigned HAVO Feature Numbers, but their locations are presented in the site maps within the report to document these additional site areas within the current study area and to help direct future survey planning.

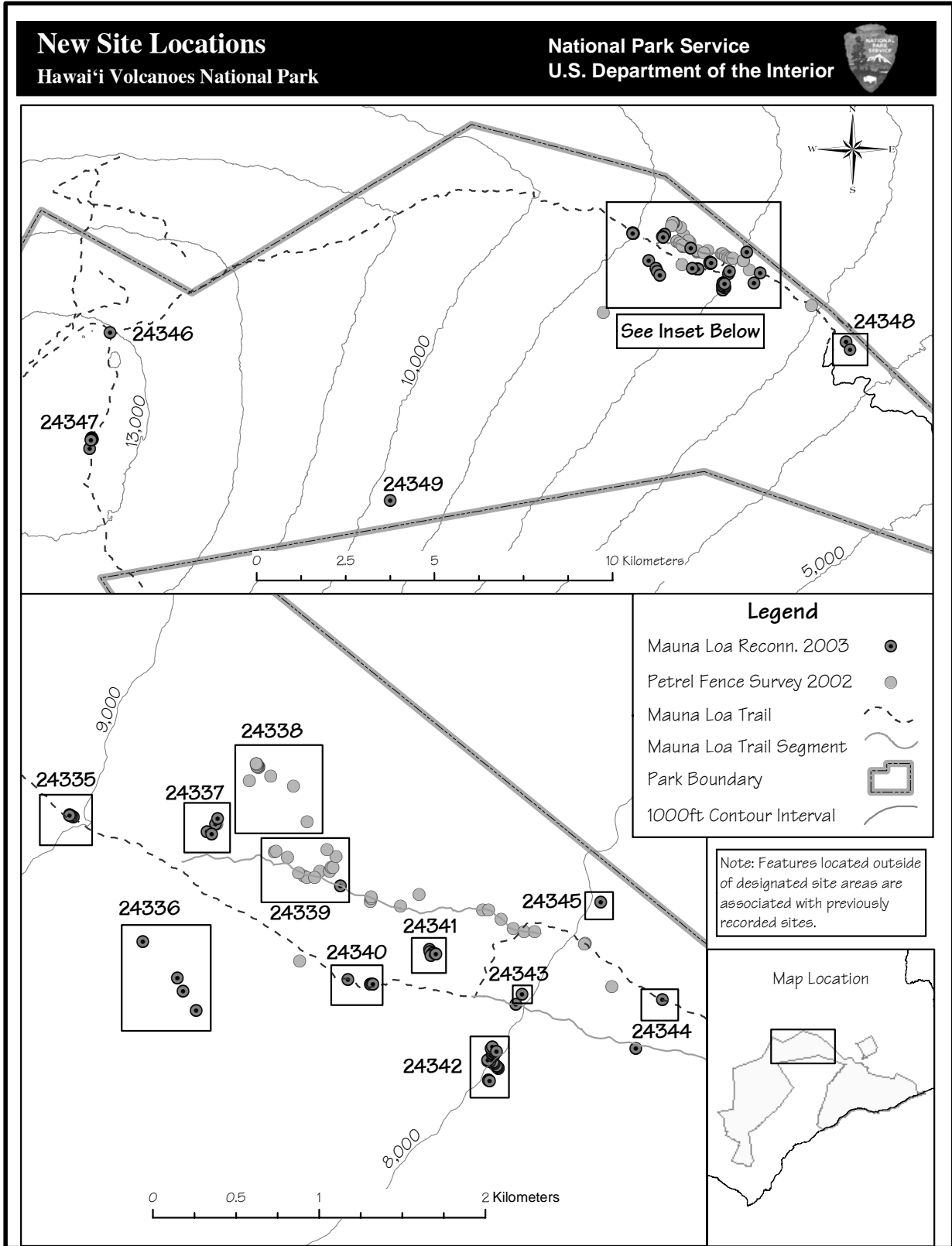


Figure 26. New site locations and distribution.

1. Aerial Reconnaissance

Features located during the aerial reconnaissance phase include excavated pits, trails, C-shapes, enclosures, shrines, and cave openings (Figures 27-29). Feature concentrations were visible from the aerial transect route; GPS coordinates were taken for site concentration areas, and digital photographs were taken when possible (see Figure 15 for flight path and feature concentrations). The fast nature of aerial reconnaissance (limited hover ability due to internal load calculations) reduced the ability to record detailed site attributes for site areas. The aerial reconnaissance method however is effective in its ability to cover vast areas in a relatively short amount of time and is able to produce complete reconnaissance level information (e.g. location, feature type, digital photographs) for features that would otherwise require extensive, logistically demanding and time intensive backcountry wilderness survey expeditions.

2. Feature Types

Feature types noted during the survey include trail, excavated pit, quarry, rock pile, rock shelter, C-Shape, wall, enclosure, and cairn and each is defined below.

Trail: linear feature found across pahoehoe and aa surface flows. These trails are characterized by areas where the original basalt surface sheen of the pahoehoe flows are worn or removed from the continual travel across the area by humans on foot and horseback, and by the hooves of pack animals. Trail routes over aa are characterized by crushed, gravel sized fragments that define the trail tread.

Excavated Pit: a hole where humans broke into the flat pahoehoe flow and removed the boulders and cobbles. Removal of the rocks exposed the spaces between the surface and the underlying flow. The excavators either tossed the rocks out of the pit in a haphazard fashion or stacked them along one or more of the edges.

Quarry: areas where 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.

Rock Pile: 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 may be poorly constructed, or may be the collapsed remains of a mound or cairn (*ahu*) feature. Mounds and rock piles were often used (and currently are used) as trail and site markers. Rock piles, when associated with soil areas are generally the remains of agricultural clearing. 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. Such use may contribute to the problems of site function interpretation.

Rock Shelter: Natural formations that provide shelter from the elements, overhangs occur in both pahoehoe and aa lava flows. Modifications to the natural formations include cleared living floor areas and wall construction to enhance the sheltered area. Marine shell remains or other non-artifactual material may be scattered within the overhang interior.

C-Shape: Generally low lying wall constructed in a c-shape with a cleared inner floor area. Shell midden may be found within the structure. C-Shape enclosures are interpreted as temporary habitation features with the opening oriented on the leeward side of the predominant night time wind direction.

Wall: Generally linear structures constructed of loosely stacked, cobble to boulder-sized basalt. Wall construction methods are defined as either core-filled (bi-face wall) or dry stacked. Walls can serve as physical boundaries to define or separate specific areas (enclosure walls, *kua iwi* agricultural walls, *ahupua'a* boundary walls). They can also serve as soil or water retention features.

Enclosure: A wide range of walled structures that enclose or partially enclose an area. Enclosures have many configurations and can be square, rectangular, circular, U-shaped, or L-shaped. Enclosures served as habitation structures and as pens for ranching activities.

Cairn (*ahu*): Piled or stacked cobbles and boulders, cairns are generally constructed along trails to mark the trail route. *Ahu* also mark land division boundaries.



Figure 27. C-Shape enclosure situated at pahoehoe/aa interface (aerial reconnaissance overview).



Figure 28. Upright shrines (*pohaku*) and circular enclosures adjacent to Umi Caverns (aerial reconnaissance overview).



Figure 29. Portion of 'Āinapo Trail above timber line (aerial reconnaissance overview).

C. Feature and Site Summary

A total of 83 features were recorded as part of the current reconnaissance study and an additional 23 previously recorded features were incorporated with the current study. The combined features represent 15 discrete site areas distributed throughout the project area and reflect previously documented land usage patterns for the high elevation areas on Mauna Loa. Traditional Hawaiian land usage of the upland forested areas included harvesting koa and sandalwood for canoe construction and building materials, and harvesting forest birds for their valued colorful plumage used in cape and garment decoration. Both the *nene* (Hawaiian native goose) and *u'au* (native petrel) were valued as a food sources and were collected from these upland forested zones. Temporary habitation shelters (huts and natural cave formations) were utilized by the small groups that engaged in these collection activities. Westerners passing through the upland regions noted the huts used by the local inhabitants while they were occupied with these various tasks.

The Mauna Loa reconnaissance efforts identified multiple resource procurement areas and trails. However, only one temporary habitation area was noted during the reconnaissance of the 7,000-9,000 elevation areas. The site is adjacent to the current Mauna Loa Trail and is accessed by a previous alignment of the same trail route. The sites' close proximity to the trail route and the lack of resource procurement features in the surrounding area indicates that it is most likely associated with trail activities.

A total of 11 cave features were located during the current reconnaissance, and no cultural modifications or remains were identified within the cave features or in the surrounding area. Similarly, the 2002 Petrel Fence survey (Moniz 2002) recorded two cave locations that were described as "short tube systems that had no associated cultural features within or outside of the cave entrances" (Moniz 2002:5).

Other resources identified during the current reconnaissance revealed historic-era related land use limited primarily to trail development and trail shelter construction. Construction efforts were completed through the combined efforts of the Hawaiian Volcano Observatory, Hawaii National Park, the U.S. Army, and through the efforts of the Civilian Conservation Corp (CCC). Modifications began as early as 1915 with construction of the Mauna Loa Trail and improvement to both the trails and shelters continued through the following decades.

Table 3 provides the feature types and totals identified during the current reconnaissance and those recorded during the 2002 survey.

Table 3. Feature types and totals for the Mauna Loa Reconnaissance 2003.

<i>Feature Type</i>	<i>No. of Features</i>	
	2002 Survey	2003 Reconnaissance
Excavated Pits	11	59
Wall Remnants	-	8
Enclosures	-	6
Trails	1	3
Rock Shelters	-	2
Cave	-	1
C-Shape	-	1
Wall	-	1
Cairn	-	1
Camp Site	-	1
Quarries	4	-
Rock Pile	7	-
Totals	23	83

D. Site Descriptions

Site 50-10-41-5504

Site 5504 consists of the Mauna Loa Trail and was nominated to the Nation Register of Historic Places in August, 1973. The trail route was a product of the planning efforts of Thomas A. Jaggar of the Hawaii Volcano Observatory in his efforts to develop an alternate route other than the 'Āinapō Trail that accessed the summit of Mauna Loa. The 'Āinapō trail extended across private ranch land (Kapapala Ranch) and the potential of restricted access would negatively effect the Observatory's scientific endeavors in the burgeoning field of volcanism. The conceptualization of a new trail route coincided with the formation and acquisition of Hawaii National Park that encompassed the summit areas of Mauna Loa and Kilauea and included a strip of land that connected the two summit regions.

In 1915 multiple surveys were conducted to mark the proposed trail route from the Volcano House at Kilauea crater to the summit of Mauna Loa. Through the combined efforts of the Hawaiian Volcano Research Association, the Territory of Hawaii, the U.S. Department of the Interior, and the U.S. Army, a trail route was constructed that enabled scientists and park visitors the ability to access Mokuaweoweo, Mauna Loa's summit caldera. Initial construction of the trail was completed by the African American enlisted soldiers that formed the segregated Company E of the 25th Infantry Division. Subsequent trail sections were re-constructed by the Civilian Conservation Corp (CCC) that widened and improved a section, named the Mauna Loa truck trail, for vehicle access. Throughout the following decades, the trail course was altered, improved, re-routed, widened, and eventually the lower section below 6,850' elevation was paved.

The current trail route is a 19 mile long trail and extends 7.5 miles from the 6,650' elevation to the Red Hill Rest House, then 9.5 miles along the Northeast Rift to the North Pit crater, and continues for 2.1 miles along the eastern edge of Mokuaweoweo to the Summit Rest House. The trail is used by recreational hikers, National Park employees, Hawaiian Volcano Observatory employees, and U.S.G.S. personnel that utilize the trail for summit observations.

Two features identified during the current reconnaissance (M-1 and M-28) were correlated with the Mauna Loa Trail. Features recorded during the 2002 Petrel Survey (Moniz 2002) that correlate with the Mauna Loa trail include: one trail segment, three artifacts (HAVO-2002-A-18, A-21, and A-22) and six rock piles (HAVO-2002-A-23 through A-28), and each is described below.

A total of three sections of un-used trail remnants were identified during the current survey (Figure 26). The northern most trail section (Feature M-1) is approximately 2,374 meters in length and ranges from 0.5-1.5 meters in width. The trail is constructed over pahoehoe lava and the northernmost section traverses an aa flow area for approximately 70 meters. The trail segment was previously identified and recorded during the 2002 Petrel Survey: associated features located along the trail route include trail markers and historic-era remains including metal cans and rusted metal fragments.

A second trail segment (designated Feature M-28) was located during the current survey. The trail route is approximately 4,743 meters in length and consists of a single width trail (~1.0 meter wide) that courses predominately through aa flows. Currently the trail is deeply incised and extends approximately 25-75 cm below the surrounding ground surface, most likely the result of erosion. Phone line remnants including phone poles, glass insulators, and phone wire were found adjacent to the trail. Other historic-era remains include metal cans, rusted metal fragments, boot soles and fragments, and one camp site that was designated as a separate site (see SIHP 24348 site description below).

The third located trail segment is located at lower elevations (4,450') and is 168 meters in length by 1.0 meters wide. The trail courses over a rough, barren aa flow and was easily identifiable by the defined trail tread that is depressed 20-50 cm below the surrounding lava flow surface. Dense vegetation located both north and south of the aa flow area obscures the trail tread and any associated features. One glass insulator was identified in an ohia tree located approximately 5 meters west of the trail tread.

A total of 28 features were associated with the central and southern trail segments and are comprised of the items described above. GSP positions were collected at each location, digital photos were taken, and brief descriptions were given for each feature. Temporary feature numbers were assigned to each feature; the numbers were retained throughout the project for administrative purposes. Because each individual feature, or "sub-feature," is associated with one of the two primary trail

feature numbers (Features M-1 and M-28), permanent HAVO feature numbers were not assigned to these associated features (“sub-feature”). The feature locations and descriptions are presented in Table 4 and in Figures 30 and 31 below.

HAVO-2003-M-1 is a 2,375 m x 1.2 m wide trail route. The trail trends southeast/northwest and adjoins the current Mauna Loa Trail at both of its terminal ends. The trail route courses over both pahoehoe and aa lava surfaces where the tread is worn (discolored, darker pahoehoe surface) over the pahoehoe surface or consists of smaller, crushed aa cobbles and gravels in the aa flow areas. Portions of the trail are delineated with kerbstone alignments that are generally 20 cm in height x 40 cm in width and consist of pahoehoe cobbles and slabs stacked one-two courses in height. Cultural material identified along the trail route includes rusted metal cans that indicate historic period use of the trail route. The trail most likely represents a previous alignment of the Mauna Loa Trail and appears to be in good condition.

HAVO-2003-M-28 is a roughly 4,7437 m x 1.0 m trail segment. The linear trail trends southeast/northwest, and the tread consists of crushed aa with larger cobbles forming the edges of the worn trail. This trail segment most likely represents a previous trail alignment of the Mauna Loa Trail, and its location roughly corresponds to the 1930 USGS Humuulu map (Scale 1:62,500). The trail route adjoins the current Mauna Loa recreational trail at both of its terminal ends. Artifacts located along the trail route include phone line remnants including phone poles, glass insulators, and phone wire; metal cans, rusted metal fragments, and boot/shoe remnants (see Table 4 below). One camp site, designated SIHP Site 24348 (see below), was located along the trail route. Vegetation in the surrounding area includes *pūkiawe*, *a‘ali‘i*, *ohelo*, and kukai nene. The field verified trail segments are located between 1,890-2450 meters elevation (6,200-8,100’) with a second trail segment located at 1,341 meters (4,400’); the trail route is in fair condition.

2002 Survey Findings: The following descriptions were recorded during the 2002 Petrel Fence Survey (Moniz 2002). Each feature appears to be spatially related to the Mauna Loa Trail and appear to be associated with trail activity.

50-10-41-5504 Mauna Loa Trail: see description above. This trail is located south of the proposed fence line. Construction of the fence will not impact the trail. Fence crew will be oriented to the location of the trail. The trail is eligible for inclusion on the National Register under Criterion B and D.

HAVO-2002-A-18 is a rusted modern can (10 cm diameter). Because the can is rusted the author is unable to tell what the contents of the can once were or the age of the can. The artifact was GPS’ed and collected.

HAVO-2002-A-21 is three concentrations of clear purple bottle glass. No diagnostic pieces were noted, however, it is believed that

the glass is sun colored, purple flat glass. This type of glass dates to between 1910 and 1915 (Schuster, per com 2002).

HAVO-2002-A-22 is a single isolated rusted metal piece. The metal was non-diagnostic.

HAVO-2002-A-23 through HAVO-2002-A-28 is a set of six rock piles. All of these rock piles are directly associated with site 5504 (Mauna Loa Trail). These features likely served as trail markers for travelers ascending and descending the summit as they are located just adjacent to the historic Mauna Loa Trail segment identified during the survey. All of these features are eligible for inclusion to the National Register under Criterion B and D. None of these features are located within the project APE and are therefore not be affected by construction of the fence line.

Table 4. Site 50-10-50-51-5504 associated trail features.

