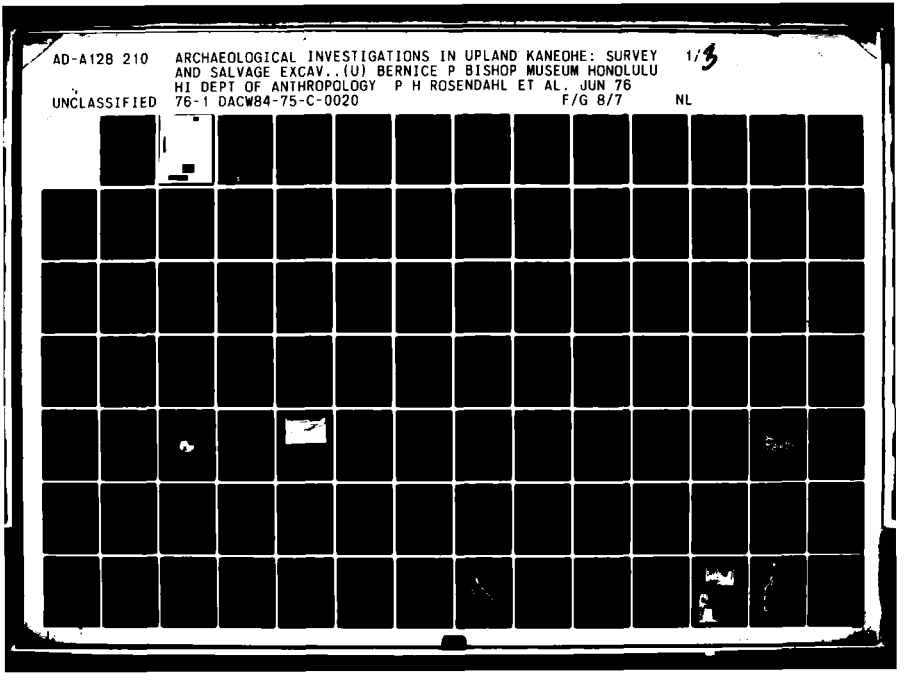
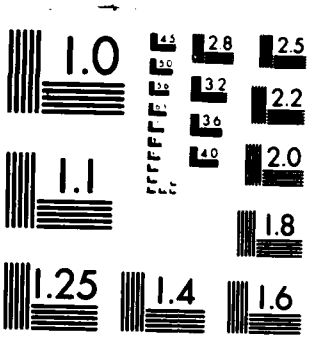
AD-A128 210 ARCHAEOLOGICAL INVESTIGATIONS IN UPLAND KANEOHE: SURVEY AND SALVAGE EXCAV..(U) BERNICE P BISHOP MUSEUM HONOLULU HI DEPT OF ANTHROPOLOGY P H ROSENDAHL ET AL. JUN 76 1/3

UNCLASSIFIED 76-1 DACW84-75-C-0020 F/G 8/7 NL





REPORT 76-1

ARCHAEOLOGICAL INVESTIGATIONS IN UPLAND KANEOHE

SURVEY AND SALVAGE EXCAVATIONS IN THE UPPER KAMO'OALI'I STREAM DRAINAGE AREA KANEOHE, KO'OLAUPOKO, OAHU, HAWAII

Paul H. Rosendahl
Editor

With Contributions by:

Ranjit Cooray
Marion Kelly
Patrick Vinton Kirch
Patrick C. McCoy
Paul H. Rosendahl
Aki Sinoto

Prepared for:

U.S. ARMY ENGINEER DIVISION, PACIFIC OCEAN

Contract No. DACW84-75-C-0020

JUNE 1976

DEPARTMENT OF ANTHROPOLOGY
BERNICE P. BISHOP MUSEUM
HONOLULU, HAWAII

PREFACE

During the period 1972 to 1976, the Department of Anthropology, Bernice P. Bishop Museum, conducted several archaeological projects in connection with the U.S. Army Corps of Engineers' Kaneohe-Kailua Flood-Control Project. These projects have included the initial cultural and botanical resource surveys (Kamo'oali'i Project, Phase I [1972]), intensive archaeological survey and test excavations (Kamo'oali'i Project, Phase II, Parts 1 and 2 [1973-1974], Upland Kaneohe Project, Phase I [1975]), historical research (Upland Kaneohe Project, Phase I [1975]), and complete salvage excavation of Site 50-OA-G5-37 (Upland Kaneohe Project, Phase II [1975-1976]).

The objectives of the successive archaeological projects were simply: (1) the identification and preliminary evaluation of archaeological resources present within the project area; (2) more intensive recording and testing of specific sites, to evaluate significance and to determine potential for yielding important information through any recommended subsequent work; and (3) complete salvage of the single prehistoric site, as the appropriate mitigation for the adverse effect of site destruction by planned dam construction. In most instances, a project scope of work was based on recommendations derived from the findings of the previous project.

One factor that restricted the scope of the archaeological investigations in terms of potential significant results and interpretation was the lack of knowledge concerning sites (apparently prehistoric sites) known to exist in the lands extending from the inland boundary of the project area to the base of the Ko'olau Mountains. Refusal of entry permission by private landowners prevented conduct of intensive survey and test excavations of sites in this large, and potentially significant, area.