<i>Temporary Feature No.</i>	<i>Easting</i>	<i>Northing</i>	<i>Comments</i>
ML28B	246,910	2,159,096	Phone pole
ML28C	247,215	2,158,998	Possible trail intersection
ML28D	247,252	2,158,964	Tin can (solder dot)
ML28E	248,558	2,158,471	Benchmark
ML28F	248,675	2,158,400	Phone pole, 2 insulators, tin can
ML28G	248,964	2,158,298	Insulator fragments
ML28H	249,425	2,158,003	Possible trail intersection
ML28J	249,893	2,157,478	Insulator fragments
ML28K	249,933	2,157,431	Insulator fragments
ML28L	249,949	2,157,418	Phone poles, wire
ML28M	249,988	2,157,380	Phone poles with insulator screws
ML28N	250,020	2,157,352	Phone poles, wire
ML28O	250,037	2,157,265	Insulator (intact)
ML28P	250,081	2,157,303	Trail/Wall intersection
ML28Q	250,085	2,157,294	Cairn
ML28R	250,109	2,157,258	Shoe fragments
ML28S	250,106	2,157,243	Phone pole
ML28T	250,167	2,157,204	Camp site
ML28U	250,222	2,157,088	Phone poles
ML28V	250,223	2,157,075	Insulator fragments
ML28W	250,404	2,156,904	Phone poles (4)
ML28X	250,427	2,156,867	Phone poles (2)
ML28Y	250,439	2,156,817	Possible trail segment
ML28Z	250,814	2,156,643	Phone pole on aa flow interface
ML28AA	256,007	2,151,815	Insulator
ML28AB	250,887	2,156,197	Insulator fragments
ML28AC	250,827	2,156,279	Phone Poles

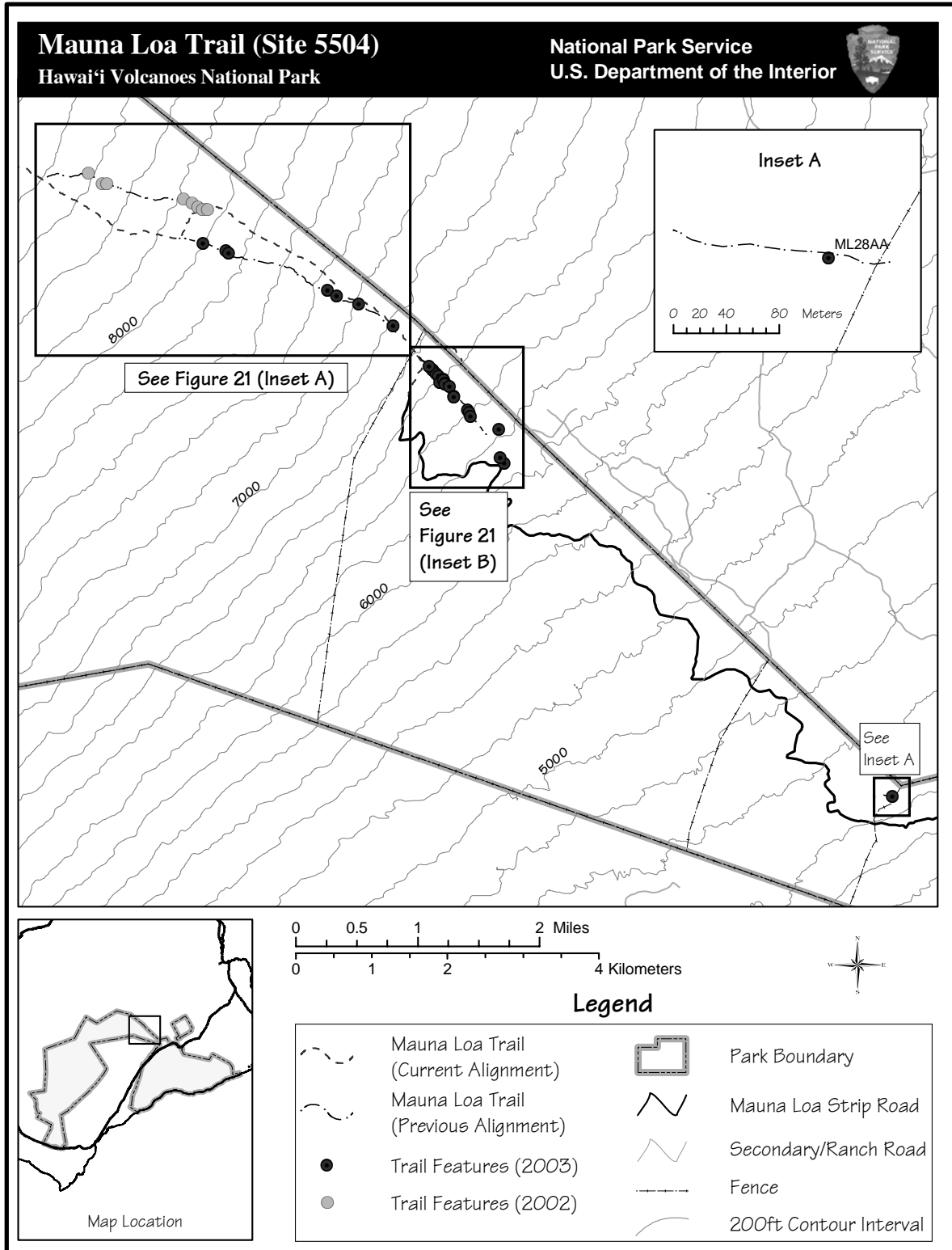


Figure 30. Site 50-10-41-5504, Mauna Loa Trail vicinity

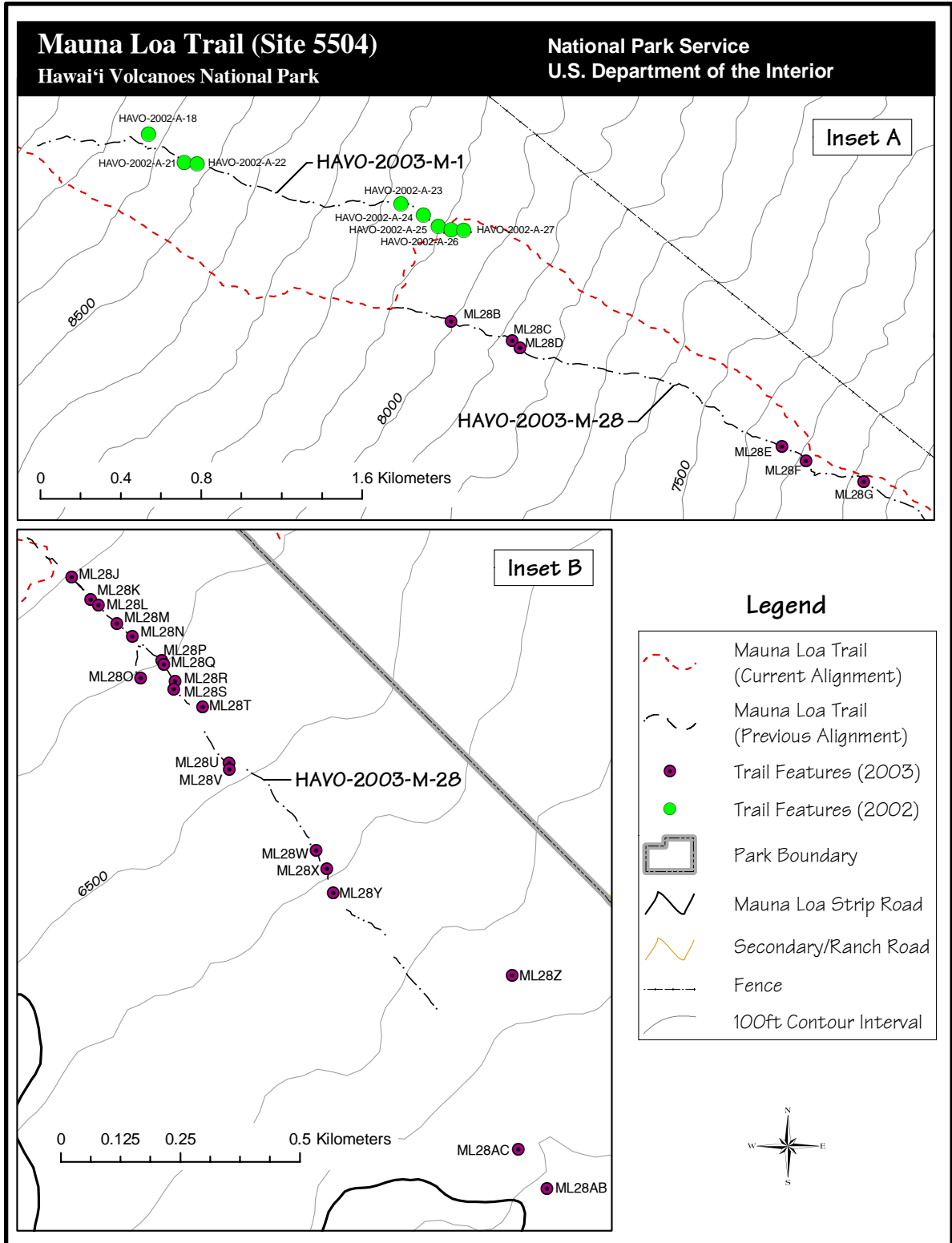


Figure 31. Site 50-10-41-5504 Mauna Loa Trail and associated features.

Site 50-10-50-5507

Site 5507 consists of the Wilkes Camp location and is currently listed on the National Register of Historic Places. The site consists of the camp remains of the U.S. Exploration Expedition that camped on the summit of Mauna Loa for twenty days during December-January, 1841. The Expedition employed nearly 300 natives to serve as porters to carry the bulky scientific instruments, camp provisions, and house tents to the summit. Led by Lt. Charles Wilkes, the team successfully mapped the summit region and made significant advances in exploring the relatively unknown alpine wilderness area of Mauna Loa.

Paul H. Baldwin, Assistant Superintendent of Hawaii National Park, visited the summit area and Wilkes Camp in 1943. In a memorandum to the park naturalist, he mentions the site of the 1940 labor gang camp that was used while the crew dismantled and relocated the Summit Rest House. The camp location was adjacent to Wilkes Camp, and a map was prepared showing the spatial relation of the two camps and summit shelter. Baldwin noted that “The south wall of the rest house is 20 feet from and parallel to the north wall of the Wilkes stone enclosure. In 1940 the labor crew built their campsite even closer to the north wall.” Baldwin continued to note that no rocks were disturbed during their investigation; the condition of the Wilkes Campsite during the site visit was described as well as an overall site description (Baldwin 1943):

The old walls, now almost leveled, are constructed of dark lava from a raised flow whose bank forms the south wall of the camp 70 feet from the north wall. The substrate of the camp is lighter reddish lava. It is probable that the original ground surface is covered by the pulverized dust and gravel now there. There is a scattering of colored boulders of types not found in the immediate vicinity. Some of these are partially buried, indicating that burying has occurred rather than exposure. It is possible that artifacts such as broken pottery and glass, lost implements, and refuse exist on the site.

The 1973 National Register Nomination Form stated the site began to deteriorate immediately after abandonment in 1841 and that “subsequent earthquakes, violent storms, and some disturbances by artifact hunters and the curious contributed to the felling of the walls.” The author continues to note that the rubble may have further been altered by National Park crews who used the material to construct the Summit Rest House in 1934. In the 1943 memorandum by Baldwin, Park crews indicated the location of their camp and where they kept their horses in relation to Wilkes Camp site. The location apparently did not disturb the site, and considering the summit shelter is a wood frame structure with corrugated metal roof and siding, it is unlikely that any stone material was quarried from the Wilkes Camp site to construct the Summit Rest House.

Investigations at the site continued, and in 1988 Patrick C. McCoy, Ph.D. prepared tape and compass plan view maps of the site and provided individual feature descriptions for eight features. Disturbances to the site were noted that include the modern trail that bisects the site, and both the northern and western portions of the site appeared to be mostly collapsed and deteriorated. No report was generated from the survey, and the notes and maps are located in the CRM Division at HAVO.

The 1999 Survey (Rivoli 1999) had two primary objectives: 1) to locate, photograph, describe, and obtain GPS data for Wilkes Camp site and 2) GPS the 'Āinapō Trail in the summit region. The feature descriptions for Wilkes Camp site include an additional 7 features that were not directly correlated with the site. Of the remaining eight features that were associated with the Wilkes site, four were described as being “disturbed,” “collapsed,” or “severely disturbed” and in conclusion stated that “there has been definite disturbances of all features” (1999:7).

During the current reconnaissance, the site’s poor condition appears to be similar to the previously recorded conditions, and may actually be further deteriorated than these earlier accounts. Only a small portion of the site is currently intact while the majority consists of scattered rubble and bears little resemblance to the original site map prepared by the Expedition or to the maps prepared by subsequent investigators. Two possible excavation areas were identified within the site area; prior surveys do not mention test unit excavations, and the possible digging may be the result of looter activity (see Figure 32 for site map).

Six enclosures are located in the area surrounding the site. The features are not associated with the Wilkes Camp and do not appear in the original site map prepared by the Expedition. The enclosures may have resulted from Summit Rest House construction activities in 1934 and its re-location in 1940 where labor crews may have built the walled shelters to provide additional protection while constructing the summit shelter. The enclosures may also represent the efforts of recreational hikers and campers who constructed the walls as additional protection against the harsh summit conditions. Rivoli (1999:7) noted that the features:

...are similar in construction and location to those on the original Wilkes map but I have found no reference to them in the Wilkes narrative. Currently, there is not enough evidence to either include or exclude them from the 1840 site. Some of the outlying features were very likely used, if not constructed, by modern hikers for protection from the strong winds and cold on the summit of Mauna Loa.

The features are mostly intact, contrasting with the collapsed Wilkes Camp site, and their good condition is most likely a result of continued modifications, maintenance, and usage. The features are related to the Wilkes site by proximity and functionality, but more importantly they do not appear to be related temporally. The lack of affiliation with the U.S. Exploration Expedition eliminates their possible inclusion with this National Register listed site, and the enclosure features were assigned SIHP Site No. 24347 (see below).

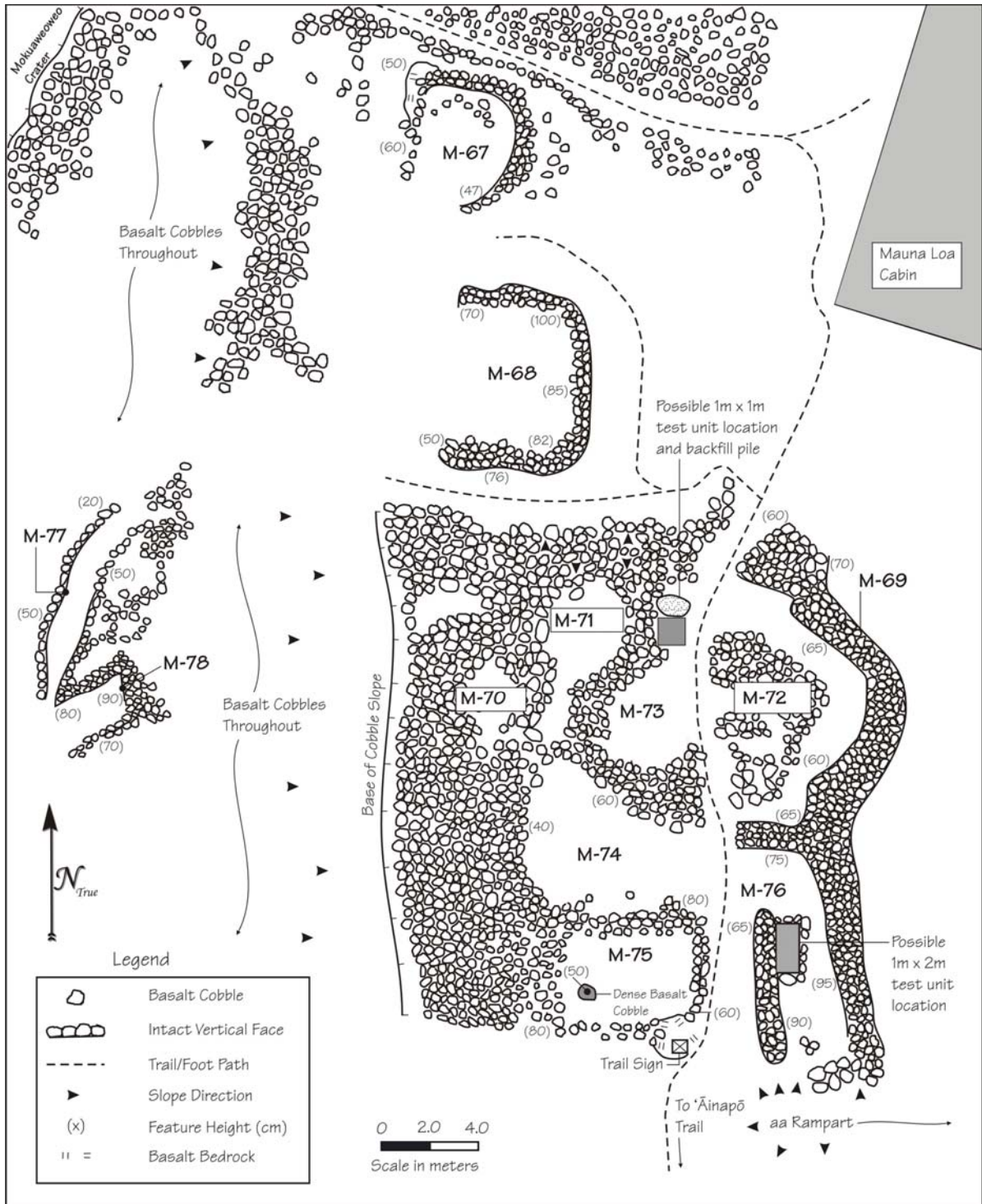


Figure 32. Site 50-10-50-5507 plan view of Wilkes Camp site, including features M-69 thru M-76 (Features M-67, M-68, M-77, and M-78 are included with SIHP Site 50-10-50-24347, see below).

A total of eight features (HAVO-2003-M-69 through M-76) are directly related to the site and each is described below; features recorded during the current survey were correlated with the previous 1999 survey and with the original Wilkes camp description and are presented below in Table 5.

Table 5. Site 50-10-50-5507, Feature correlations with previous surveys and historic documentation.

<i>Wilkes Camp No.*</i>	<i>Designated Structure*</i>	<i>1999 Feat. No.</i>	<i>2003 Feat. No.</i>
1	Pendulum-house	Feature 3C, 3D	HAVO-2003-M-72, 73
2	Captain Wilkes' tent	Feature 3A	HAVO-2003-M-70
3	Officers' tent	Feature 3F	HAVO-2003-M-75
4	Men's quarters		Unidentified
5	Men's quarters		Unidentified
6	Men's quarters	Feature 3G	HAVO-2003-M-76
7	Magnetic house		Unidentified
8	Observatory	Feature 3B	HAVO-2003-M-71
9	Store-house		Unidentified
10	Wood-house		Unidentified
11	Kitchen		Unidentified
12	Thermometer and barometer house		Unidentified
13	Entrance	Feature 3	HAVO-2003-M-69

* From Wilkes (1845).