In spite of the problems and restrictions encountered, the archaeological investigations have produced significant results. They have provided detailed knowledge of the archaeological remains within a previously unknown inland area for which there were no recorded sites (with the spatially distant exception of a fishpond [Site 50-OA-G5-11] located at the end of Kaneohe Stream). In the case of Site 50-OA-G5-37, the investigations have yielded data about a little-known aspect of Hawaiian prehistory--the nature and time depth of aboriginal inland occupation and terrestrial exploitation.

The intent of this volume is to present a comprehensive account of all archaeological research conducted by the Bishop Museum in upland Kaneohe. Thus the volume contains not only reports prepared to meet the requirements of Army Corps of Engineers Contract No. DACW84-75-C-0020 (Reports 1, 2, and 6), but also reports on previous work done in upland Kaneohe for the Corps of Engineers (Reports 3 and 4), and for the National Park Service (Report 5), in connection with the Kaneohe-Kailua Flood-Control Project. Reports 3, 4, and 5 are presented here unaltered from the manuscript versions submitted earlier to the Corps of Engineers and the National Park Service, with the exception of minor editorial changes and corrections, and deletion of several illustrations to avoid repetition within this volume. With submission of these reports, all archaeological work necessary in connection with the flood-control project can be considered completed.

The Introduction provides the background to all archaeological work conducted in upland Kaneohe by Bishop Museum as part of the Kaneohe-Kailua Flood-Control Project, including other archaeological work done within Kaneohe, but outside the project area, and summarizes the environmental setting, both present local environment and the probable prehistoric local environment, as the setting for prehistoric occupation and exploitation. Report 1 presents a general narration concerning past human occupation and exploitation within the project area, based on the integration of results from the archaeological investigation of the project area and historical research of the project area and immediate surroundings.

Reports 2 through 6 comprise the detailed descriptive accounts and interpretative conclusions of the specific archaeological and historical investigations. Report 2, by Marion Kelly, concerns the historical research of the project area and immediate surrounding area of Kaneohe. Report 3, by Patrick C. McCoy, Aki Sinoto, and Ranjit Cooray, relates the archaeological and botanical surveys conducted in 1972 as part of the initial inventory of cultural and natural resources located within the project area. Report 4, by Patrick McCoy, details the intensive archaeological survey and test excavations conducted in 1973, and includes a note on the limited intensive survey work conducted in 1975. Report 5, by Patrick Vinton Kirch, details the supplemental test excavations conducted at the earthen mound site (Site 50-OA-G5-37) in 1973-74, and Report 6, by Paul H. Rosendahl, presents the complete salvage excavation of Site 50-OA-G5-37, conducted in 1975.

Two items requested in the original Scope of Work for Contract No. DACW84-75-C-0020--project area site significance evaluations, and recommendations relating to the development of recreational opportunities within the project area--are not included here. This information has been submitted separately to the Corps of Engineers.

Use of Hawaiian language words has been restricted. The few examples are defined in the text. Pukui and Elbert's *Hawaiian Dictionary* (1971) has been used as the authoritative reference for spelling and meaning.* The directional referents *mauka* ("inland, upland, toward the mountain"), and *makai* ("at the seaside, toward the sea, in the direction of the sea") are the only Hawaiian terms retained for general use (Pukui and Elbert 1971:223, 208). Actual compass direction is of little importance for discussing the orientation of the aboriginal Hawaiian within his natural environment; *mauka* and *makai* were the essential native concepts. For the common, Hawaiian, and scientific names of floral species, Marie C. Neal's *In Gardens of Hawaii* (1965) was used as the standard reference.*

All records and materials generated by the archaeological, botanical, and historic research investigations conducted by Bishop Museum in upland Kaneohe for the Kaneohe-Kailua Flood-Control Project are deposited with the Department of Anthropology, Bishop Museum. These records and materials will be made available to any qualified individual who wishes to use them.

Specific acknowledgements of the different authors are presented in the prefaces to their individual reports. In overall regard to work conducted

---

* For complete reference, see list at end of Report 6.

between 1972 and 1976 by Bishop Museum as part of the Kaneohe-Kailua Flood-Control Project, I want to acknowledge the continuing support and assistance, both official and otherwise, given by the staff of the Environmental Resources Section of Planning Branch, U.S. Army Corps of Engineers--Pacific Ocean Division, particularly by Dr. John Belshé and Mrs. Ruby Mizue (née Ibaraki), and by the National Park Service--Pacific Archeologist, Mr. Edmund J. Ladd.

Paul H. Rosendahl

Honolulu, Hawaii
March 31, 1976

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

INTRODUCTION

by

Paul H. Rosendahl

BACKGROUND

KANEOHE-KAILUA FLOOD-CONTROL PROJECT

During the past several years, the Department of Anthropology, Bernice P. Bishop Museum, has undertaken a series of archaeological investigations for the U.S. Army Corps of Engineers in the upland part of Kaneohe, Oahu (Fig. I-1, foldout at end of volume). These archaeological investigations were done as an integral part of the Kaneohe-Kailua Flood-Control and Allied Purposes Project, a joint flood-control and recreation project of the Corps of Engineers and the City and County of Honolulu.

> The Kaneohe-Kailua project was authorized in the Flood Control Act of 1970 (Public Law 91-611) by the 91st Congress, 1st Session, approved 31 December 1971. The recreation development has been named Ho'omaluhia [*ho'omaluhia:* to cause or give peace] by the Department of Recreation, City and County of Honolulu.
>
> The authorized purposes of the project are flood control and recreation. The project consists of a detention dam and reservoir in the headwaters of Kamooalii Stream and about 1,200 feet of allied channel improvements at the stream outlet to Kaneohe Bay which will provide flood protection for the highly urbanized area on the east coast of the island of Oahu [U.S. Army Corps of Engineers 1974:I-1].

An important aspect of the Corps of Engineers project planning and pre-construction work was the identification and evaluation of recreational and environmental resources (natural and cultural) within the project area. Archaeological-historical work conducted by the Bishop Museum, comprising only one aspect of the planning and pre-construction work, has consisted of three levels of increasingly intensive investigation: (1) cultural resources reconnaissance; (2) cultural resources survey; and (3) mitigation of adverse effects. Table I-1 summarizes the various archaeological investigations conducted by the Bishop Museum as part of the Kaneohe-Kailua Flood-Control Project.

ARCHAEOLOGICAL RESEARCH IN KANEOHE

Investigations Prior to Flood-Control Project

Prior to commencement of the flood-control project, relatively little archaeological research had been done in Kaneohe. There were only about

Table I-1.

ARCHAEOLOGICAL INVESTIGATIONS CONDUCTED BY THE DEPARTMENT OF ANTHROPOLOGY, B.P. BISHOP MUSEUM, FOR THE KANEOHE-KAILUA FLOOD-CONTROL AND ALLIED PURPOSES PROJECT

Level of Investigation	Type of Investigation	Bishop Museum Project Name & Number	Date of Project
Cultural resources reconnaissance	Environmental inventory study: cultural and botanical surveys	Kamo'oali'i Phase I (Project 58)	1972
Cultural resources survey	Intensive archaeological survey & test excavations	Kamo'oali'i Phase II, Part 1 (Project 59)	1973
Cultural resources survey	Supplemental archaeological resource examination of Site 50-OA-G5-37	Kamo'oali'i Phase II, Part 2 (Project 60)	1973-1974
Cultural resources survey & mitigation	Intensive archaeological survey, & salvage excavation of Site 50-OA-G5-37	Upland Kaneohe, Phases I & II (Project 138)	1975-1976

36 known or recorded sites for the entire *ahupua'a** (Table I-2), and none of these sites were located within the flood-control project area. Most of the known sites had been recorded in 1930 by Bishop Museum archaeologist J. Gilbert McAllister during his early survey of archaeological and traditional sites on Oahu (McAllister 1933). Many of the *heiau* sites (pre-Christian places of worship) had been first described earlier in the century by T.G. Thrum (1907, 1909, 1916). The only survey of Kaneohe archaeological sites done after McAllister's was Sterling and Summers' (Ms.) compilation of historical, traditional, legendary, and other pre-European information relating to Kaneohe, done as part of their study of Oahu sites.

Early excavations in Kaneohe involved the extensive Hawaiian burials in the sand dune of Mokapu Peninsula (Site 50-OA-G5-32; see Fig. I-1). Since the early part of the century, burial remains had been observed, and unsystematically collected, as they eroded out of the sand dune. The first supervised excavations were conducted in both the Heeia and Kaneohe portions of the Mokapu dune, between October 1938 and January 1940, by University of Hawaii anthropology students and interested volunteers under the supervision of Gordon T. Bowles (University of Hawaii) and Kenneth P. Emory (Bishop Museum). These large-scale excavations were initiated on the basis of a test excavation conducted by Emory earlier in 1938 (Bowen 1974:132-133).

* *ahupua'a*--traditional land division, usually extending from the uplands to the sea.

Table I-2.

RECORDED SITES IN THE *AHUPUA'A* OF KANEOHE

Site No. 50-OA-G5	Site Type
-1	Mokapu fishponds (Halekou, Kaluapuhi, Nuupia)
-2	Spring (near top, Puu Hawaiiloa)
-3	Unassigned
-4	Papaa fishpond
-5	Hanalua fishpond
-6	Keaalau fishpond
-7	Fishponds (Kaluoa, Mahinui, Mikiola)
-8	Spring (Kinikailua-Manukaneohe)
-9	Ponds (Keana and Kalokohanaou)
-10	Ahukini Heiau
-11	Waikalua fishpond
-12	Laamaikahiki houses site (traditional)
-13	Kalaoa heiau (destroyed)
-14	Punaluu pond
-15	Ditch (traditional)
-16	Kanohuluiwi pond
-17	Puupahu Heiau (destroyed)
-18	Kalokahanahou fishpond
-19	Kawaewae Heiau
-20	Holua slide (destroyed)
-21	Puumakani Heiau (destroyed)
-22	Kamaikola (legendary site)
-23	Na Maka o Kana (legendary site)
-24	Puu-waniania Heiau
-25	Unassigned
-26	*Heiau*? (poss. house site)
-27	Three pana (distinguished places)
-27a	Hiilani Wai (traditional) (legendary stream)
-27b	Hiilaniwai (traditional) (altar?)
-28	Papuaa a Kane (traditional, legendary)
-29	Kukuiokane Heiau (destroyed)
-30	Kumukumu spring
-31	Kapoho (salt pans) (at Ka-lua-puhi)
-32	Mokapu sand dune burial ground
-33	Kuao (named, female stone)
-34	Kea-alau (former village site)
-35	Stone platform
-36	Burial (Mokapu dune site?)
-37 to -66	See Table I-3 for sites recorded during Flood-Control Project archaeological investigations
-67	Complex (extensive occupation deposits)