HAVO-2003-M-69 is an enclosure measuring approximately 22.4 m (N/S) x 20.6 m (E/W) x 60-95 cm high constructed from basalt cobbles and small boulders stacked 4-8 courses high. Seven additional features are situated within the enclosure interior and were designated Features M-70 to M-76 (see below). The feature is mostly collapsed with only the eastern wall retaining any structural stability and vertical facing (Figure 33): the northern and southern walls are completely collapsed where the collapsed rubble delineates the enclosures outer extent; the western wall is also collapsed and is delineated by a sloping cobble rampart that forms a natural boundary. The wall is part of the Wilkes campsite complex and was the primary wall constructed around the encampment to provide added protection from the strong gale-force winds that buffet the summit regions.

Figure 33. Site 50-10-50-5507, Features M-69 and M-72 with portion of the 'Āinapō Trail coursing through the site (view to southeast).



The current 'Ainapō Trail alignment courses through the eastern portion of the feature: the trail utilizes the original enclosure entrance on the north, and proceeds south between the structures identified as the Pendulum House and Magnetic House, and continues between the Officers' tent and the Men's quarters before exiting at the southern edge of the complex. The trail, a maintained recreational trail within the national park, is most likely a modern alignment that was intentionally routed to access the summit cabin and does not reflect the original trail route traditionally used by Native Hawaiians. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in fair condition.

HAVO-2003-M-70 is a 3.0 m x 2.8 m x 50 cm high enclosure remnant located at the western edge of the site complex. The feature is mostly collapsed and consists of basalt cobbles and small boulders piled 3-5 courses in height (Figure 34). The enclosure interior consists of sand and gravels and is oval in shape, a result of the collapsed state of the enclosure wall. No cultural material was observed within the enclosure interior. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in poor condition.



Figure 34. Site 50-10-50-5507, Features M-70, M-74, and M-75, enclosure remnants with collapsed western wall (view to south).

HAVO-2003-M-71 is a 3.2 m x 4.0 m x 50 cm high enclosure remnant located along the northern edge of the site complex. The feature is mostly collapsed and consists of basalt cobbles and small boulders piled 3-5 courses in height. The enclosure interior consists of sand and gravels and is irregular in shape, a result of the collapsed state of the enclosure wall. No cultural material was observed within the enclosure interior. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in poor condition.

HAVO-2003-M-72 is a 5.0 m x 7.2 m x 50 cm high enclosure remnant constructed from basalt cobbles and small boulders stacked 3-5 courses in height. The resulting cobble concentration is triangular in shape and is bounded on the east by feature M-69 (enclosure wall) and to the west by the 'Ainapō Trail. The

relatively large cobble pile is most likely a remnant of the enclosure wall that surrounded Wilkes' Pendulum House and corresponds to the structure 1 in Wilkes' camp illustration (see Figure 6). This enclosure was the primary structure within Wilkes' camp and was situated in the central portion of the camp. The scientific instruments within the structure were the most highly valued articles of the Expedition. The primary wall (M-69) erected around the camp, and the individual walls constructed within the camp, were all built to provide protection from the harsh climatic conditions present at the summit location. The wall constructed around the Pendulum house was most likely a substantial wall used to protect the house from its vulnerable position at the eastern edge of the complex (highest exposure to the predominant easterly winds) and to protect the delicate scientific instruments housed within the structure. This feature combined with M-73 (see below) most likely represent the remnants of the enclosure wall that surrounded the Pendulum house. Wall construction efforts were described by Wilkes (1845:145):

We also employed ourselves in building a high stone wall [M-69] around a space large enough to contain the houses and tents, when they should arrive, having found the necessity of it to protect ourselves from the violent winds. Besides this, each tent was to be surrounded by a separate wall, up as high as the eaves, when completed.

Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in poor condition.

HAVO-2003-M-73 is 4.0 m x 3.8 m x 40 cm high enclosure remnant constructed from basalt cobbles and small boulders. The feature was previously described (Rivoli 1999) as "a paved area directly west and just across the 'Āinapō Trail from Feature 3C...it consists of cobbles and small boulders." During the current inventory, the feature interior consisted of partially compacted cobbles, sand, and gravels. The compaction may be a result of pedestrian (visitor) traffic through the site area and is not a traditional pavement type associated with habitation activities. As noted above, the feature most likely represents the western portion of the enclosure that surrounded Wilkes' Pendulum house. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in poor condition.

HAVO-2003-M-74 is an 8.4 m x 6.2 m cleared area consisting of partially compacted cobbles, sand, and gravel. The area was previously described by Rivoli (1999) as "A paved area directly south of Feature 3D." Again, the paved area most likely reflects compaction due to visitor foot traffic through the site area rather than a traditional-style habitation pavement. The cleared area appears to correspond with a relatively large, un-used area within Wilkes' camp complex that may have facilitated internal camp movement as multiple entrances generally open into this vacant area. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in fair condition.

HAVO-2003-M-75 is a 5.0 m x 4.0 m x 50-80 cm high square enclosure constructed of basalt cobbles and small boulders. The enclosure walls are mostly collapsed, and the enclosure interior consists of sand, gravels, and cobbles and is roughly 3.0 m x 4.0 m. The southern wall utilizes a natural embankment, and the Mauna Loa Cabin and 'Āinapō Trail sign is embedded within the wall. A relatively large dense basalt boulder is situated within the central portion of the enclosure interior and differs from the surrounding basalt material. No cultural material was observed within the enclosure. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in fair condition.

HAVO-2003-M-76 is an 11.0 m x 4.4 m x 65-90 cm high rectangular enclosure constructed of small to large basalt cobbles and boulders stacked 4-6 courses high (Figure 35). The enclosure walls are mostly intact, and the southern wall is formed by a sloping aa embankment. The interior floor consists of level sand and gravel with scattered cobbles that have collapsed from the wall. A possible 1m x 2m test unit is located along the interior western wall of the feature; the unit appears to have been backfilled with larger cobble material and sand/gravels, and scattered cobbles remain on the surface along the perimeter of the excavated unit. Previous surveys at the site have not included testing phases, and the excavation may be the result of looter activity within the site. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in fair condition.



Figure 35. Site 50-10-50-5507, Feature M-76, linear enclosure identified as “Men’s Quarters” (view to south).

SITE 50-10-41-24335

Site 24335 consists of four features that comprise a temporary habitation complex located adjacent to the current Mauna Loa Trail at approximately the 9,000' elevation. The features consist of one trail route (M-4), one rock shelter (M-5), one wall (M-6) and one C-shape (M-7) and are illustrated in Figure 36. The features are situated in a depressed area within the surrounding landscape and appear to be well sheltered from the elements; the features most likely represent historic-era use of the trail.

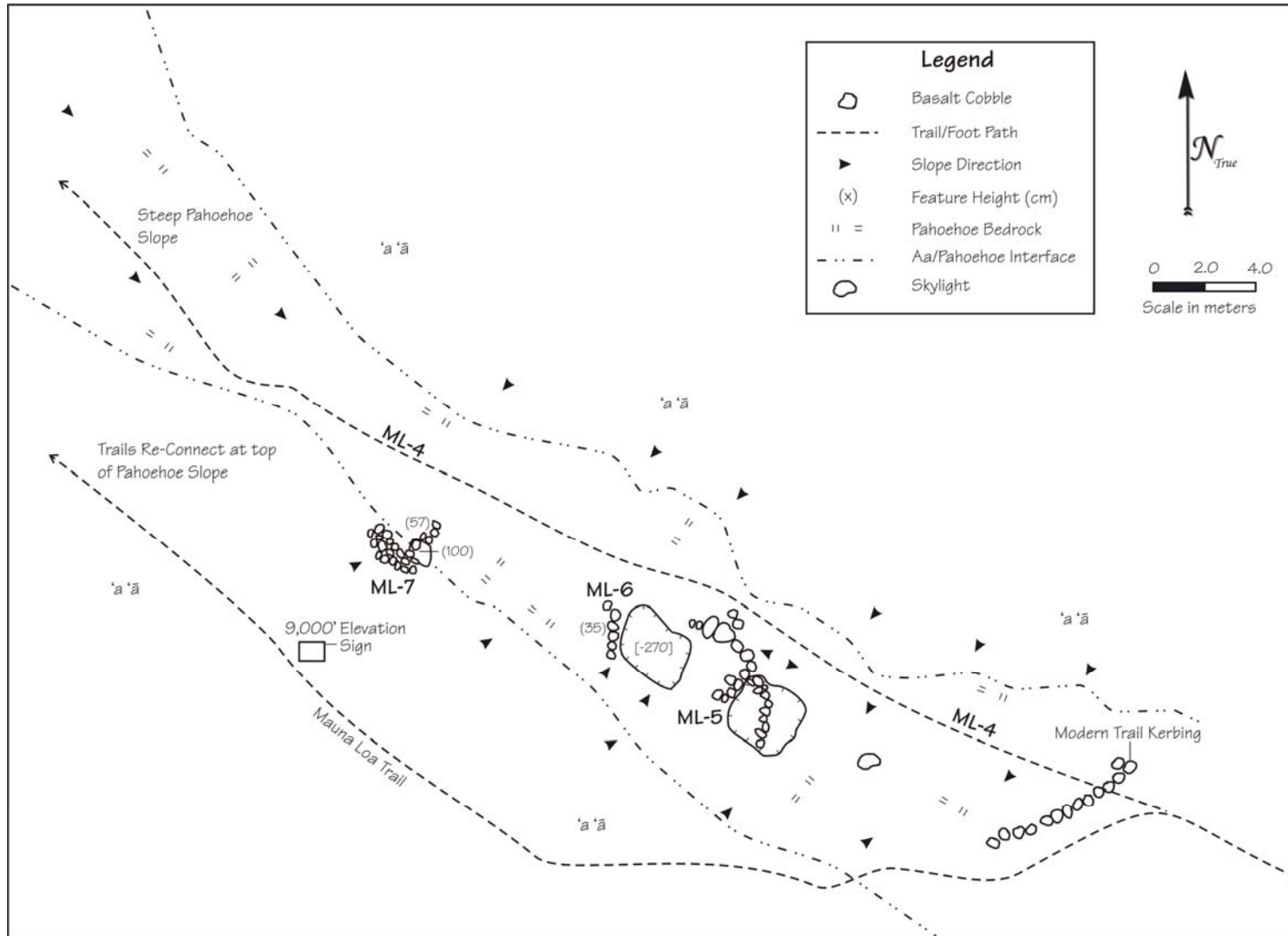


Figure 36. Site 50-10-41-24335, plan view.

HAVO-2003-M-4 is a trail segment that is approximately 77 meters in length and ranges from 0.5-1.0 meters in width. The trail bisects a site complex consisting of a modified cave shelter and several wall features. The trail tread is worn in the existing pahoehoe bedrock ground surface; the dark gray discoloration of the trail contrasts with the surrounding unmodified rust colored pahoehoe (Figure 37). No kerbing or paving modifications have been constructed along the trail route. The trail is oriented southeast/northwest: both ends of the trail adjoin the existing Mauna Loa Trail where the trail forms a hypotenuse-like shortcut segment. A pahoehoe cobble alignment borders a portion of the National Park maintained Mauna Loa Trail and appears to have been constructed to prevent usage of the old trail alignment. Vegetation in the surrounding area includes *ohelo* and *'a'ali'i*. The feature is located at 2,750 meters elevation (9,022') and is in good condition.

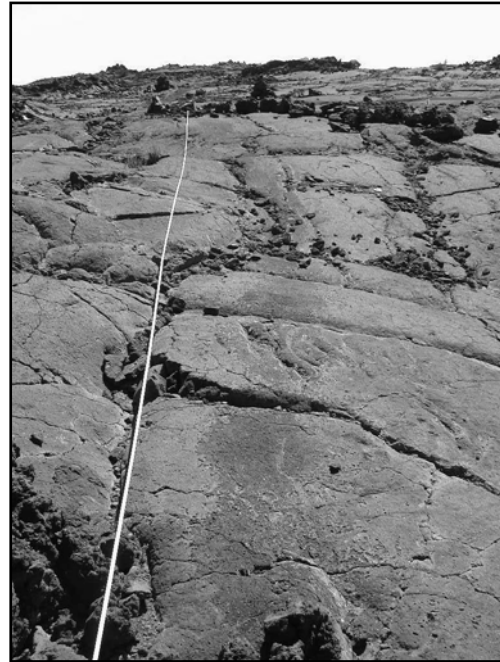


Figure 37. Site 50-10-41-24335 Feature M-4, worn trail tread, view to southeast (note pahoehoe cobble alignment in background that separates current Mauna Loa Trail from older segment).

HAVO-2003-M-5 consists of a rock shelter where the southern shelter opening is roughly 2.8 meters in diameter, and the northern opening, located 3 meters north, and has a 2.7 meter vertical drop to the base of the cave floor. One cairn (*ahu*) is situated near the shelter opening, and pahoehoe cobbles and small boulders are stacked 1-4 courses in height along the shelter opening creating a walled wind break. Cleared areas are located adjacent to the wall structures that may have served as separate shelters (Figure 38). No cultural material was observed within the shelter or in the surrounding area, and vegetation at the site consists of scattered *ohelo*. The features are in good condition and are located at 2,750 m (9,022') elevation.



Figure 38. Site 50-10-41-24335 Feature M-5, typical cleared, walled area (note trail immediately adjacent to cleared area).

HAVO-2003-M-6 is a 2.0 m x 0.5 m x 35 cm in height rock wall shelter located at the northern edge of the M-5 skylight. The feature is constructed from stacked basalt cobbles and small boulders (1-2 course height) and adjoins a pahoehoe outcrop formation. A cleared area is located on the western side of the wall and consists of smooth, level pahoehoe bedrock. No cultural material was observed within the shelter or in the surrounding area, and vegetation at the site consists of scattered *ohelo*. The feature is in good condition and is located at 2,750 m (9,022') elevation.

HAVO-2003-M-7 is a 2.8 m x 1.0 m x 57-108 cm high C-shape located in the northwestern portion of the site complex. The feature is constructed from stacked basalt cobbles and small boulders (1-5 courses in height) with a relatively large aa boulder situated in the middle section of the wall. The interior consists of cleared, level pahoehoe bedrock, and the feature partially adjoins a sloping aa embankment. No cultural material was observed within the shelter or in the surrounding area, and vegetation at the site consists of scattered *ohelo*. The feature is in good condition and is located at 2,750 m (9,022') elevation.

SITE 50-10-41-24336

Site 24336 consists of four excavated pit features (M-18, M-19, M-20, and M-21) located in the western portion of the project area. The features are distributed in a linear line that extends roughly 525 meters northwest/southeast and were grouped within a single site based on similar feature types and construction methods. The features are interpreted as resource procurement based on their formal type and each is described below.

HAVO-2003-M-18 is a 5.7 m x 0.7-1.3 m x 35 cm in depth excavated pit. The north/south trending linear pit is excavated in the pahoehoe ground surface. Excavated cobbles are scattered along the perimeter of the pit and few cobbles remain within the pit interior. A possible burrow is located at the southeast corner of the pit but is obscured by a dense *pūkiawe* bush growing within the pit. The feature is located at 2,660 meters elevation (8,727') and is in good condition.

HAVO-2003-M-19 is a 3.3 m x 1.9 m x 36 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered to the south of the pit. Vegetation in the surrounding area includes *pūkiawe* and grasses. The feature is located at 2,630 meters elevation (8,629') and is in good condition.

HAVO-2003-M-20 is a 2.3 m x 1.3 m x 40 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface, and excavated cobbles are scattered around the eastern, southern, and western edges of the pit (Figure 39). Vegetation in the surrounding area includes *pūkiawe* and grasses. The feature is located at 2,620 meters elevation (8,569') and is in good condition.

HAVO-2003-M-21 is a 1.9 m x 1.7 m x 53 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and is situated approximately 10 m north of an aa flow area. Excavated pahoehoe slabs are scattered along the southern edge of the pit. Three possible burrow locations are present with the pit interior, and multiple pits (possible natural formations) are located north of the pit. Vegetation in the surrounding area includes *pūkiawe* and grasses. The feature is located at 2,610 meters elevation (8,563') and is in good condition.



Figure 39. Site 50-10-41-24336, Feature M-20, typical excavated pit within site complex, view to south.

SITE 50-10-41-24337

Site 24337 consists of four features comprised of ten excavated pit features. The site area measures approximately 100 meters northeast/southwest by 30 meters northwest/southeast and the features were grouped within a single site based on similar feature types and construction methods. One additional excavated pit is situated within the site area; the pit was recorded by biological resource personnel and no data is available for the feature. The features are interpreted as resource procurement based on formal feature type and each is described below.

HAVO-2003-M-8 consists of four excavated pits designated A-D, each excavated into the pahoehoe ground surface. Pit A is rectangular in shape and measures 0.9 m x 0.6 m x 45 cm depth. Pit B is located 1.8 meters from Pit A and is 0.8 m x 0.4 m x 38 cm depth. Pit C is located 2.8 m from Pit B and is 0.9 m x 0.2-0.5 m x 40 cm in depth. Pit D is located 1.7 from Pit A and is 0.9 m x 0.6 m x 40 cm in depth. Pits A-C trend northeast/southwest, and a cobble concentration is situated between Pits A, B, and D. Vegetation in the surrounding area includes *pūkiawe*, *ohelo*, and sparse grasses. The features are located at 2,670 meters elevation (8,760') and are in good condition.

HAVO-2003-M-9 consists of three excavated pits designated A-C, each excavated into the pahoehoe ground surface: Pit A is 1.8 m x 0.7 m x 42 cm depth, Pit B is 2.4 m x 1.8 m x 50 cm depth, and Pit C is 8.2 m x 0.8-2.2 m x 28 cm depth. Pahoehoe cobbles are scattered along the edges of both pits B and C, and cobbles are present within the pit interiors. Vegetation in the surrounding area includes *pūkiawe*, *ohelo*, and sparse grasses. The features are located at 2,670 meters elevation (8,760') and are in good condition.

HAVO-2003-M-10 is a 1.2 m x 1.1 m x 45 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface. Excavated cobbles are scattered along the perimeter of the pit, and cobbles are present within the pit

interior. Vegetation in the surrounding area includes *pūkiawe*, ‘*a‘ali‘i*, and grasses. The feature is located at 2,670 meters elevation (8,760’) and is in good condition.

HAVO-2003-M-11 consists of two excavated pits designated A and B, each excavated into the pahoehoe ground surface. Pit A is triangular in shape and measures 1.3 m x 0.3-1.0 m x 27 cm depth, and Pit B is 3.9 m x 1.75 m x 50 cm depth. Excavated cobbles are stacked along the eastern and southern edges of Pit A, and along the south, southwest, and northeast edges of Pit B. A Dark-rump Petrel carcass and feathers are located in the northwest corner of Pit B (Figure 40). The pit was previously identified by biological technicians and was assigned nest number C-52A. A *pūkiawe* bush is growing within the central portion of the pit and partially conceals the burrow location. Other vegetation in the area includes *ohelo*, and the features are located at 2,670 meters elevation (8,760’). The features are in good condition.



Figure 40. Site 50-10-41-24337 Feature M-11, Petrel feathers within burrow.

SITE 50-10-41-24338

Site 24338 consists of 11 features previously recorded (Moniz 2002) during the 2002 Petrel Fence survey and consist of nine excavated pits (HAVO-2002-A-7 – A-15), two quarry areas (HAVO-2002-A-6 and A-17), and one non-cultural cave (HAVO-2002-A-16). The site area measures roughly 260 meters northwest/southeast by 110 meters northeast/southwest and the features and were grouped within a single site based on similar feature types and construction methods. The features are interpreted as resource procurement based on formal feature type and the following descriptions were excerpted from the 2002 Petrel Fence Survey (Moniz 2002:6).

HAVO-2002-A-6 is a 1.40 x 1.10 m and 160 cm high quarry. This quarry is characterized by greater than 20 small boulders that have been removed from the surface of a *pahoehoe* tumulus. The boulders are located at the base of the tumulus. The quarry is located 22 m west of the fence line. Therefore, this feature is outside of the 10 m established APE and the 20 m buffer and will not be impacted by the

project. This feature is eligible for the National Register under Criterion D.

HAVO-2002-A-7 through HAVO-2002-A-15 are a cluster of excavated pits. These pits are spread over a 50 m area, approximately 26 to 63 meters south of the fence line. The petrel crew previously identified these pits as an area where active Dark-rumped petrel nesting sites were noted. Thus, the pits will be included within the proposed fence. The fence line will be kept well away from these features because the fence could adversely impact the nesting birds if it were located too close. These features are eligible for the National Register under Criterion D.

HAVO-2002-A-16 is a cave. No cultural material was identified within the cave or near the cave entrance. A dead goat skeleton was found just beyond the overhang. Although it is located just 16 m from the center line of the proposed fence, this cave will not be adversely impacted by construction because fence crews will be advised to stay clear of the cave. This cave is a natural feature and therefore not eligible for inclusion on the National Register.

HAVO-2002-A-17 is a 0.50 x 0.20 m and 40 cm quarry. No obvious battering was noted on the *pahoehoe* tumulus. However, eight to 10 large cobbles are located at the base of a low rise that appears to have been purposefully removed. This feature has poor integrity. Due to its questionable cultural affiliation and poor condition, feature A-17 is not eligible for inclusion on the National Register.

SITE 50-10-41-24339

Site 24339 consists of one excavated pit (M-2) recorded during the current reconnaissance and an additional 7 features recorded during the 2002 Petrel Fence Survey that include: 3 quarries (HAVO-2002-A-1, 2, and 4), two excavated pits (HAVO-2002-A-19 and 20), one rock pile (HAVO-2002-A-3), and one non-cultural cave (HAVO-2002-A-5) (Figure 41). An additional two excavated pits are situated within the site area and were identified by biological resource personnel, and no data is available for these features. The site area measure roughly 430 meters north/south by 370 meters east/west and the features were grouped within a single site based on similar feature types and construction methods. The features are interpreted as resource procurement based on formal feature type and each is described below (feature descriptions A-1 through A-5, A-19, and A-20 from Moniz 2002:5-6).

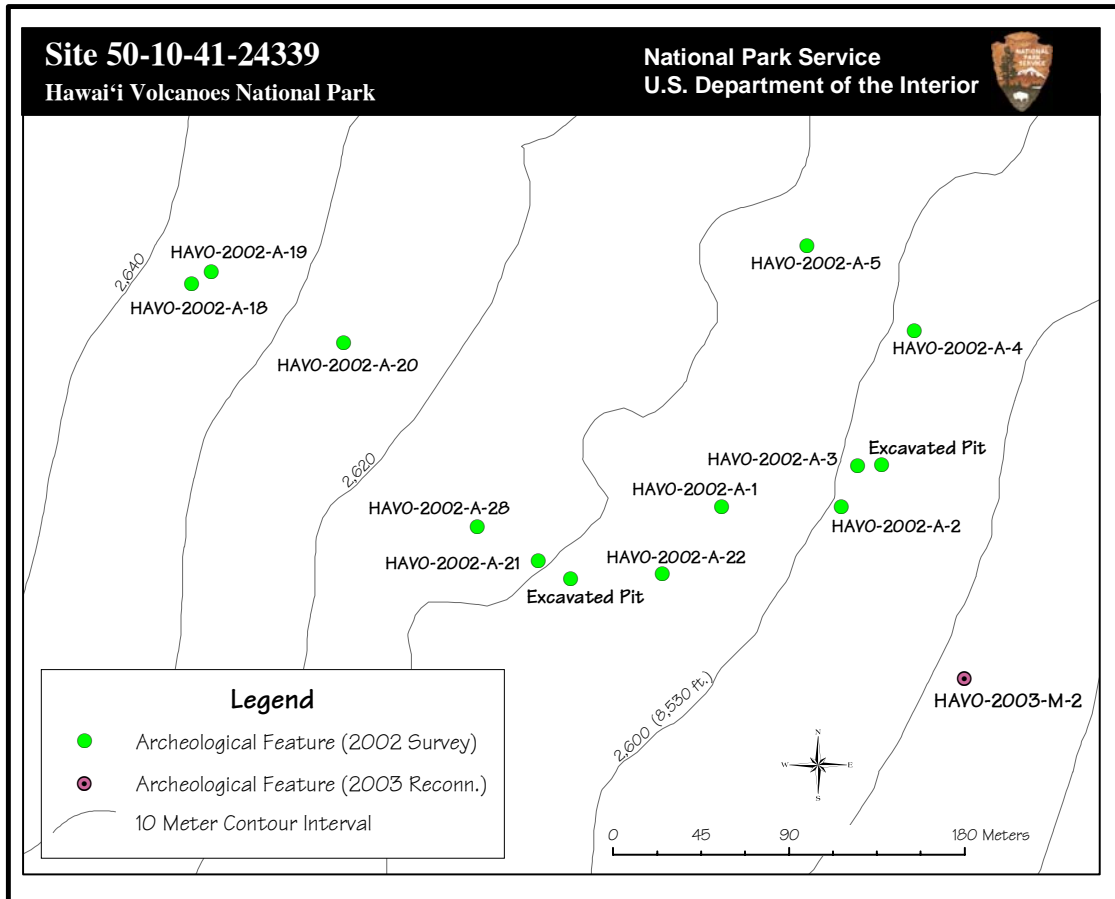


Figure 41. Site 50-10-41-24339 feature distribution.

HAVO-2003-M-2 is a 3.0 m x 2.35 m x 60 cm in depth excavated pit. The pit is excavated within the pahoehoe ground surface and is located adjacent to an existing trail route (M1). Excavated cobble and boulder material, stacked three courses in height, is located adjacent to the pit. Vegetation in the surrounding area includes *pūkiawe* and *'a'ali'i*. The feature is located at 2,590 meters elevation (8,497') and is in fair condition.

HAVO-2002-A-1 is a 0.90 x 2.60 m and 80 cm high quarry. This quarry feature is located on the edge of a low *pahoehoe* rise. Battering is evident on the surface of the *pahoehoe*. Some small boulders to large cobbles have been excavated out and are located at the base of the rise. No stacking of these boulders was evident. This feature is located outside of the APE (97 m from the centerline of the fence). This feature is eligible under Criterion D on the National Register.

HAVO-2002-A-2 is a 0.60 x 0.50 m and 40 cm high quarry. This feature is located on top of a low tumulus. Less than 10 small boulders have been removed from the tumulus and are located at its

base. No stacking is evident. This feature is located outside of the APE (98 m from the centerline). This feature is eligible under Criterion D on the National Register.

HAVO-2002-A-3 is a rock pile. Consisting of less than 10 large cobbles this feature has little structural integrity. This rock pile is 98 m away from the proposed fence line. This feature is not eligible for inclusion on the National Register due to its poor structural integrity.

HAVO-2002-A-4 is a 0.60 x 0.40 m and 20 cm high quarry. Located on a high point of a tumulus, large cobbles have been removed from the surface *pahoehoe* flow. Over 16 cobbles are located approximately 2.0 to 2.5 m downslope of the quarry site. These cobbles were removed from the quarry area. This quarry is located outside of the APE (69 m southeast of the center line). This feature is eligible for the National Register under Criterion D.

HAVO-2002-A-5 is a cave. No cultural features were identified in association with this cave. This cave is located within 15 m of the fence line. The cave has been flagged and will be avoided by the fencing crew. No fence posts will be constructed through the roof of the cave. This cave is a natural feature and therefore not eligible for inclusion to the National Register.

HAVO-2002-A-19 is a 0.56 x 0.54 m and 50 cm high excavated pit. This pit consists of at least ten large cobbles that are scattered but not stacked to the north of the pit. The pit is excavated into the side of a low *pahoehoe* tumulus. This feature is located 19 m southwest of the fence line and therefore it is outside of the APE. The pit will not be impacted by construction of the fence. This feature is eligible to the National Register under Criterion D.

HAVO-2002-A-20 is a 0.90 x 0.90 m and 26 cm high excavated pit. At least ten large cobbles were removed from an edge of the base of a low tumulus. This feature is located 61 m southwest of the fence line and will not be impacted by its construction. This pit is eligible under Criterion D to the National Register.

SITE 50-10-41-24340

Site 24340 consists of five excavated pit features (M-3, M-22, M-23, M-24, and M-25) all located within approximately 10 meters of the Mauna Loa Trail. The site area measure roughly 150 meters east/west by 15 meters north/south and the features were grouped within a single site based on similar feature types and construction methods. Although all the features are situated near the current Mauna Loa Trail, the features are most likely unrelated to trail activity; use of the excavated pits most

likely predates the trail, and continued use of the pits probably ceased by the 1915 trail construction. The features are interpreted as resource procurement based on formal feature type and each is described below.

HAVO-2003-M-3 consists of a 1.2 m x 0.9 m x 1.0 m in depth excavated pit. The circular pit is situated at the southern base of a relatively small tumulus formation. Excavated cobble and boulder material is scattered south of the pit. Vegetation in the surrounding area includes *pūkiawe* and 'a'ali'i. The feature is located at 2,550 meters elevation (8,366') and is in good condition.

HAVO-2003-M-22 is a 4.1 m x 1.5 m x 75 cm in depth excavated pit. The linear pit trends northeast/southwest and is excavated in the pahoehoe ground surface. Excavated cobbles are scattered along the eastern side of the pit. Vegetation in the surrounding area includes *pūkiawe*, 'a'ali'i, *ohelo*, and kukai nene. The feature is located at 2,540 meters elevation (8,333') and is in good condition.

HAVO-2003-M-23 is a 3.5 m x 1.2 m x 48 cm in depth excavated pit. The pit is located adjacent to the Mauna Loa Trail and was previously identified by park biological technicians and designated pit P-29. Excavated cobbles are scattered along the eastern and northern edges of the pit. Vegetation in the surrounding area includes *pūkiawe*, 'a'ali'i, *ohelo*, and kukai nene. The feature is located at 2,540 meters elevation (8,333') and is in good condition.

HAVO-2003-M-24 is a 1.5 m x 1.0 m x 30 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered around the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, 'a'ali'i, and *ohelo*. The feature is located at 2,540 meters elevation (8,333') and is in good condition.

HAVO-2003-M-25 is a 3.75 m x 1.3 m x 38 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the northern edge of the pit. One bird bone fragment was identified within the eastern edge of the pit. Vegetation in the surrounding area includes *pūkiawe*, 'a'ali'i, and *ohelo*. The feature is located at 2,540 meters elevation (8,333') and is in good condition.

SITE 50-10-41-24341

Site 24341 consists of six excavated pits (M-12 – M-17) that are clustered within a 40 meter diameter area. The features were grouped within a single site based on similar feature types and construction methods. The features are interpreted as resource procurement based on formal feature type and each is described below.

HAVO-2003-M-12 is a 2.2 m x 1.7 m x 35 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface. Vegetation in the surrounding area includes *pūkiawe*, 'a'ali'i, and grasses. The feature is located at 2,510 meters elevation (8,235') and is in good condition.

HAVO-2003-M-13 is a 2.3 m x 1.8 m x 38 cm in depth excavated pit. Vegetation growing within the pit includes *pūkiawe* and 'a'ali'i. A linear rock pile consisting of pahoehoe cobbles and small boulders (arranged one to two courses in width) is

present on the western side of the pit. The feature is located at 2,510 meters elevation (8,235') and is in good condition.

HAVO-2003-M-14 is a 2.8 m x 1.3 m x 35 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface, and excavated cobbles are scattered along both the eastern and western edges of the pit. Vegetation in the surrounding area includes *pūkiawe* and 'a'ali'i. The feature is located at 2,510 meters elevation (8,235') and is in good condition.

HAVO-2003-M-15 is a 0.6 m x 0.3 m x 53 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface revealing a hollow chamber. Excavated cobbles are scattered south of the pit. Vegetation in the surrounding area includes *pūkiawe* and 'a'ali'i. The feature is located at 2,510 meters elevation (8,235') and is in good condition.

HAVO-2003-M-16 is a 1.1 meter diameter x 25 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface. Large pahoehoe cobbles are located along the perimeter of the pit, and dense vegetation (*pūkiawe* and 'a'ali'i) are growing within the pit and obscure the pit's interior. Vegetation in the surrounding area includes *pūkiawe* and 'a'ali'i. The feature is located at 2,510 meters elevation (8,235') and is in good condition.

HAVO-2003-M-17 is a 1.1 m x 0.8 m x 35 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface, and excavated cobbles are scattered to the north of the pit (Figure 42). Vegetation in the surrounding area includes *pūkiawe* and 'a'ali'i. The feature is located at 2,510 meters elevation (8,235') and is in good condition.



Figure 42. Site 50-10-41-24341 Feature M-17, excavated pit with removed cobbles scattered north of pit and pukeawe growing in central portion of pit, view to east

SITE 50-10-41-24342

Site 24342 consists of a relatively dense cluster of 37 excavated pit features situated within a roughly 200 meter north/south by 70 meter east/west area (Figure 43). The features were grouped within a single site based on similar feature types, construction methods, and proximity. The features are interpreted as resource procurement based on formal feature type and each is described below.

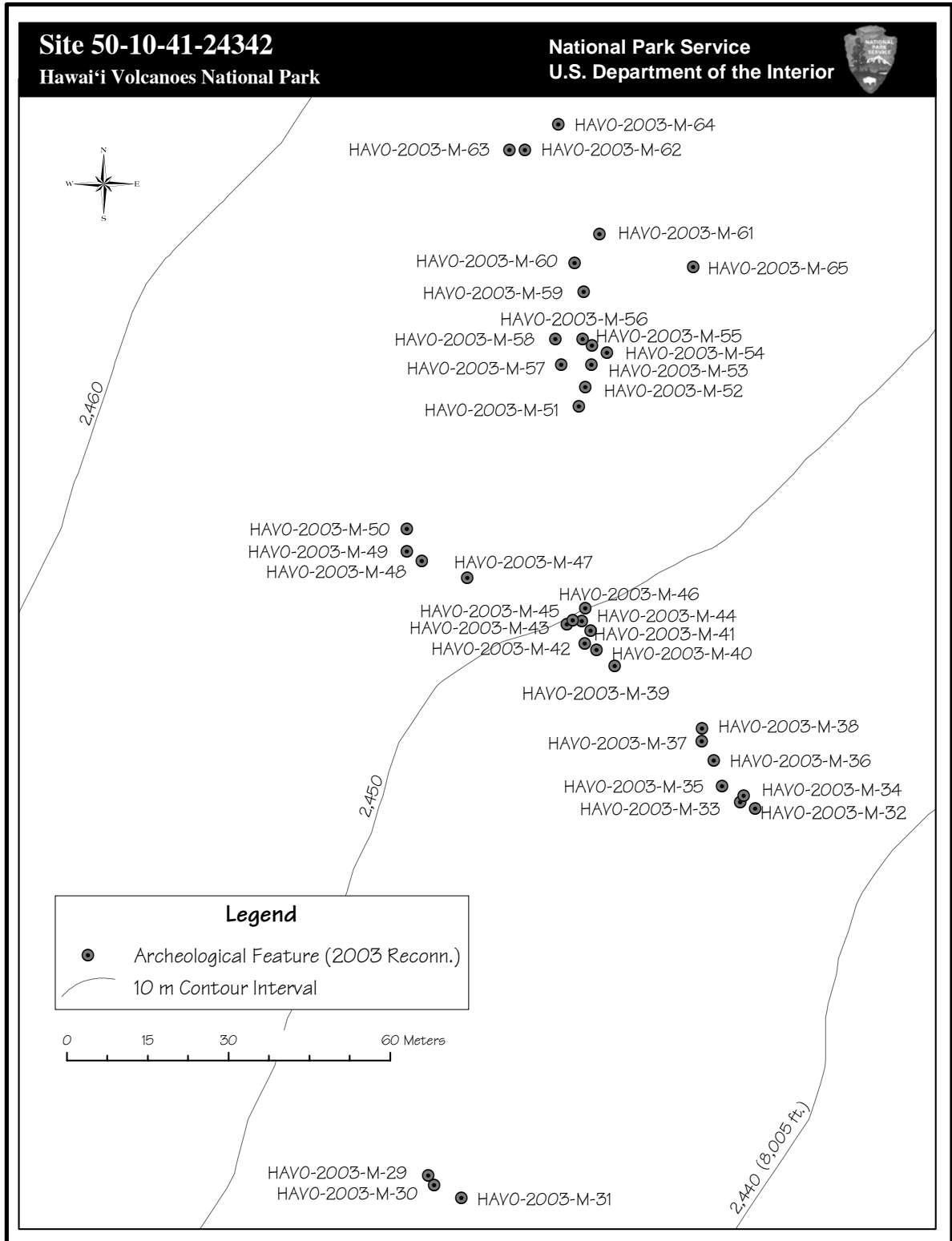


Figure 43. Site 50-10-41-24342 feature distribution.