The second major excavation in Kaneohe was also on the Kaneohe portion of the Mokapu dune site (Bowen 1974:133). This excavation was conducted in 1957 by Robert N. Bowen, a University of Hawaii graduate student in anthropology, as part of his M.A. thesis research into patterns of Hawaiian disposal of the dead (Bowen 1961).

Prior to the archaeological investigations done by Bishop Museum as part of the flood-control project, McAllister's survey and the two Mokapu excavation projects constituted the only detailed archaeological investigations completed

in Kaneohe. The only other work has been the extended coastal survey and salvage work done in 1975 by Bishop Museum at the Kaneohe Marine Corps Air Station on Mokapu Peninsula. This work was conducted as part of the Kailua Effluent Force Main construction project of the Division of Sewers, City and County of Honolulu. Fieldwork consisted of the testing and salvage of extensive habitation deposits and burials in the dune facing Kailua Bay, extending from Kaluapuhi Fishpond to the base of Ulupau Crater. The entire site complex was designated as Site 50-OA-G5-67. Fieldwork was completed in December 1975, and the report on the work is in preparation. Preliminary age-determination analyses, involving hydration-rind dating of basaltic glass, have indicated that portions of the site complex were occupied as early as the middle of the 13th century A.D.

Kamo'oali'i Phase I--Reconnaissance Survey (1972)

The initial archaeological and botanical surveys for the Kaneohe-Kailua Flood-Control Project were conducted by Bishop Museum for the Corps of Engineers under Contract No. DACW84-72-C-0007. The study objectives of this inventory of the project area included:

1. Identification, location, and preparation of an inventory of all archaeological and historical remains;
2. Preparation of a biota inventory, with major emphasis on botany;
3. Formulation of recommendations regarding the preservation or alternative treatment of significant cultural or natural features; and
4. Formulation of recommendations regarding the incorporation of such features in the plans for recreational development.

Fieldwork was conducted in January 1972 under the direction of archaeologists Patrick McCoy and Aki Sinoto, and botanist Ranjit Cooray. During the archaeological reconnaissance, 30 new sites were recorded within this previously unknown area of Kaneohe (Table I-3). The final report on the archaeological and botanical surveys was submitted to the Corps of Engineers in April 1972 (McCoy, Sinoto, and Cooray Ms.), and is presented in this volume as Report 3.

Kamo'oali'i Phase II, Part 1--Intensive Survey and Test Excavations (1973)

Based on findings of the initial reconnaissance, recommendations were made for further archaeological study. These recommendations, subsequently modified in discussions between Bishop Museum and the Corps of Engineers, formed the basis for the intensive survey and test excavations conducted in 1973. This work, done for the Corps of Engineers under Contract No. DACW84-73-C-0018, involved detailed site recording and mapping, and test excavations at seven sites (Table I-3). Study objectives for this work included:

1. Intensive investigation of the seven specified sites to determine their function and cultural association; and
2. Consultation with the National Park Service regarding recommendations for possible subsequent detailed site studies.

Fieldwork was conducted in February and March 1973, under the direction of archaeologist Patrick McCoy. The final report on the intensive survey and test

Table I-3.

SITES INVESTIGATED DURING ARCHAEOLOGICAL RESEARCH IN UPLAND KANEOHE

Site No. 50-OA-G5	Site Type	Type of Investigation* RS	IS	SE
-11	Waikalua fishpond	X		
-37	Earthen mound	X	X	X
-38	Earthen embankment, depression & platform	X	X	
-39	Retaining wall	X		
-40	Stone alignment (terrace border?)	X		
-41	Stone alignment	X		
-42	Seepage well?	X		
-43	Seepage well & ditch	X		
-44	Stone alignment	X		
-45	Habitation site (historic)	X	X	
-46	Habitation site (historic)	X	X	
-47	Ditch	X		
-48	Burial (modern)	X		
-49	Circular depression	X		
-50	Terrace complex	X		
-51	Retaining wall	X		
-52	Ditch	X		
-53	Charcoal oven (historic)	X		
-54	Terrace complex	X	X	
-55	Charcoal preparation pit/site (historic)	X	X	
-56	Terrace complex	X		
-57	Terrace complex	X		
-58	Terrace & stone mounds (historic)	X		
-59	Stone alignment & mound	X		
-60	Retaining wall	X		
-61	Charcoal oven (historic)	X		
-62	Retaining wall	X		
-63	Terrace complex	X		
-64	Enclosure & stone platform	X	X	
-65	Ditch system	X		
-66	Ditch	X		

* RS--Reconnaissance Survey (Kamo'oali'i Phase I [1972]).
IS--Intensive Survey & Test Excavations (Kamo'oali'i Phase II, Parts 1 and 2 [1974]).
SE--Salvage Excavations (Upland Kaneohe Phase II [1975]).

excavations was submitted to the Corps of Engineers in July 1973 (McCoy Ms.), and is presented in this volume as Report 4.