HAVO-2003-M-29 is a 1.0 m x 0.7 m x 33 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface and the excavated cobbles are scattered along the northeastern and southwestern edges of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-30 is a 3.35 m x 2.0m x 28 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the northwestern edge of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-31 is a 2.15 m x 0.8 m x 54 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are piled on the north and south sides of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-32 is a 3.9 m x 0.7 m x 9 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are piled on the north and south sides of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-33 is a 1.2 m x 0.6 m x 25 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered to the east of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-34 is a 2.2 m x 0.85 m x 20 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are piled on the north edge of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-35 is a 1.8 m x 1.05 m x 25 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are piled along the south side of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-36 is a 5.2 m x 0.7 m x 20 cm in depth excavated pit. The rectangular, linear pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-37 is a 0.8 m x 0.4 m x 20 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-38 is a 0.8 m x 0.6 m x 20 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-39 is an excavated pit area; one pit within the area measures 0.4 m x 0.3 m x 20 cm in depth, and an associated mound is 4.9 m x 3.1 m x 30 cm in height. The pit is excavated in the pahoehoe ground surface and excavated cobbles are piled on the north and south sides of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-40 is a 0.6 m x 0.5 m x 30 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-41 is a 3.05 m x 2.25 m x 30 cm in depth excavated pit. The “T-shaped” pit is excavated along a shallow pahoehoe tumulus formation, and excavated cobbles are scattered along the perimeter of the pit. The western edge of the pit partially connects with HAVO-2003-M-44 (see below). Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-42 is a 0.9 m x 0.6 m x 25 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface and excavated cobbles are piled along the southern edge of the pit. The piled mound measures 2.2 m x 1.2 m x 20 cm in height and is one to two courses in height. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-43 is a 1.1 m x 0.7 m x 32 cm in depth excavated pit. The rectangular pit is excavated in a shallow pahoehoe tumulus formation and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-44 is a 1.2 m x 1.2 m x 46 cm in depth excavated pit. The square pit is excavated in the same formation as M-45 and 46 (see below), and excavated cobbles are piled along the south/southwest edge of the pit. Dense vegetation consisting of *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene are growing within the

center of the feature. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-45 is a 1.55 m x 0.8 m x 41 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Dense vegetation obscured the pit interior. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-46 is a 0.5 m x 0.4 m x 30 cm in depth excavated pit. The triangular pit is excavated in a shallow pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-47 is a 3.2 m x 2.0 m x 48 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are piled south of the pit. Dense vegetation obscures the pit interior. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-48 is a 1.4 m x 1.4 m x 29 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-49 is a 1.7 m x 2.6 m x 50 cm in depth excavated pit. The "L-shape" pit is excavated in the pahoehoe ground surface and excavated cobbles are piled south of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-50 is a 1.3 m x 1.2 m x 34 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-51 is a 0.9 m x 0.8 m x 30 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-52 is a 1.1 m x 0.7 m x 20 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the southwestern edge of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-53 is a 1.1 m x 0.7 m x 37 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-54 is a 0.85 m x 0.85 m x 19 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-55 is a 2.45 m x 1.5 m x 28 cm in depth excavated pit. The pit is excavated in the apex of pahoehoe tumulus formation and excavated cobbles are scattered along the northern perimeter of the pit. The feature partially adjoins M-56 (see below). Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-56 is a 1.4 m x 1.0 m x 20 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-57 is a 2.9 m x 2.2 m x 20 cm in depth excavated pit. The irregularly shaped, large excavated pit is excavated in the pahoehoe ground surface and excavated cobbles are piled one to two courses in height in the central interior of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-58 is a 1.6 m x 2.6 m x 30 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are piled along the northern edge of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-59 is a 3.0 m x 2.0 m x 30 cm in depth excavated pit. The linear pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Dense vegetation obscures in the pit interior. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-60 is a 3.3 m x 1.6 m x 40 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005') and is in good condition.

HAVO-2003-M-61 is a 1.1 m x 1.1 m x 30 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-62 is a 2.2 m x 0.5-1.2 m x 30 cm in depth excavated pit. The “L-shape” pit is excavated in a low lying pahoehoe tumulus formation and excavated cobbles are scattered along the perimeter of the pit with piled concentrations along the eastern and southwestern edges of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-63 is a 1.7 m x 0.7 m x 35 cm in depth excavated pit. The rectangular pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-64 is a 2.3 m x 1.7 m x 20 cm in depth excavated pit. The pit is excavated in the pahoehoe ground surface and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

HAVO-2003-M-65 is a 0.8 m x 0.45 m x 50 cm in depth excavated pit. The rectangular pit is excavated in a low lying pahoehoe tube formation and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

SITE 50-10-41-24343

Site 24343 consists of a single isolated excavated pit located approximately 70 meters northeast from an abandoned alignment of the Mauna Loa Trail. No other features or cultural material was observed in the surrounding area. The feature is interpreted as resource procurement based on formal feature type and is described below.

HAVO-2003-M-66 is a 5.5 m x 2.1 m x 30 cm in depth excavated pit. The pit is excavated in the apex of a low lying pahoehoe tube formation and excavated cobbles are scattered along the perimeter of the pit. Vegetation in the surrounding area includes *pūkiawe*, *‘a‘ali‘i*, *ohelo*, and kukai nene. The feature is located at 2,440 meters elevation (8,005’) and is in good condition.

SITE 50-10-41-24344

Site 24344 consists of a single isolated excavated pit located approximately 30 meters southwest of the current Mauna Loa Trail. No other features or cultural

material was observed in the surrounding area. The feature is interpreted as resource procurement based on formal feature type and is described below.

HAVO-2003-M-27 is a 1.8 m x 1.55 m x 65 cm in depth excavated pit. The circular pit is excavated in the pahoehoe ground surface and excavated cobbles are stacked (1-2 courses) along the southeastern edge of the pit. Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, *ohelo*, and kukai nene. The feature is located at 2,360 meters elevation (7,743) and is in good condition.

SITE 50-10-41-24345

Site 24345 consists of a single rock pile (collapsed cairn (*ahu*)) located on an elevated tumulus formation. The feature is located between the Mauna Loa Trail and National Park boundary (260 meters northeast and 210 meters southwest respectively). No trail route was identified near the feature, and it remains unclear what the marker was intended to mark. The feature is interpreted as a marker based on its formal type and is described below.

HAVO-2003-M-26 is a 1.75 m x 1.2 m x 39 cm in height rock pile constructed from pahoehoe cobbles stacked three courses in height and is situated on a pahoehoe rise/tumulus formation. The rock pile is mostly collapsed and a single stick (80 cm in length) located with the collapse rubble may have been integrated within the stacked rock pile. The feature's location on a prominent land form indicates the feature was most likely a cairn (*ahu*). Vegetation in the surrounding area includes *pūkiawe*, *'a'ali'i*, and *ohelo*. The feature is located at 2,420 meters elevation (7,940') and is in poor condition.

SITE 50-10-41-24346

Site 24346 consists of a rock shelter that has historically been referred to as Jaggar's Cave. The site is listed as a Classified Structure in the National Register nomination form for the Mauna Loa Trail and is described as:

Located near the benchmark which indicated an elevation of 13,019 feet above sea level on the summit area of Mauna Loa, at the end of the Mauna Loa Trail at N. Lat. 19° 29' 47" and W. Long 155° 34' 48".

The site consists of multiple features, the principle being the rock shelter itself. The shelter was improvised first by Thomas A. Jaggar as a temporary shelter and was selected for its close location to the summit and its close proximity to a water cave. The lack of summit shelter prompted Jaggar to modify the natural formation to provide protection from the extreme summit conditions while monitoring volcanic activity at the summit caldera. During the first pack train ascent of Mauna Loa via the Mauna Loa Trail, T.A. Jaggar, R.H. Finch, John Kama (guide), and Joseph Kaipalaoa (packer) left for the summit from Keauhou Ranch on June 29, 1920. After reaching the summit, the pack animals and guides were sent back the Red Hill Rest House while Jaggar and Finch remained at the summit. In his monthly bulletin

Jaggar notes that “Messrs. Jaggar and Finch camped in a cavern near a waterhole and explored the floor of Mokuaweoweo” (Jaggar 1920).

In July of the next year, a party of four travelers climbed three of Hawai‘i’s volcanoes in an epic 10½ day, 220 mile journey beginning with Hualalai, then Mauna Kea, then Mauna Loa. The expedition consisted of Lawrence Hit Daingerfield, who later chronicled their travels in the article “On arctic peaks ‘neath trop skies,” T.R.L. McGuire, Max H. Carson, and guide William H. Meinecke. The team reached the north rim of Mauna Loa on July 28 and Daingerfield described their camp accommodations:

That night [July 28-29] we slept in a lava tube cave on the rim, a couple of hundred yards to the right of the last marker. We called it Hotel de Jaggar, in honor of its earlier occupant and possible discoverer. For feathers we had thirty bags of cinders which we had carried in. Canned heat supplied our fire for cooking.

The feature was used during the following decade as the only shelter available at the summit. Frances Jackson prepared administrative histories for both HAVO and Haleakala Nation Parks (1972) and noted that “...the Superintendent of the Park requested Hui O Pele to provide \$2500 for a summit rest house. This was constructed during the summer of 1934 and replaced the old summit cave known as the Hotel de Jaggar.” Apple (1973) described the shelter in his articles on the Mauna Loa and ‘Āinapō trails:

Until a summit shelter was built by the National Park Service in 1934, hikers and riders were forced to camp in “Jaggar’s Cave,” a crack in the lava roofed over with corrugated metal sheets. It was near another crack where water, frozen in winter, accumulated.

The site remains today and is frequently used by day hikers as a place to rest, to lunch, and to escape the strong winds and intense sun that buffet the summit. The cinder floor within the shelter remains and provides a nice respite compared to the hardened lava surfaces that encompass the massive mountain. Water still remains within the crack formation to the east of the shelter, and the feature’s overall condition appears to be good considering the frequent use of the shelter and that the site is comprised of substantive construction/modification to a crack formation that is situated approximately 25 meters from the northern caldera edge.

HAVO-2003-M-81 is an 11.0 m x 5.0 m x 195 cm deep rock shelter. The shelter is northwest of the Mauna Loa Trail and is immediately adjacent to the Mauna Loa Observatory Trail. The shelter consists of a relatively large modified crack formation (Figure 44). A series of 8 pahoehoe slab stair steps located at the southeastern edge of the feature provides access to the base of the crack formation (Figure 45). The depression is roughly 2.0 m deep and the level interior floor area measures 7.2 m x 3.5 m (25.2 sq. m) and consists predominantly of gravel-size

cinder. Wall modifications to the formation are constructed from basalt cobbles, small boulders, and pahoehoe slabs: walls are constructed on the ground surface around the perimeter of the crack, and an additional wall is constructed within and perpendicular to the crack that effectively delineates the interior shelter area. Cultural material identified with the shelter includes metal nails and glass fragments, most likely the remains of the roof structure that once enclosed the shelter (Figure 46). Burnt wood fragments are present in the southeastern corner of the shelter and are also likely remnants of the roof structure.

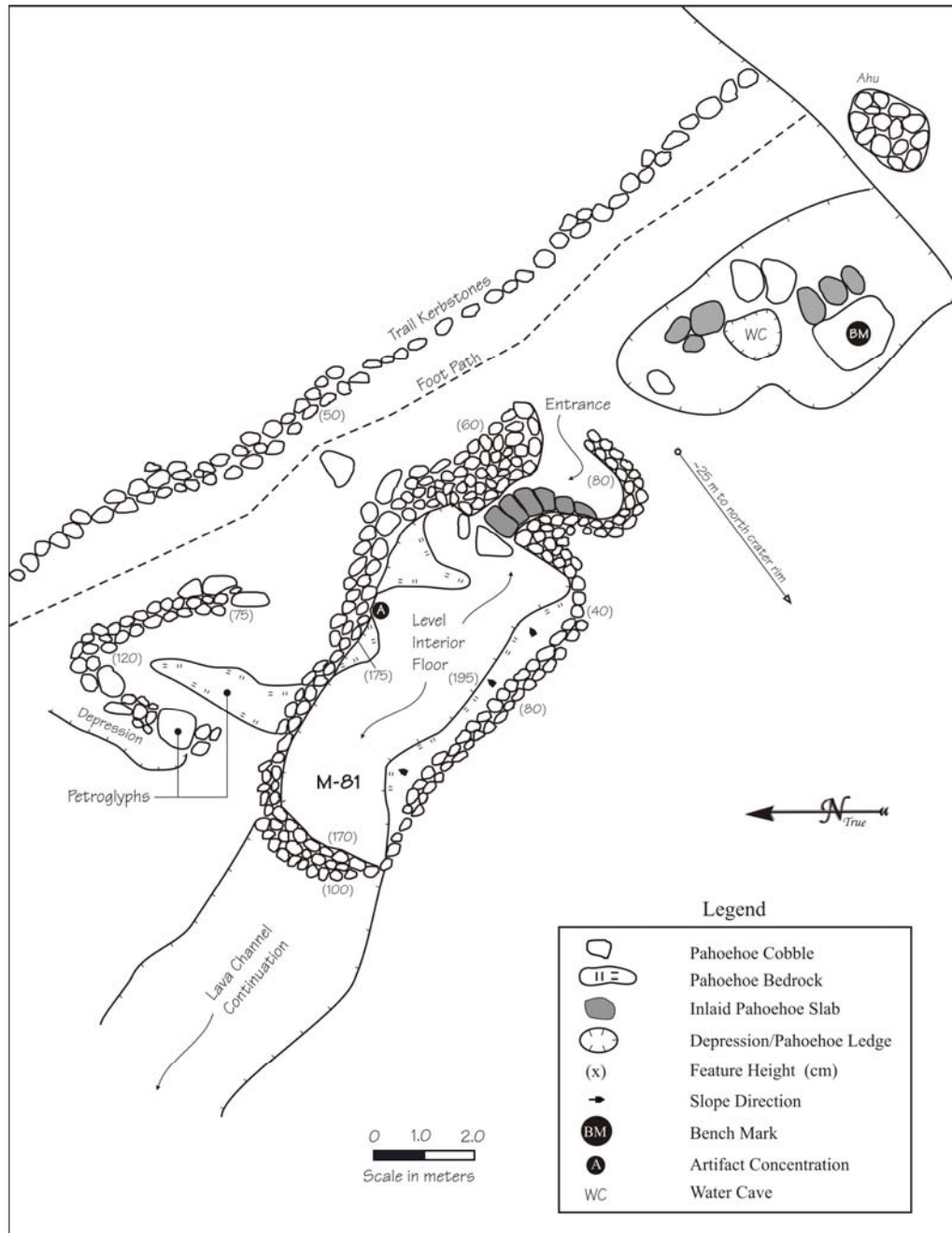


Figure 44. Site 50-10-50-24346 Feature M-81, plan view.



Figure 45. Site 50-10-50-24346 Feature M-81, pahoehoe slab stair treads leading to base of shelter with adjacent interior wall, view to southeast.



Figure 46. Site 50-10-50-24346 Feature M-81, metal nail fasteners and glass fragments concentrated along the northern edge of shelter, overview.

The crack formation continues to the northwest and southeast from the shelter area. A water cave is located approximately 3.5 m southeast from the shelter steps. The water cave is accessed by a series of inlaid pahoehoe slabs that provide a stable area within the crack. Water was present within the cave during the current survey but was frozen. A 1926 U.S. Coast & Geodetic Survey benchmark is located 2.0 meters southeast of the water cave and is embedded in a large boulder.

Additional features adjacent to the shelter include a C-shape feature located approximately 1.0 meter north of the shelter. The feature is constructed from stacked basalt cobbles, boulders, and pahoehoe slabs and measures 3.5 m x 3.0 m x 40-120 cm in height (Figure 47). The interior floor consists of bedrock and the opening is oriented to the south. No cultural material was observed within the C-shape interior, and the feature appears to be associated with the crack shelter based on proximity and style and method of construction. Modern petroglyph

motifs are etched on a relatively large boulder that is incorporated in the western wall of the feature. The motifs consist of un-readable lettering forming four words; poor lighting conditions combined with the weathered state of the boulder made the lettering indecipherable. One word appears to be “FLY,” and the remaining words were not readable.



Figure 47. Site 50-10-50-24346, C-shape feature north of Jaggar’s Cave, view to the northeast.

The Mauna Loa Summit Trail is roughly 3-6 meters north of the shelter and courses along the northern edge of the shelter and the C-shape feature. The trail consists of an approximate 1.0 meter wide tread with trail kerbing along the northern edge. Multiple cairns (*ahu*) are present along this trail and along the Observatory Trail and range from piled cobbles 0.5 meters in height to relatively large monumental-like *ahu* that reach 2.0 meters in height and are prominent markers in the surrounding barren landscape.

The features are all located at a trail intersection area and visitor traffic going to both the summit and the summit cabin pass through the site area. The rock shelter is an inviting feature and allows recreational hikers a brief respite from the often inclement summit weather conditions. As a result of frequent visitation the features have most likely sustained varying alterations through the years including wall modification and cairn (*ahu*) construction, in addition to the usual impacts of camping/recreational activities that includes increased amounts of modern rubbish to the shelter and surrounding site area. The summit region is also subject to frequent seismic activity, and the shelter’s close proximity (~25 meters) to the north rim of the caldera appears to be situated in a relatively unstable area. The features appear to be in relatively good condition despite the high number of users and the seismic activity of the area, and the overall site appears to be mostly intact. Vegetation is absent at this summit location, and the features are located at 3,962 m (13,000’) elevation.

SITE 50-10-50-24347

Site 24347 consists of 6 enclosure features located along the eastern rim of Mokuaweoweo caldera: four of the enclosures (M-67, M-68, M-77, and M-78) are situated immediately adjacent to Wilkes Camp site (see Figure 28); one enclosure (M-80) is located approximately 15 meters south of Wilkes Camp; and one enclosure (M-79) is located roughly 255 meters south of Wilkes Camp (Figure 48). None of the features appear on the camp maps prepared by the Expedition, indicating that they were constructed sometime after 1841. The enclosure walls are generally in good condition and differ from the collapsed wall rubble that comprises the Wilkes Camp site. The features appear to be spatially related to the Wilkes site, but their preserved condition combined with their apparent lack of temporal association with the Expedition warrants their own site designation. Each feature is interpreted as temporary habitation based on formal feature type and each is described below.

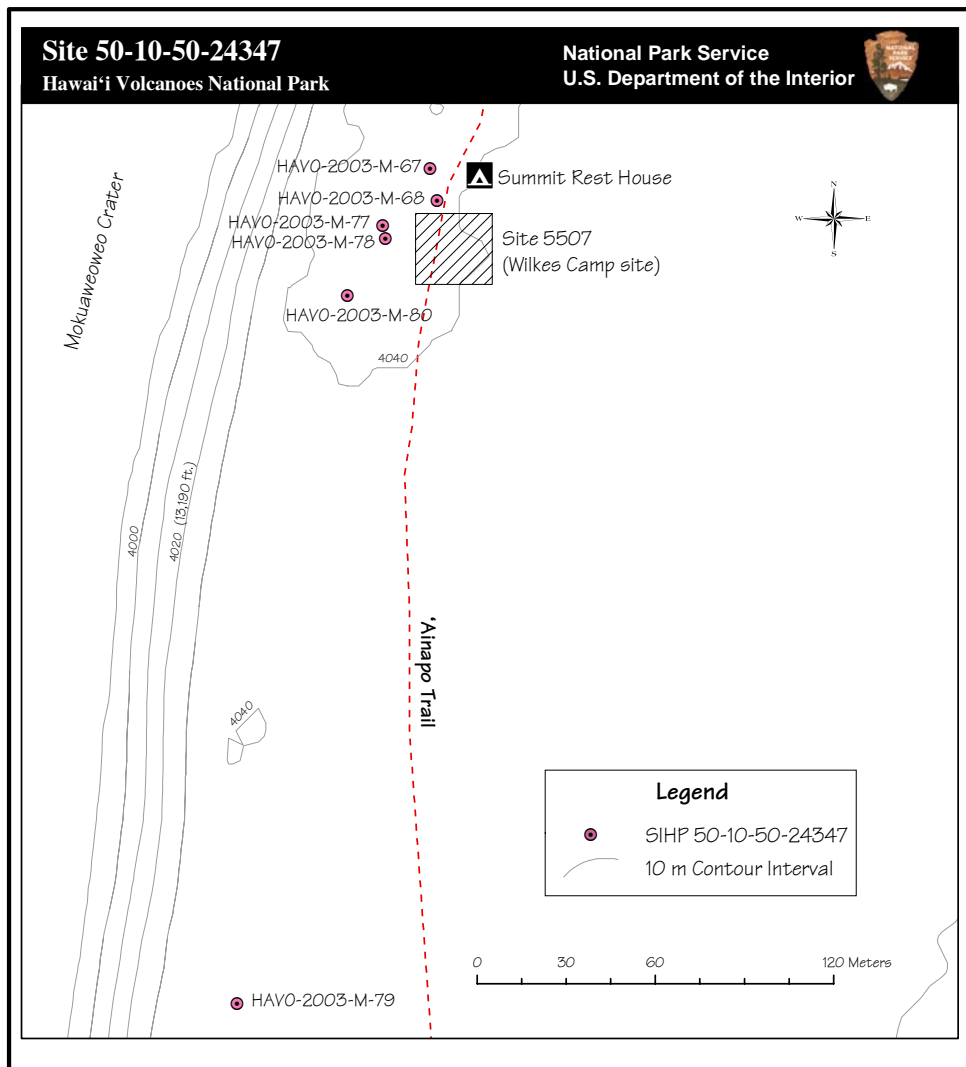


Figure 48. Site 50-10-50-24347 feature distribution.

HAVO-2003-M-67 is a 5.0 m x 4.2 m x 47-60 cm high U-shape enclosure constructed from basalt cobbles and boulders stacked 3-4 courses high. The U-shape opens to the southwest with the back wall protecting the interior from the predominant easterly winds. The feature is located approximately 12 meters west of the Mauna Loa cabin. The level interior consists of sand and gravel, and no cultural material is present in the enclosure interior. The enclosure is located approximately 12 meters north of the Wilkes campsite complex and does not appear in the maps and illustrations prepared by the Expedition. The feature appears to be a modern structure based on its preserved condition (frequent and high magnitude earthquakes at the summit region) and on the absence of previous documentation. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in fair condition.

HAVO-2003-M-68 is a 7.6 m x 6.0 m x 50-100 cm high three sided U-shape enclosure constructed from basalt cobbles and small boulders stacked 3-7 courses high. The feature is located approximately 10.0 meters southwest of the Mauna Loa cabin, and the enclosure opens to the west with the back wall protecting the interior from the predominant easterly winds (Figure 49). The interior of the enclosure consists of a sand and gravel mixture. Rivoli (1999) noted a single stone alignment that bisected the feature interior; during the current survey the alignment was not present within the enclosure interior. The feature alteration demonstrates visitor impacts to the overall site area and denotes the contemporary use of the features. The enclosure is immediately adjacent to and north of the Wilkes campsite complex and does not appear in the maps and illustrations prepared by the Expedition. The feature appears to be a modern structure based on its preserved condition, its close proximity to the caldera edge, and on the absence of previous documentation. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in good condition.



Figure 49. Site 50-10-50-24347, Feature M-68, enclosure with summit cabin in background, view to east.

HAVO-2003-M-77 is an 8.4 m x 2.0 m x 20-50 cm high rectangular enclosure constructed from basalt cobbles and boulders stacked 3-6 courses in height. The walls are mostly intact, and the interior floor slopes to the southwest (toward the crater) and consists of small cobbles and gravel. The narrow enclosure opening

(40 cm) is located at the southwestern end; the southeastern edge of the opening partially adjoins to a second enclosure, M-78. Both enclosures are located approximately 10 m east of the caldera edge and are situated on the aa embankment that separates these features from the Wilkes camp complex. The feature does not appear to correspond with any of the structures associated with Wilkes' camp and does not appear in any of the illustrations or maps prepared by the Expedition. The feature is most likely a modern shelter constructed near the edge of the caldera to provide wind protection while offering an unbroken view of the caldera and the summit region. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in fair condition.

HAVO-2003-M-78 is a 4.0 m x 2.8 m x 70-90 cm high U-shape enclosure constructed from basalt cobbles and boulders stacked 5-10 courses in height. The enclosure opening is oriented to the southwest, facing the caldera. The feature is located approximately 10 meters east of the caldera edge and is situated on an aa embankment. The feature is similar to Feature M-77 in that it does not appear on maps and illustrations prepared by the Expedition, and is also most likely a modern shelter feature. The features' fair to good condition is also an indication that the features are relatively modern given the frequency and magnitude of seismic activity at the summit. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in fair condition.

HAVO-2003-M-79 is a 4.0 m x 4.0 m x 50-70 cm high circular enclosure constructed from small to large basalt cobbles and is located approximately 1.0 meter east of Mokuaweoweo caldera edge. The enclosure walls are mostly intact and the level interior consists of sand, gravels, and small cobbles. A relatively small opening along the northern wall allows access to the enclosure interior. The feature is situated approximately 15 meters west of a crack formation that contains water. Based on the well preserved condition of the feature, it is likely that the enclosure represents modern construction, especially considering its close proximity (~1 meter) to the caldera edge. The feature is located approximately 250 meters south of the Wilkes campsite and does not appear in the maps and illustrations prepared by the Expedition. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in good condition.

HAVO-2003-M-80 is a 2.0 m x 1.8 m wide x 35-75 cm high rectangular enclosure situated approximately 3.0 meters east of Mokuaweoweo caldera edge. The enclosure walls are generally 1-3 courses wide, are trapezoidal in cross-section, with the base course being the widest. The wall is constructed from basalt cobbles and small boulders stacked 4-8 courses in height with smaller cobbles used for chinking. The enclosure entrance is located along the north wall at the northwest corner. The southern wall is constructed on pahoehoe bedrock, and the remaining walls are built on gravel and fractured bedrock (Figure 50). The interior is level and consists of gravel and small cobbles. The enclosure is located approximately 20 meters southwest of the Wilkes campsite complex and does not

appear in the maps and illustrations prepared by the Expedition. The feature appears to be a modern structure based on its preserved condition, its close proximity to the caldera edge, and on the absence of previous documentation. No cultural material was observed in the enclosure interior or the surrounding area. Vegetation is absent at this summit location and the feature is located at 4,039 m elevation (13,250'). The feature is in good condition.

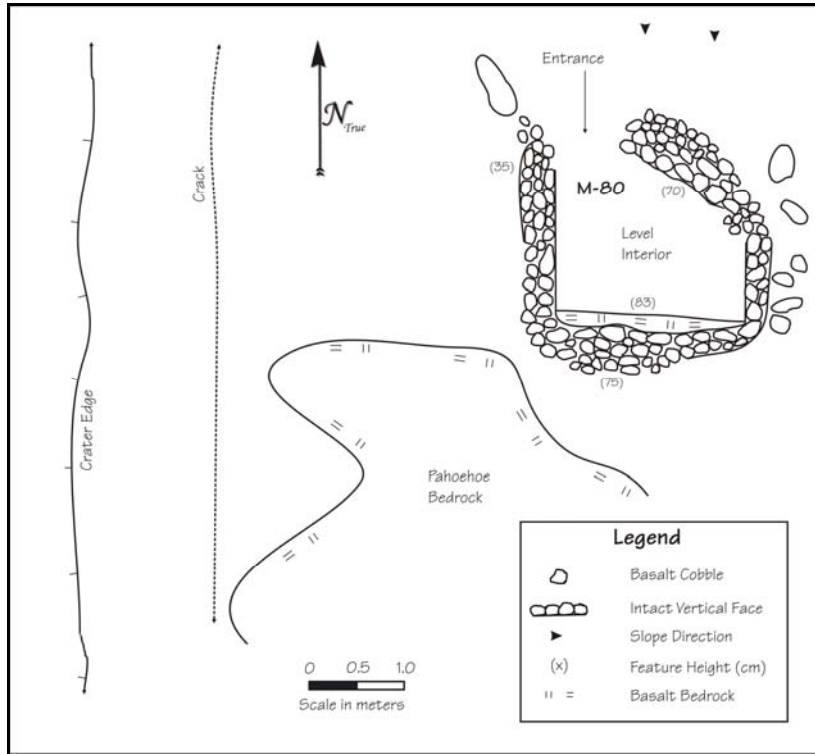


Figure 50. Site 50-10-50-24347, Feature M-80, enclosure plan view.

SITE 50-10-51-24348

Site 24348 consists of a historic-era campsite located along an un-used segment of the Mauna Loa trail (Site 5504). The camp is situated between the 6,500' and 6,600' elevations and its location, combined with the artifactual remains identified at the site, suggest that the camp site is most likely the remains of Bates camp. Subsequent use (or re-use) of the site has introduced later historical artifacts to the site. The camp site was used sporadically from its first construction in 1915 throughout the following years and may have been utilized as a staging and camping area during phone line installation efforts that began in 1933. Both the initial Mauna Loa Trail construction and phone line installation efforts were conducted by military personnel and the presence of military remains at the site provides a strong association with either one or both of these events.

The National Register nomination form for the Mauna Loa Trail (Apple 1973) discusses trail construction logistics, and Apple writes:

By October 14, a 5,000 gallon wooden water tank has been built at the observatory near the rim of Kilauea crater (to store water caught from the roof) 'to supply the camp of the soldiers who are coming to build the Mauna Loa trail, and two other smaller tanks have been shipped up the mountain to a camp ground near the timber line.' This upper camp was at about the 6,600-foot elevation and became known as Camp Bates. Its exact location is now unknown.

The nomination form also details the arrival of military personnel headquartered at Schofield Barracks, and on October 15, Lt. Philoon and 30 African American enlisted men of Company E, 25th Infantry, arrived in Hilo from Oahu aboard the *Matsonia*. The form states that "two days later the remainder of Company E, under Captain Bates, arrived in Hilo aboard the *Mauna Kea*."

In the *Weekly Bulletin of the Hawaiian Observatory* (Jaggar 1915) reported that

On October 19-20 the officers, guided by Mr. Burdick and accompanied by L.A. Thurston and H.O. Wood, went up Mauna Loa over the route of the proposed trail, and Captain Bates and Mr. Burdick remained over night on the mountain, exploring as far as Puu Ulaula. At the half way camp ground on the mountain two 2000-gallon tanks have been erected to supply the trail builders with water and a third tank has been placed at Keauhou ranch for their use.

The following year, Jaggar (1916:64) supplied an account of a summit expedition that included himself and A.J.W. Mackenzie where the two ascended to "Camp Bates and the Red Hill by the new trail."

Superintendent reports for the years 1933 and 1935 describe the phone line installation efforts and the logistical demands required to complete the project. In the 1933 report, Superintendent Wingate notes that Ranger Christ of Hawaii National Park was detailed to supervise construction of the phone line. Ranger Christ enlisted the use of Army Signal Corp materials and enlisted men. Upon receiving the Superintendent's approval for the project, Ranger Christ radioed Army Headquarters at Fort Shafter for the necessary materials. The following day, 10 miles of telephone wire were delivered at Hilo by the U.S. Coast Guard Cutter *Itasca*, captained by Commander J. S. Baylis. Christ also secured the use of pack train mules to cover the proposed 17 miles from manager James Campsie of the Hawaii Agricultural Company, Bradford Sumner, manager of Kapapala Ranch, and A. M. Brown, Keauhou Ranch manager.

On December 4, staging operations were completed and the phone line had been laid out at Ohaikea along the Mauna Loa trail. Actual construction was supervised by Ranger Williams who was assisted by Ranger Peck and a detail of 15 volunteers from the Kilauea Military Camp. The report enumerates the several hardships endured by the workers during construction:

The story of the next several days is simply that of a job well done. There were twenty men in the rest house built to accommodate eight. There was cold. There were sleepless nights. The work was at high altitude. The water supply had to be conserved. Meals had to be prepared. Visitors made comfortable. Morale kept up. But the work went on.

Upon completion, the Superintendent reported that the phone line extended up the Mauna Loa trail to the Red Hill Rest House, and continued “over the lava fields from the Halfway House to the ‘Hotel de Jaggar,’ a cavern at the northeast edge of Mokuaweoweo Crater.” The report also noted that “the telephone line was put into use at 11 a.m. December 9.”

The route chosen to lay the phone line paralleled the Mauna Loa Trail alignment. Numerous phone poles, phone line insulators, and bundled phone line were recorded along the abandoned Mauna Loa Trail segments that were inventoried during the current reconnaissance. The trail route and phone line pass through the camp site, indicating again that the camp is either associated with the original trail construction or phone line construction or both activities. Dates secured from the existing ceramic, bottle, and tin can remains suggest the site was established during the first few decades of the 1900s and confirms the site usage during the periods of both trail and phone line construction.

During the current reconnaissance, the two 2,000-gallon water tanks were not relocated at the site. Their absence indicates that either the camp is not the Bates Camp location, or that when construction efforts were completed, the tanks were dismantled and shipped down the mountain. It is likely that the tanks were disassembled for re-use near the Kilauea Crater area at the Hawaiian Observatory or were integrated into the soon to be established Kilauea Military Camp.

Although the Mauna Loa trail courses near the site and the camp area is associated both spatially and functionally with the Mauna Loa trail, the site was designated as a separate site based on it being potentially established before the trail route was constructed and because the significance of the site representing the only established camp site along the total 19 mile trail route. The site was issued a HAVO feature number and is described below.

HAVO-2003-M-82 is a roughly 30.0 meter by 20.0 meter historic era camp situated along the Mauna Loa trail. The site consists of scattered historic era remains and is located in a relatively flat lying area that is partially protected by an east/west trending ridge formation north of the camp. Abandoned sections of the Mauna Loa trail are located both 28 meters northwest (upslope) and 50 meters southwest (downslope) from the campsite. Historic materials are distributed throughout the camp area and on the adjacent ridge formation (Figure 51)

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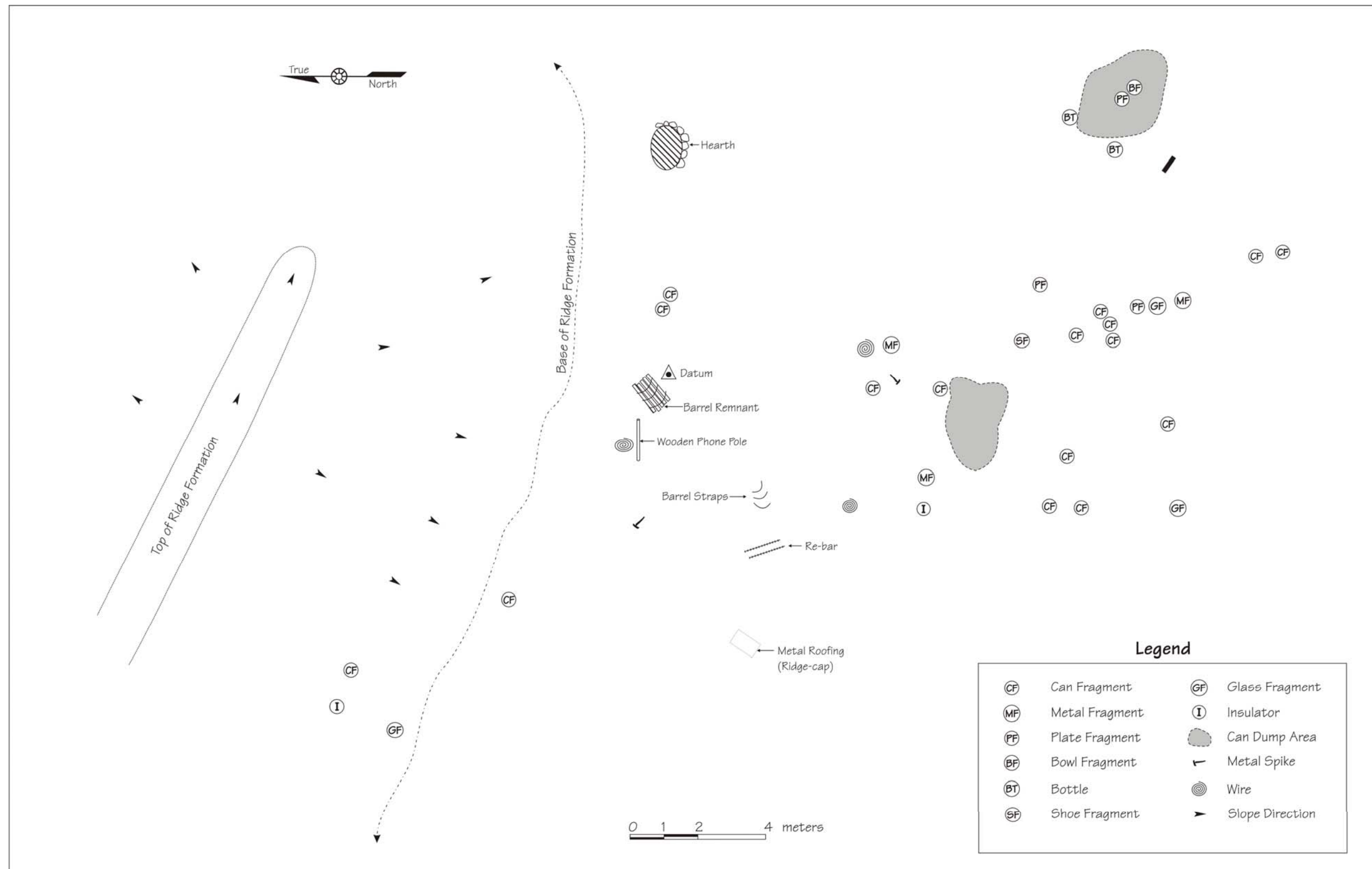


Figure 51. Site 50-10-51-24348, historic era camp site (Bates Camp), plan view.