Kamo'oali'i Phase II, Part 2--Supplemental Archaeological Resource Examination of Site 50-OA-G5-37 (1973-74)

Based on the findings of the intensive survey and test excavations, two major recommendations were made:

1. Intensive excavation investigation of Site 50-OA-G5-37, an earthen mound which appeared to be a unique Hawaiian site--a stratified prehistoric habitation mound; and
2. Investigation (intensive survey and test excavations) of the lands *mauka* of the flood-control project area, above the proposed H-3 Highway right-of-way, up to the base of the Koʻolau Mountains, in order to obtain information essential to a fuller comprehension of the sites and settlement patterns within the flood-control project area, and upland Kaneohe in general.

While these recommendations were being considered, the Bishop Museum conducted supplemental test excavations at Site 50-OA-G5-37. This work, done for the National Park Service under Contract No. CX800030028 T, was intended to determine the presence or absence of any significant subsurface cultural remains in the area immediately adjacent to, and possibly associated with, the earthen mound feature.

Fieldwork was conducted in August 1973 under the direction of archaeologist Patrick V. Kirch; work was continued in December 1973 and early January 1974. Reports on the supplemental research examination were submitted to the National Park Service in August 1973 (Kirch Ms.a) and February 1974 (Kirch Ms.b). The final report on the supplemental research examination of Site 50-OA-G5-37 is presented in this volume as Report 5.

Upland Kaneohe Phases I and II--Intensive Survey and Salvage Excavations of Site 50-OA-G5-37 (1975-76)

Initially, the final archaeological work to be done as part of the flood-control project was intended to follow the two recommendations made in the earlier report on the intensive survey and test excavations (Kamo'oali'i Phase II, Part 1; Report 4, this volume); but since it proved impossible to obtain right-of-entry permission from private landowners, it became necessary to delete the proposed intensive survey and testing of sites in the *mauka* lands beyond the flood-control project area.

The revised study objectives for the final archaeological work were limited to the following:

1. Intensive survey of two project-area access-road corridors;
2. Intensive survey of historical knowledge of the project area and its immediate surroundings;
3. Complete salvage excavations of the earthen mound, Site 50-OA-G5-37; and

4. Production of a written integrative narration concerning past human occupation and exploitation of the project area and immediately surrounding area of upland Kaneohe.

The complete salvage excavation of the earthen mound was done in accordance with the Memorandum of Agreement between the National Advisory Council, the Hawaii State Historic Preservation Officer, and the Army Corps of Engineers. This Memorandum stated their agreement that salvage excavation constituted satisfactory mitigation of the adverse effect of the flood-control project dam construction upon Site 50-OA-G5-37.

The upland Kaneohe intensive survey (Phase I) and salvage excavations (Phase II) were conducted for the Corps of Engineers under Contract No. DACW84-75-C-0020. Fieldwork was carried out between July and October 1975 under the direction of archaeologist Paul H. Rosendahl. A preliminary report was submitted to the Corps of Engineers at the end of fieldwork (Rosendahl Ms.) The final report on the salvage excavations is presented in this volume as Report 6. The final report on the historical research is presented in this volume as Report 2, and the integrative narration is presented as Report 1. With submission of these reports, all archaeological work necessary in connection with the flood-control project can be considered completed.

ENVIRONMENTAL SETTING

The area of the Kaneohe-Kailua Flood-Control Project is located on the windward side of Oahu Island, within Kaneohe Ahupua'a, Ko'olaupoko District. The project area is situated in upland Kaneohe, c. 3.2 miles inland along Kaneohe Stream from Kaneohe Bay, below the precipitous *pali* (cliffs) of the Ko'olau Mountains. The project area, including the five acres (2.03 hectares) of downstream channel improvements, totals approximately 423 acres (171.32 hectares).

The following discussion of the local environment of the project area has two objectives: (1) to present a descriptive summary of the present environmental setting, and (2) to make inferences regarding the probable environmental setting at the time of prehistoric occupation. Information on the present local environment has been abstracted from a limited number of sources (Blumenstock and Price 1972; Foote et al. 1972; Stearns and Vaksvik 1935; Taliaferro 1959; Takasaki et al. 1969; U.S. Army Corps of Engineers 1974).

PRESENT ENVIRONMENT

Climate

The project area is within the Hawaiian climatic-region type defined as windward lowlands--a moderately rainy region with frequent tradewind showers, commonly partly cloudy to cloudy, and a uniform and mild temperature (Blumenstock and Price 1972:200). Annual rainfall within the project area averages about 65 to 75 inches (1,651 to 1,905 mm), approximately 70% of which falls during the winter season (October to April). The average yearly temperature is about 74°F, with monthly averages varying from 71°F (March) to 77°F (August). The NE tradewinds

prevail most of the year. Winds tend to be light and somewhat variable within the project area. Days generally are partly cloudy or cloudy.

Geology

The project area is almost entirely covered with Late Pleistocene age, consolidated, non-calcareous sediments, principally older alluvium and colluvium, which overlie portions of the dike complex of the Tertiary and Early Pleistocene Koolau volcanic series. Along present streams are more recent, unconsolidated, non-calcareous sediments, principally younger alluvium. Halekou Hill, the remains of a cinder cone of the Kaneohe volcanics of the Middle to Late Pleistocene Honolulu volcanic series, is situated at the eastern boundary of the project area.

Topography

The elevation of the project area, from the dam site to the *mauka* limits, ranges from c. 120 ft (36.6 meters) mean sea level, to about 350 ft (106.7 meters). The general terrain comprises an undulating series of often steep-sided, domed ridges and narrow valleys or drainage swales. The overall slope of the ground surface within the project area, as measured along the west bank of Kamo'oali'i Stream, generally averages IV on 10H (10% slope).

The terrain is dominated by two major physical features: (1) Halekou Hill, the cinder cone, 300 ft (91.5 meters) high, forming the eastern project area boundary, against which Kamo'oali'i Stream has cut; and (2) seven radial valleys or drainage swales and intervening ridges which all terminate at or near the dam site. These swales are natural stream erosion features. Four of the seven, Kamo'oali'i and Kuou Streams and two unnamed streams, are perennial, while the others are swampy drainages which flow intermittently during the winter rainy season.

Kamo'oali'i Stream and its several tributaries compose the major stream draining the project area. The spring-fed headwaters are situated in the Ko'olau Mountains, at an elevation of about 2,500 ft (762 meters). The drainage area above the dam site, including the portion of the basin beyond the immediate project area, farther *mauka* to the base of the *pali*, varies from 1.0 to 1.8 miles (1.61 to 2.9 km) in width, and is about 2.2 miles (3.54 km) long, yielding a total drainage basin area of about 3.14 square miles (2,010 acres, 813 hectares). Kamo'oali'i Stream and the other streams of the project area flood at times, in response to high-intensity rainfall within the drainage basin.

Soils

The soils of the project area are of the Lolekaa-Waikane association--generally deep, well-drained soils with dominantly fine-textured subsoils. The principal soils present are those of the Lolekaa and Hanalei series. The former are composed of Lolekaa silty clays, well-drained soils that cover the domed ridges and sides of the several valleys, and vary in slope from 3% to as much as 70%. In general, the *makai* portion of the project area has more of the

steeper slopes (25 to 40%), while the *mauka* portion has broader areas of less slope (3 to 15%). Along the drainage courses of the various streams are found the poorly drained soils of the Hanalei series, Hanalei silty clay and stony silty clay (1 to 6% slopes).

Flora

A botanical survey of the project area was conducted as part of the initial reconnaissance survey (Kamo'oali'i Phase I). The results of that survey are presented in this volume as part of Report 3. Included is a summary of major vegetation cover types, along with plant lists for the most typical plant associations. The project area is a mosaic of three major vegetation cover types--herbaceous, scrub, and forest. Herbaceous covers, composed principally of exotic species, include tall grass covers in depressional areas and in moderately to well-drained areas. Scrub covers, composed of both native and exotic species, are found bordering depressional areas, along stream beds, and on sloping and well-drained areas. Forest covers, composed principally of exotic species, are found on low-lying to well-drained areas and on slopes. A portion of the project area (c. 45 acres, 18.23 hectares) is under intensive banana cultivation. Most of the project area, excepting the steep slopes, has been under banana, rice, taro, or pineapple cultivation during the historic period.

Approximately 30% of the project area is occupied by exotic introductions such as tall panicum or California grass (*Panicum purpurascens* Raddi, synonym, *Brachiaria mutica* [Forst.] Stapf), broomsedge (a grass) (*Andropogon virginicus* L.), Java plum (*Eugenia cuminii* [L.] Druce.), and guava (*Psidium guajava* L.). The principal native species noted within the project area are *hau* (*Hibiscus tiliaceus* L.), as scrub cover bordering depressional areas and along stream beds, and as forest cover on low-lying to well-drained areas; *'ōhi'a-lehua* (*Metrosideros collina* [Forst.] Gray subsp. *polymorpha* [Gaud.] Rock), as scrub cover on sloping and well-drained areas; coconut (*Cocos nucifera* L.), as forest cover on low-lying to well-drained areas; *kukui* (candlenut, *Aleurites moluccana* [L.] Willd.), as scrub cover along stream beds and on sloping and well-drained areas, and as forest cover on low-lying to well-drained areas; ti (*ki*, *Cordyline terminalis* [L.] Kunth), as scrub cover along stream beds and on sloping and well-drained areas, and as forest cover on low-lying and well-drained areas; *hala* (screwpine, *Pandanus odoratissimus* L.f.; synonym, *P. tectorius* Sol.), as scrub cover on sloping and well-drained areas, and as forest cover on low-lying to well-drained areas; and *hoi* (bitter yam, *Dioscorea bulbifera* L.), as scrub cover along stream beds, and as forest cover on low-lying to well-drained areas.