HAVO-2003-M-82 (*continued*)

The site consists of scattered material throughout the site with two concentrated areas located in the central and eastern/central portion of the camp. The concentrations consist of dense can dump areas intermixed with ceramics, glass, and miscellaneous metal fragments. One wooden barrel (decayed) is located at the northern end of the camp, and a single hearth feature is situated approximately 6 meters east of the barrel. Other material identified includes: phone poles and phone line insulators, early machine cut nails and modern wire nails, shoe pieces including rubber soles and leather uppers, roofing material, re-bar, metal wire strands, metal fragments, ceramic plates and bowls, tin can remains, and glass and bottle fragments.

The tin can remains generally consist of round canisters (ranging from 8-11 cm diameter by 5-12 cm height) with key-wind side strip reclosable lids (ca 1910-1960); flat oval canisters (16 cm x 11 cm x 4 cm height); and square canisters (13 cm x 9.5 cm x 21 cm height and 6 cm x 8 cm x 9 cm height) with holes in the can lids.

Glass bottle maker's marks identified included the Owens Illinois Glass Co. (ca 1929-present) (Toulouse 1971). No other maker's marks were identified; however several other bottles were present and had tapered lips (Figure 52) that suggest either brandy or wine bottles and were finished with a Lipping Tool (ca 1870-1920). Threaded glass insulators located within the camp (Figure 53) and along the Mauna Loa Trail consist of aqua glass embossed with "Hemingray No 16" (Munsey 1970).

Ceramic plates and bowls located with the camp were integrated within the can dump piles. Two china bowl fragments were present (Figure 54), and the maker's mark for one bowl, imprinted in blue, is "Carr China Co." The company was founded in 1916 and continued operations until 1952 (oldtymecollectiblespottery 2004). The white china plate fragment (Figure 55) is marked in blue with "SHENANGO New Castle, Pa 'CHINA' U.S.Q.M.C. 4696 P-33." The Shenango Potter Company was first incorporated in 1901 and continued to manufacture commercial and fine china throughout the 20th century. The company also produced sets for the U.S. Quartermaster Corp that was used in the early-1900s (WW I-era) and later during the 1940s (WW II-era).

The material located with the camp provides dates that span through the first half of the 1900s. It is likely that the camp was constructed to facilitate construction efforts of the Mauna Loa trail and was subsequently re-used in the following decades. Vegetation at the site consists of *pūkiawe*, *'a'ali'i*, *mamane*, *kukainene*, grasses, and *'ohi'a* and the site is in good condition.



Figure 52. Site 50-10-51-24348, tapered lip brandy or wine bottle.



Figure 53. Site 50-10-51-24348, aqua glass insulator with “Hemingray No 16” embossed.



Figure 54. Site 50-10-51-24348, china bowl fragment (“Carr China Co”) in can dump concentration.



Figure 55. Site 50-10-51-24348, china plate fragment (“SHENANGO New Castle, PA”) within can dump concentration.

SITE 50-10-50-24349

Site 24349 consists of a cave located at the 9,700' elevation on the eastern slopes of Mauna Loa. The site was initially identified by the park's contract helicopter pilot David Okita as consisting of a cave opening with a relatively large log located at its entrance. Mr. Okita was able to examine the cave interior during a previous flight and noted internal modifications and artifactual remains. A flight was scheduled on October 15, 2004 to further examine the site and fully record the surface area surrounding the cave and the cave interior. Time restraints partially restricted site recordation. Two surveyors were dropped off at the site and spent approximately 90 minutes recording the site at which time the pilot returned to extract the surveyors. The survey efforts were successful in recording the site and surveyors were able to produce site maps, digital photographs, and site descriptions during the brief site visit.

The field visit was most successful in identifying historic-era artifacts that firmly ascribed the site's temporary habitation remains to a specific expedition. During the field reconnaissance, one artifact was located on the ground surface near the cave opening that consisted of a metal lid inscribed with "Sawkins 1851." Although the "8" appeared mostly worn/corroded, archival research provided additional substantiating information confirming the 1851 expedition to the summit of Mauna Loa. Other historic-era remains identified within the cave contribute to confirming site activity during the mid-1800s.

The site is located in a remote area of the park. Its location is nearly 4 miles east of the current 'Āinapo Trail alignment and poses the question of what route did the 1851 expedition employ to reach the summit. The U.S. Exploring Expedition summit team ascended the mountain one decade earlier in 1840. The route chosen by Expedition leaders was not along the established 'Āinapo Trail and coursed some unknown distance east of the trail. The guide employed by Sawkins, Pohano, was one of the same guides used by the U.S. Ex. Ex. and it appears that they used the same route established 10 years earlier by the Expedition. The route that Sawkins had taken closely parallels the route used in 1840, and the Sawkins expedition also used the Wilkes Camp site, "Pendulum Peak" once the team reached the summit area. Only one site (Site 5507) has been attributed to the U.S. Ex. Ex. activities, but their summit routes and temporary encampments ("Stations") have yet to be identified. It is likely that the "Sunday Station" and "Recruitment Station," named campsites by Wilkes, are within the nearby vicinity of Sawkins Cave and are most likely situated along a direct southeastern route from the current site.

Because of the remoteness of the site, helicopter access is the most feasible way to reach the site area. The site consists of the remains of the James Gay Sawkins' summit expedition based on the existing historical accounts and on the analysis of the artifactual remains at the site. Site interpretation efforts were made easier in part by the inscription left at the site; the inscribed metal lid attributes site usage to a least one specific single event. The site's remote location reduces the likelihood of site tampering from park visitors and partially insures continued preservation of the site. The site is currently in good condition and was assigned a single HAVO feature number. The site is described and illustrated below (Figure 56).

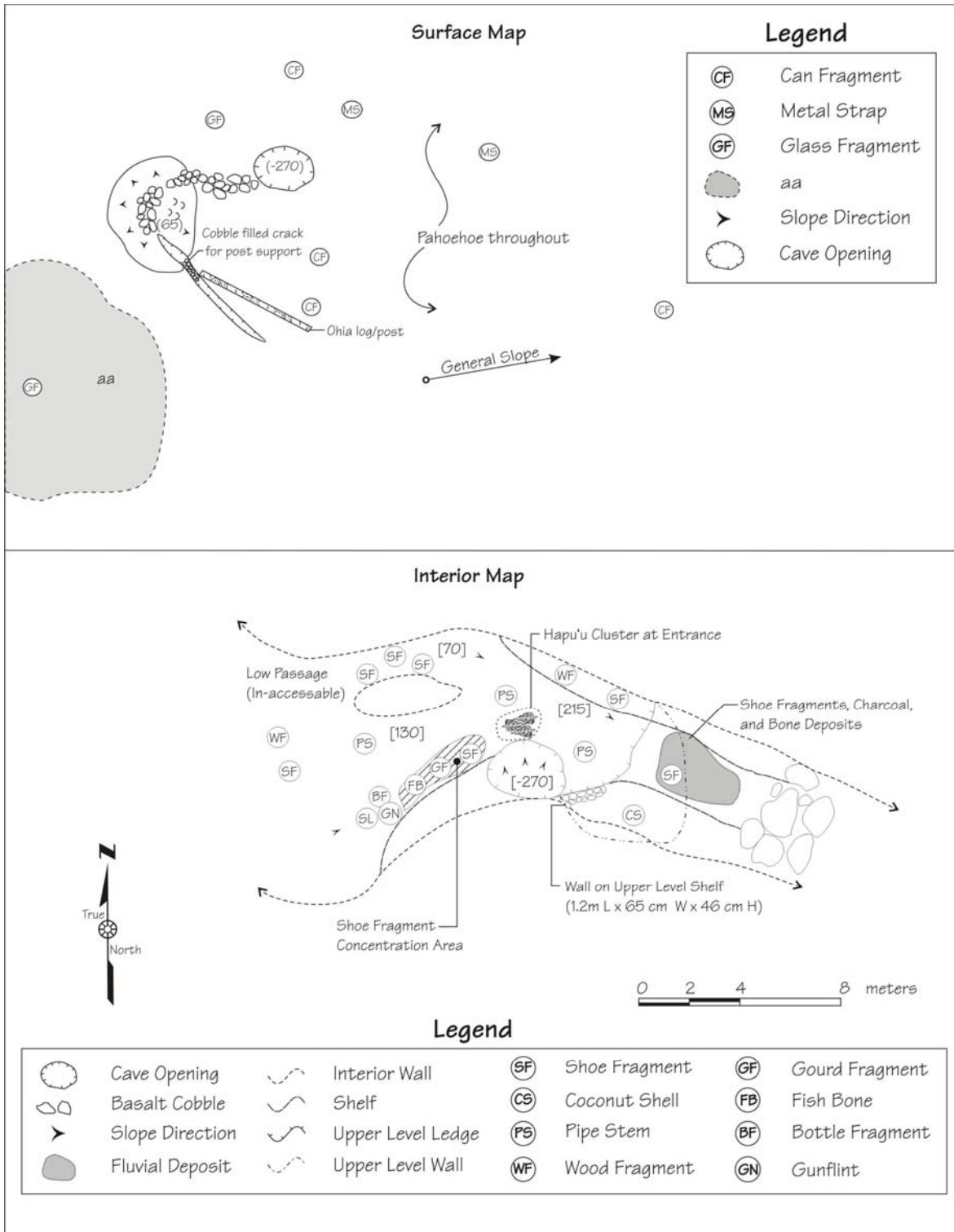


Figure 56. Site 50-10-50-24349, plan view of both surface and cave interior.

HAVO-2003-M-83 is a temporary habitation cave located at the 9,700 foot elevation on the eastern slopes of Mauna Loa. Cultural material is scattered on the surface surrounding the cave opening and within the cave interior and consists predominately of historic-era material with lesser amounts of traditional Hawaiian remains.

Surface material located near the cave entrance consists of wood, glass, and metal remains as well as one low-lying wall constructed near the cave opening. The wooden material consists of a single ohia log that measures 4.0 m in length and is 11 cm in diameter (Figure 57). The base of the log is positioned near a crack feature with numerous cobbles placed in the crack indicating that the log was originally placed upright in the crack and secured in place with cobbles. The log's upright position most likely served as a sign post that enhanced the cave's location when viewed from afar.



Figure 57. Site 50-10-50-24349, ohia log and cave entrance, view to northwest.

Glass remains on the surface consist of two green glass bottle fragments; one base fragment and one lip fragment representing at least one bottle. No seam was observed on the bottle indicating that it is a free-blown bottle.

Metal fragments on the surface include metal can lids and metal strips that are heavily weathered and oxidized. However, the relatively heavy gauge of metal has contributed to their overall preservation including the metal lid piece that is inscribed with "Sawkins 1851" (Figure 58).



Figure 58. Site 24349, Feature M-83, metal lid with “Sawkins 1851” inscribed on the surface.

A low-lying wall is situated west of the cave entrance and is constructed from stacked pahoehoe and aa cobbles and small boulders. The L-shaped wall is generally 1-2 courses in height and width. The wall measures 3.6 meters (long axis) by 2.0 meters (short axis), is 40-65 cm in height, and ranges from 50-70 cm width. Portions of the wall are constructed on an elevated pahoehoe tumulus formation; the wall and natural formation combined provide a relatively well protected area on the southern (leeward) side of the formation and is situated adjacent to the cave opening.

The cave interior is accessed by a vertical opening that measures 3.0 m x 2.2 m and is 270 cm deep. The ground surface slopes north at the entrance and provides access to the central portion of the cave. From the entrance the cave extends approximately 10 meters to the southeast to a roof fall concentration area (Chamber A). The eastern extension of the cave continues past the roof fall concentration area; no cultural material was observed within this extension or at the surface opening that accesses this portion of the cave. The cave extends west for an additional 2 meters where it bifurcates. The northern segment (Chamber B) continues for 3-6 meters to a low, inaccessible passageway. The main cave section (Chamber A) continues east/southeast for approximately 10 meters to a similar low passage. Interior cave heights range from low passages (70 cm) to higher ceiling passages that measure 215 cm. The cave floor consists predominately of pahoehoe with little to no soil development and subsequently no excavation potential.

Cultural material is distributed throughout the interior of the cave and includes: shoe fragments (leather uppers, shoe laces, soles); clay pipe stems, milled lumber, glass bottle fragments, and gunflints (most likely re-used as strike a lights). Other cultural material observed within the interior includes one coconut shell (intact), fish bone (vertebrae), gourd fragments, and several native (*hapu'u*) fern trunk bases and fronds. These native materials suggest that the pair of travelers most likely employed local Hawaiian guides to conduct the pair to the summit. The team may have also utilized porters, a common practice for similar expeditions, and these remains indicate their presence at the site.

The shoe fragments observed with the cave are distributed throughout the interior (Figure 59). These remains represent what is commonly known about Mauna Loa ascents; that the rugged terrain (ubiquitous pahoehoe and aa lava) combined with the extreme hiking distances will quickly destroy footwear. This phenomenon was encountered by nearly every expedition that ascended (by foot) Mauna Loa; those fortunate to have the aid of mules or horse back were spared this uncomfortable and brutish treatment. The U.S. Exploring Expedition was constantly afflicted by the lack of adequate foot gear that could protect both the sailors and the porters employed by the Expedition. The climbing pair of Benchly and Remy were acutely aware of the need for multiple pairs of shoes and equipped their expedition accordingly. The shoe remains observed at the Bates Campsite (Site 14) also lend credence to the brutish hiking conditions that reduce an individual's foot wear to pieces.



Figure 59. Site 24349, shoe fragments observed within cave interior.

The historic-era materials correlate with the expected time frame of 1851; the clay pipe stems (one collected, two left on site) reflect the style during this period when “hundreds of makers all over the country produced millions of pipes which were cheap, expendable and sometimes even given away free at the local tavern. It was often the case after one use that a pipe was tossed away in the nearest convenient place in the same manner as litter is today” (Coleman 1999). The collected stem fragment is of white clay, is undecorated, and measures 46 mm in length by 7 mm in diameter with a 2 mm diameter bore hole. The two fragments left at the site both appeared to be of the same material and dimensions as the one collected.

Two gunflints were observed within the cave interior and both were collected. The gunflints differ from each other in both form and material. The first gunflint is of brown chert, is irregular in shape and measures 30 mm L x 29 mm W x 10 mm thick. The distal end exhibits battering and step flaking, both indicating re-use as a strike a light. The second flint is of gray chert and is rectangular in shape with a trapezoidal cross-section and measures 30 mm L x 26 mm W x 8 mm thickness. This gunflint also exhibits step flaking on three edges indicating possible re-use as a strike a light (Figure 60).

Both the clay pipe stem fragments and the chert strike a light represent a “tobacco consumption package” where “a number of artefacts [artifacts] can be linked to the use of pipes, although not necessarily those made of clay...” including flint strike-a-lights (Cessford 1991). These remains strongly indicate that tobacco was included in the expedition provisions and supplied the travelers with a preferred leisure hobby.

The site is unique in that it presents both western-European artifacts and traditional Hawaiian remains in a remote, high elevation setting. The site remains are associated with the 1851 summit expedition of James Gay Sawkins. The site’s location places it in close proximity to the likely route of the Wilkes’ expedition. The site occupational period also places its activity within only 10 years of the previous scientific expedition. Both of these factors (spatial and temporal) provide much needed information and critical clues toward identifying the route and camp remains of the famed scientific expedition.

The traditional Hawaiian remains located at the site (Figure 61) most likely reflect the expedition’s use of local porters and guides during their summit ascent. The pair hired six local porters (including the guide Pohano) to carry the large supply of provisions to the summit. The combined remains at the site create a unique transition era site reflecting both western European and traditional Hawaiian remains in one site.



Figure 60. Site 24349 Feature M-83, artifacts recovered from cave interior. Clay pipe stem fragment, brown chert gunflint and gray chert gunflint.



Figure 61. Site 24349, coconut shell located on ledge/shelf formation in eastern portion of cave.

V. Conclusions

A. Site Significance Assessments

The resources recorded during the current reconnaissance were each evaluated for site significance based on the National Register Criteria established in the National Historic Preservation Act of 1966. To be considered eligible for the National Register, resources must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and: A) Are associated with events that have made a significant contribution to the broad patterns of our history; or B) Are associated with the lives of persons significant in our past; or C) Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or D) Have yielded or may be likely to yield, information important in prehistory or history. The resources located during the reconnaissance are each evaluated through the National Register eligibility requirements and determinations are presented in Appendix A.