Fauna

The fauna of the project area is quite limited in both species and number. Faunal species are almost entirely introduced species. Several species of introduced birds are present, including the Brazilian cardinal (*Paroaria cucullata* [Latham]), the Kentucky cardinal (*Richmondena cardinalis* [L.]), the white-eye (*Zosterops palpebrosus japonicus* Temminck & Schlegal), the English sparrow (*Passer domesticus* [L.]), the ricebird (*Munia punctulata topela* Swinhoe), the Pekin nightingale (*Liothrix lutea* [Scopoli]), and the Shama thrush (*Kittacincla macroura* [Gmelin]). Also noted within the project

area was the native black-crowned night heron (*Nycticorax nycticorax hoactli* [Gmelin]).

Feral pigs (*Sus scrofa* L.) are found in the more remote parts of the project area. The African snail (*Achatina fulica* Bowdich) is found everywhere. The streams are inhabited by crayfish, swordtails, snails, caddisfly larvae, and an endemic freshwater goby (*'o'opu nākea, Chonophorus stamineus*).

PREHISTORIC ENVIRONMENT

There is no evidence to suggest that the environment of the project area, at the time of prehistoric occupation, was in any way significantly different than at present, in terms of climate, geology, or soils. The obvious differences are in flora and fauna, where the great proportion of historically introduced species indicates the extensive replacement of native flora and fauna. Less obvious are possible minor differences in topography that can be inferred as possibly resulting from prehistoric exploitation activities.

On the basis of the present environment, it is possible to infer the probable general environment of the project area at the time of initial prehistoric occupation. Most likely the area comprised a mixed, mesophytic forest dominated by *kukui* and *hala*, with *'ōhi'a-lehua*, *koa* (*Acacia koa* Gray) and *'ōhi'a-'ai* (mountain apple, *Eugenia malaccensis* L.) also being prominent. *Kukui* would have occupied principally the valley bottom lands, with *hala*, *'ohi'a-lehua*, and *koa* on the slopes and ridges. Beneath this forest cover the most common vegetation was probably ti (*kī*) and a variety of native grasses and ferns (especially *Gleichenia*). The nature of the fauna is uncertain, but probably comprised a wide range of native bird species, as well as feral pigs.

Prehistoric Hawaiian exploitation of natural forest products probably had very little effect on the floral and faunal composition of the project area environment. The mixed mesophytic forest land was also undoubtedly utilized by the prehistoric Hawaiians for dryland swidden (slash and burn) cultivation. Such cultivation would have involved the clearing of land plots on the natural terraces of the narrow valley bottoms, and on the slopes and ridges, most likely by cutting and burning, in preparation for planting a variety of appropriate cultigens.

The intensity of this cultivation is unknown, making it difficult to suggest the nature or extent of floral regrowth permitted, or the degree to which forest clearing and cultivation might possibly be related to eventual degradation of the local landscape, particularly in the form of sheet and gully erosion. The latter possibility can be suggested, on the basis of the evidence from Site 50-OA-G5-37 for recurrent prehistoric flooding of Kamo'oali'i Stream. Similarly, forest clearing and cultivation might also have caused eventual generation of open lands with fern and grass cover, as climax vegetation, on upper slopes and ridges.

The local environment of the project area at the time of prehistoric occupation was most likely much the same as at present, with the major

exception being the historically introduced plant species which have so extensively replaced the native flora. As a setting for prehistoric exploitation, both dryland cultivation and procurement of natural forest resources, the project area was probably quite favorable, as long as exploitation, particularly the dryland cultivation, remained extensive rather than intensive, and allowed sufficient time for regeneration of natural vegetation covers.

LITERATURE CITED

Blumenstock, David L., and Saul Price
1972 "Climates of the States: Hawaii." IN *A Natural History of the Hawaiian Islands*. E.A. Kay (ed.). pp. 155-203. Honolulu: University of Hawaii Press.

Bowen, Robert N.
1961 "Hawaiian Disposal of the Dead." Unpublished M.A. Thesis (Anthropology). University of Hawaii.

1974 "Mokapu: Its Historical and Archaeological Past." IN *Early Hawaiians. An Initial Study of Skeletal Remains from Mokapu, Oahu.* Charles E. Snow. pp. 129-148 (Appendix A). Lexington: University of Kentucky Press.

Foote, Donald E., Elmer L. Hill, Sakiuchi Nakamura, and Floyd Stephens
1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*. U.S. Dept. of Agriculture, Soil Conservation Service.

Kirch, Patrick Vinton
Ms.a Field Report on Supplemental Archaeological Resource Examination of the Kamo'oali'i Mound Site (50-OA-G5-37), Oahu Island (1973). Manuscript in Dept. Anthropology, B.P. Bishop Museum.

Ms.b Final Report on Supplemental Archaeological Resource Examination of the Kamo'oali'i Mound Site (50-OA-G5-37), Oahu Island (1974). Manuscript in Dept. Anthropology, B.P. Bishop Museum. Included as Report 5 in this volume.