B. Summary

The current reconnaissance successfully located an array of feature types distributed in the alpine, sub-alpine, and montane environments on Mauna Loa through both pedestrian survey and aerial transects. These features represent a broad range of feature functions and span from pre-Contact resource procurement activities to historic-era camp sites and trail routes. The resources identified during the investigation closely parallel the previously generated expectations for the upper elevations within Hawaii Volcanoes National Park.

Previous research and limited field investigations reveal that pre-Contact-era features located on Mauna Loa include excavated pits, quarries, trails, shrines, and lava tube habitation sites. The predominant feature type consists of excavated pits where the pits were used either to capture Dark-rumped petrels or to modify and improve nesting habitat, or possibly a combination of both. Additional features previously identified include quarry areas, trail routes, stone uprights (*pohaku*) indicating ceremonial usage, and lava tube habitations. These features, combined with historic-era modifications including ranching activities, trail construction efforts, trail shelter construction, and Hawaiian Volcano Observatory and Civilian Conservation Corp construction activities comprise the current suite of site types located on the upper slopes of Mauna Loa.

The current investigation's findings deviate slightly from the previously generated pattern in that no pre-Contact temporary habitation features (e.g. lava tubes, rock shelters, C-shapes) were encountered. Dense concentrations of excavated pits were located and recorded during the study, but no temporary habitation features were identified adjacent to or near these preferred resource areas. Numerous caves and natural rock shelter formations are present at these high elevations, but no cultural

material was observed within the shelter formations or on the surrounding ground surface. Of the total 15 sites identified, only 5 sites (30%) are interpreted as temporary habitation sites and all represent historic-era camps associated with historic trail development and shelter improvements.

The lack of temporary habitation features within this high elevation resource zone may result from the transitory nature of these activities that required short-term excursions into the area. Tomonari-Tuggle (1996), in discussing shelters in the forested slopes of Mauna Kea at Hakalau, cite Emerson as describing the habitation of bird catchers as being modest and that the catcher “erects the necessary huts for himself and his family” (1894:105). These structures were most likely temporary in nature, and when abandoned, they rapidly deteriorated and were overgrown, becoming unrecognizable within the surrounding forest. Food remains, and later historic era artifacts, may remain at the sites, but identification of these sites is reduced by dense vegetation that reduces ground surface visibility, degradation and deterioration.

Likewise, high elevation resources including petrels were located well above the forest tree line and habitation sites were mostly likely minimally constructed (or slightly modified natural areas, e.g. rock shelters, overhangs, caves) and used by a relatively small groups of individuals. The temporary habitation sites also may have been located away from the nesting colony of seabirds to avoid “spooking” the population by maintaining an appropriate buffer distance. These sites may consist of minimal food remains (e.g. marine shell, bird bones) within natural shelter areas that are subject to deterioration and poor preservation in this alpine environment.

Temporary habitation sites were identified during inventory survey efforts of Pohakuloa Training Area (PTA) by Ogden Environmental and Energy Services Co., Inc. (Williams et al. 2000). Their study area is located within the high elevation saddle area situated between Mauna Loa and Mauna Kea. Features identified during the survey include lava tube shelters, cairns, petroglyphs, surface work areas, shrines, paved structures, C-shapes, walls, basalt outcrops, and a total of 1,822 excavated pits were recorded. Of the total 34 sites recorded, 14 sites (41%) were interpreted as habitation sites. The high incidence of habitation sites at this location may result from a larger population exploiting both the high elevation faunal resources (petrels) as well as other highly valued resources such as the Mauna Kea adze quarries. In addition, a cross-island travel route most likely increased the number of individuals and groups passing through the area requiring temporary shelter during their travels.

The resource procurement areas identified during the current reconnaissance are situated in remote, alpine wilderness. Subsistence is often undermined and hindered by the radical environmental extremes encountered at the higher elevations on Mauna Loa (blistering heat, absence of water sources, driving winds, raging blizzards). Accessing these slopes for resource procurement efforts would have required complete commitment by the brave individuals who traversed these slopes and would have demanded multiple day expeditions to complete their journeys. They no doubt erected temporary shelters along their developed routes and at established camps where they might remain for days while securing their quarry.

These camp locations have most likely since deteriorated and have become camouflaged by time and the elements.

C. Recommendations

The Mauna Loa Reconnaissance 2003 has aided in locating and identifying cultural resources located in this remote portion of Hawaii Volcanoes National Park. Additional aerial transects examined sections of the new Kahuku extension of the park and the upper reaches of the eastern flank of Mauna Loa. These efforts revealed dense concentrations of archeological features including: excavated pits, C-shapes, enclosures, shrines, platforms, cave openings, and networks of trail routes. These remains reveal the legacy of traditional Hawaiian life ways and represent the cultural identity and heritage of the Hawaiian people of today.

The reconnaissance succeeded in identifying cultural resources in the remote, high altitude, alpine environment of Mauna Loa. The primary objectives previously outlined were completed: an archival research of the HAVO Cultural Resource Division libraries and files was completed; the reconnaissance level investigation of the alpine environment was completed; and a summary and synthesis of these efforts are presented and detailed in this report. These accomplishments represent the culmination of a multi-phased project that spanned multiple years and required coordination of Cultural Resource Division personnel and cooperation between the multiple divisions within the park.

The overall objective of these efforts was to provide the much needed baseline information that will better enable HAVO managers to plan and direct activities within these remote alpine reaches of the park. The current study will also contribute to park's efforts in providing interpretive material for park employees, visitors, and the adjacent neighboring communities. Reconnaissance level information collected as a part of the project will benefit resource managers through the identification of the diverse site types and their distribution on portions of Mauna Loa. This information will aid managers in directing future projects and activities that occur within the remote areas of the park. Interpretive material is currently being prepared and includes a paper/presentation to be given at the 17th annual conference of the Society for Hawaiian Archaeology and the park's popular "After Dark in the Park" lecture series.

1. Wilkes Campsite and Mauna Loa Trail

The current investigation contributed substantially to our understanding of one National Register listed site (Site 5507 Wilkes Camp) and one National Register eligible site (Site 5504 Mauna Loa Trail). Through archival research and field investigations the sites have undergone an updated recordation process that expanded and clarified our previous understanding of these nationally significant resources. Further work at these sites (including re-nominating the Mauna Loa trail) will continue to refine and expand our understanding of these sites.

On site interpretation (signage) should be incorporated at the Wilkes Camp (Site 5507) to better inform intrepid hikers who make the arduous trek to Moku'āweoweo. A National Register of Historic Places placard would better instill

the importance of place at the site and would likely serve to protect and preserve the site from continued deterioration and modification. The current 'Āinapo Trail alignment bisects the site; the trail should be re-routed to the east to avoid further pedestrian impacts to the site, to maintain site integrity, to promote preservation, and to illustrate to the visitors the park's commitment to protect this fragile site.

2. Sawkins Cave

The newly recorded Sawkins camp site (Site 50-10-50-24349) provides invaluable clues toward identifying the U.S. Exploring Expeditions campsites on Mauna Loa used during their summit ascent. Future surveys should be directed in the adjacent areas, both northwest and southeast of the site, to examine the area for both "Sunday Station" and "Recruitment Station," Wilkes' named campsites along his summit trail.

3. Kahuku Unit

During aerial reconnaissance efforts within the new Kahuku extension, multiple features were observed at the upper elevations (7,000' +). Dense concentrations of temporary habitation features were clustered along existing pahoehoe/aa interface areas near Umi caverns. Excavated pits are distributed throughout this area and a single trail route traverses through this dense resource area. Previous investigations (Moniz 2003) of the Ka'u Desert Footprints District (Site 5505) revealed similar feature types and distribution where temporary habitation features were constructed along the edge of the Ke'amoku Flow. Structures were built from the available loose aa cobbles and small boulders within the flow and utilized natural formations to enhance the structures. The position of the features' walls suggests that they were constructed to block the prevailing easterly trade winds. The structures were situated within inlets of the Ke'amoku that provided further protection from the strong desert winds (2003:103-104). Continued study of similar features identified within the Kahuku extension will likely reveal subtle similarities and discrete differences between the site complexes.

Further inventory level recordation of the features observed in the Kahuku extension is necessary to better develop an understanding of these resources. Comprehensive archeological inventory/surveys conducted in the area will better identify pre-existing resources of the area, define the sites' relations to these resources; and generate a more complete analysis of the site types and site processes of this upland region. Further investigations will provide complete data necessary for site comparisons between this and known resource areas of the park and will better enable resource managers to 1) direct and manage activities in sensitive resource areas, 2) generate preservation plans including National Register of Historic Places eligibility determinations, and 3) supply interpretive materials for park employees and the Island community.

4. Monitoring

The remoteness of these high elevation resources limits the number of park visitors; however, a number of resources are easily accessed and a number of historic-era structures are currently incorporated into the park's recreational trail system and receive weekly usage. Impacts to these sites are cumulative and unavoidable. A site monitoring program would better allow resource personnel to identify and record both natural and human-caused site alterations. Program implementation could integrate routine backcountry Ranger patrols with cultural resource personnel efforts to regularly examine existing site conditions.

D. Summary

The upper reaches of Mauna Loa's alpine terrain represent a natural wonder and our efforts to systemically document the cultural resources in this remote wilderness have only begun. These resources are significant on national, regional, and local levels and will be preserved, protected, and interpreted through the park's current management policies. Continued investigations of the remote alpine, sub-alpine, and montane regions of Hawaii Volcanoes National Park will likely reveal unique cultural resources; these resources will yield the previously untold stories that will significantly contribute to the character and uniqueness of Hawaii Volcanoes National Park and will continue to speak for the indomitable Hawaiian culture and character.

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VII. Appendix A
Summary of Identified Sites

Appendix A: Summary Of Identified Sites

<i>State Site No.</i>	<i>HAVO Feature No.</i>	<i>Temporary Feature No.</i>	<i>Feature Type</i>	<i>Feature Function</i>	<i>NRHP Criteria¹</i>
SIHP-50-10-41-5504	HAVO-2003-M-1	M1	Trail	Transportation	A, B
SIHP-50-10-41-24337	HAVO-2003-M-10	ML10	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24337	HAVO-2003-M-11	ML11	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24341	HAVO-2003-M-12	ML12	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24341	HAVO-2003-M-13	ML13	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24341	HAVO-2003-M-14	ML14	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24341	HAVO-2003-M-15	ML15	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24341	HAVO-2003-M-16	ML16	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24341	HAVO-2003-M-17	ML17	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24336	HAVO-2003-M-18	ML18	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24336	HAVO-2003-M-19	ML19	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24339	HAVO-2003-M-2	ML2	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24336	HAVO-2003-M-20	ML20	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24336	HAVO-2003-M-21	ML21	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24340	HAVO-2003-M-22	ML22	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24340	HAVO-2003-M-23	ML23	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24340	HAVO-2003-M-24	ML24	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24340	HAVO-2003-M-25	ML25	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24345	HAVO-2003-M-26	ML26	Rock Pile (<i>ahu</i>)	Marker	D
SIHP-50-10-41-24344	HAVO-2003-M-27	ML27	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-5504	HAVO-2003-M-28	ML28	Trail	Transportation	A, B
SIHP-50-10-41-24342	HAVO-2003-M-29	ML29	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24340	HAVO-2003-M-3	ML3	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-30	ML30	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-31	ML31	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-32	ML32	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-33	ML33	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-34	ML34	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-35	ML35	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-36	ML36	Excavated Pit	Resource Procurement	D

Appendix A: Summary Of Identified Sites

<i>State Site No.</i>	<i>HAVO Feature No.</i>	<i>Temporary Feature No.</i>	<i>Feature Type</i>	<i>Feature Function</i>	<i>NRHP Criteria</i>
SIHP-50-10-41-24342	HAVO-2003-M-37	ML37	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-38	ML38	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-39	ML39	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24335	HAVO-2003-M-4	ML4	Trail	Transportation	D
SIHP-50-10-41-24342	HAVO-2003-M-40	ML40	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-41	ML41	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-42	ML42	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-43	ML43	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-44	ML44	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-45	ML45	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-46	ML46	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-47	ML47	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-48	ML48	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-49	ML49	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24335	HAVO-2003-M-4	ML4B	Trail	Transportation	D
SIHP-50-10-41-24335	HAVO-2003-M-5	ML5	Rock Shelter	Temporary Habitation	D
SIHP-50-10-41-24342	HAVO-2003-M-50	ML50	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-51	ML51	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-52	ML52	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-53	ML53	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-54	ML54	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-55	ML55	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-56	ML56	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-57	ML57	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-58	ML58	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-59	ML59	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24335	HAVO-2003-M-6	ML6	Wall	Temporary Habitation	D
SIHP-50-10-41-24342	HAVO-2003-M-60	ML60	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-61	ML61	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-62	ML62	Excavated Pit	Resource Procurement	D

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<i>State Site No.</i>	<i>HAVO Feature No.</i>	<i>Temporary Feature No.</i>	<i>Feature Type</i>	<i>Feature Function</i>	<i>NRHP Criteria</i>
SIHP-50-10-41-24342	HAVO-2003-M-63	ML63	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-64	ML64	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24342	HAVO-2003-M-65	ML65	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24343	HAVO-2003-M-66	ML66	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24335	HAVO-2003-M-7	ML7	C-Shape	Temporary Habitation	D
SIHP-50-10-41-24337	HAVO-2003-M-8	ML8	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24337	HAVO-2003-M-9	ML9	Excavated Pit	Resource Procurement	D
SIHP-50-10-50-24347	HAVO-2003-M-67	MLS1	Enclosure (Historic)	Temporary Habitation	None
SIHP-50-10-50-24347	HAVO-2003-M-68	MLS2	Enclosure (Historic)	Temporary Habitation	None
SIHP-50-10-50-5507	HAVO-2003-M-69	MLS3	Wall	Enclosure	B
SIHP-50-10-50-5507	HAVO-2003-M-70	MLS3A	Wall Remnant	Enclosure	B
SIHP-50-10-50-5507	HAVO-2003-M-71	MLS3B	Wall Remnant	Enclosure	B
SIHP-50-10-50-5507	HAVO-2003-M-72	MLS3C	Wall Remnant	Enclosure	B
SIHP-50-10-50-5507	HAVO-2003-M-73	MLS3D	Wall Remnant	Enclosure	B
SIHP-50-10-50-5507	HAVO-2003-M-74	MLS3E	Wall Remnant	Enclosure	B
SIHP-50-10-50-5507	HAVO-2003-M-75	MLS3F	Wall Remnant	Enclosure	B
SIHP-50-10-50-5507	HAVO-2003-M-76	MLS3G	Wall Remnant	Enclosure	B
SIHP-50-10-50-24347	HAVO-2003-M-77	MLS4	Enclosure	Unknown	None
SIHP-50-10-50-24347	HAVO-2003-M-78	MLS5	Enclosure	Unknown	None
SIHP-50-10-50-24347	HAVO-2003-M-79	MLS6	Enclosure	Unknown	None
SIHP-50-10-50-24347	HAVO-2003-M-80	MLS7	Enclosure	Unknown	None
SIHP-50-10-50-24346	HAVO-2003-M-81	MLS8	Rock Shelter	Temporary Habitation	B
SIHP-50-10-51-24348	HAVO-2003-M-82	ML28T	Camp Site	Temporary Habitation	A, B
SIHP-50-10-50-24349	HAVO-2003-M-83	ML83	Cave	Temporary Habitation	B, D
SIHP-50-10-41-24339	HAVO-2002-A-1	141	Quarry	Resource Procurement	D
SIHP-50-10-41-24339	HAVO-2002-A-2	142	Quarry	Resource Procurement	D
SIHP-50-10-41-24339	HAVO-2002-A-3	143	Rock Pile	Unknown	None
SIHP-50-10-41-24339	HAVO-2002-A-4	145	Quarry	Resource Procurement	D
SIHP-50-10-41-24338	HAVO-2002-A-6	147	Quarry	Resource Procurement	D
SIHP-50-10-41-24338	HAVO-2002-A-7	148	Excavated Pit	Resource Procurement	D

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<i>State Site No.</i>	<i>HAVO Feature No.</i>	<i>Temporary Feature No.</i>	<i>Feature Type</i>	<i>Feature Function</i>	<i>NRHP Criteria</i>
SIHP-50-10-41-24338	HAVO-2002-A-8	149	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24338	HAVO-2002-A-9	150	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24338	HAVO-2002-A-10	151	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24338	HAVO-2002-A-11	152	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24338	HAVO-2002-A-12	153	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24338	HAVO-2002-A-13	154	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24338	HAVO-2002-A-14	155	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24338	HAVO-2002-A-15	156	Excavated Pit	Resource Procurement	None
SIHP-50-10-41-24338	HAVO-2002-A-17	158	Quarry	Resource Procurement	None
SIHP-50-10-41-5504	HAVO-2002-A-18	159	Artifact		None
SIHP-50-10-41-24339	HAVO-2002-A-19	160	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-24339	HAVO-2002-A-20	161	Excavated Pit	Resource Procurement	D
SIHP-50-10-41-5504	HAVO-2002-A-21	162	Artifact		None
SIHP-50-10-41-5504	HAVO-2002-A-22	164	Artifact		None
SIHP-50-10-41-5504	HAVO-2002-A-23	165	Rock Pile	Marker	B, D
SIHP-50-10-41-5504	HAVO-2002-A-24	167	Rock Pile	Marker	B, D
SIHP-50-10-41-5504	HAVO-2002-A-25	168	Rock Pile	Marker	B, D
SIHP-50-10-41-5504	HAVO-2002-A-26	169	Rock Pile	Marker	B, D
SIHP-50-10-41-5504	HAVO-2002-A-27	170	Rock Pile	Marker	B, D
SIHP-50-10-41-5504	HAVO-2002-A-28	PFAHUT	Rock Pile	Marker	B, D

¹ NRHP Criteria for cultural resources: A) Associated with events that have made a significant contribution to the broad patterns of our history. B) Associated with the lives of persons significant in our past. C) Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction. D) Yielded or may be likely to yield, information important in prehistory or history.