McAllister, J. Gilbert
1933 *Archaeology of Oahu*. B.P. Bishop Mus. Bull. 104. Honolulu.

McCoy, Patrick C.
Ms. Archaeological Investigations along Upper Kamo'oali'i Stream, Kaneohe, Oahu (1973). Manuscript in Dept. Anthropology, B.P. Bishop Museum. Included in this volume as Report 4.

McCoy, Patrick C., Aki Sinoto, and Ranjit Cooray
Ms. Environmental Inventory Study for Kaneohe-Kailua Flood-Control Project (1972). Manuscript in Dept. Anthropology, B.P. Bishop Museum. Included in this volume as Report 3.

Rosendahl, Paul H.
Ms. A Preliminary Report upon Completion of Archaeological Fieldwork in the Upper Kamo'oali'i Stream Drainage Area, Kāne'ohe, Ko'olaupoko, O'ahu, Hawai'i. Manuscript in Dept. Anthropology, B.P. Bishop Museum.

Stearns, Harold T., and Knute N. Vaksvik
1935 *Geology and Ground-Water Resources of the Island of Oahu, Hawaii.* Bulletin 1, Division of Hydrography, Territory of Hawaii.

Sterling, Elspeth, and Catherine Summers
Ms. The Sites of Oahu (1962). Notebooks on file in Dept. Anthropology, B.P. Bishop Museum.

Takasaki, K.J., G.T. Hirashima, and E.R. Lubke
1969 "Water Resources of Windward Oahu, Hawaii." U.S. Dept. of Interior; Geological Survey Water Supply Paper 1894.

Taliaferro, William J.
1959 "Rainfall of the Hawaiian Islands." Hawaii Water Authority. Honolulu.

Thrum, T.G.
1907 "Heiaus and Heiau Sites Throughout the Hawaiian Islands." *Hawaiian Annual.*

1909 "Heiaus and Heiau Sites Throughout the Hawaiian Islands." *Hawaiian Annual.*

1916 "Completing Oahu's Heiau Search." *Hawaiian Annual.*

U.S. Army Corps of Engineers - Pacific Ocean Division
1974 Ho'omaluhia--Kaneohe-Kailua Project, Oahu, Hawaii. Design Memorandum No. 3, Master Plan. Honolulu.

REPORT 1. INTEGRATIVE NARRATION

HAWAIIAN OCCUPATION AT KANEOHE, OAHU

by

Paul H. Rosendahl

PREFACE

This report presents "...an integrative narration of our best knowledge concerning past human use [of] and human incursions [into the project area], based on archaeological investigation of the [Kaneohe-Kailua Flood-Control] project area and historical survey of the project area and immediate surroundings."* Based on the findings of the detailed archaeological and historical investigations, this narration is intended for the general reader rather than professional archaeologists or other researchers.

Certain relevant limitations must be mentioned first. Prior to 1972, there were no known sites recorded within the project area. Of the 30 sites now recorded (Table 1-3), only a single site (50-OA-G5-37) was identified as definitely prehistoric; the remaining sites appear to be historic. This demonstrates the extent to which historic land modification, related to agricultural and ranching activities within the project area, has eliminated or substantially altered most traces of prehistoric occupation sites. The single prehistoric site was itself only a fortuitous survival--a remnant of a more extensive prehistoric site.

The paucity of archaeological work done to-date within Kaneohe is a second major limitation. This work is summarized elsewhere (Introduction). Kaneohe has only 37 recorded sites outside the project area; most of these are traditional or legendary sites, or sites that have been destroyed within the last 100 years (Table 1-2). Other than excavations conducted by Bishop Museum in upland Kaneohe as part of the flood-control project, the only archaeological excavations have been at coastal sites on Mokapu Peninsula--burial excavations at the Mokapu dune site (50-OA-G5-32) in 1938-1940 and in 1957; and recent salvage excavations of extensive occupation deposits (Site 50-OA-G5-67) located along the E shore of the peninsula, between Kaluapuhi Fishpond and Ulupau Crater.

The lack of knowledge about archaeological sites known to be present in the lands *mauka* of the project area is a final important limitation. The original intention was to conduct intensive survey and test excavations of sites in these lands, but private landowners denied entry permission. A preliminary look at this extensive area during the initial archaeological reconnaissance survey of the project area (1972) indicated the presence of many sites, several apparently prehistoric. The inability to investigate this area was unfortunate, as it undoubtedly would have provided data significant for interpretation of the archaeological remains found within the project area. The need for eventual investigation of this area remains obvious.

Given these limitations, this narration combines the knowledge of past human occupation and exploitation within the project area, as derived from the detailed archaeological investigations and historical research, with information from archaeological, ethnohistoric, and ethnographic sources relating to other areas of Kaneohe and the Hawaiian Islands. This integration presents a generalized account of the probable nature and sequence of man's prehistoric and early historic occupation and exploitation within the Kaneohe area.

---

* Contract No. DACW84-75-C-0020, "Scope of Work....", p. 1; revised August 22, 1975.

NARRATION

Traditionally a productive and populous land, the *ahupua'a* of Kaneohe was a large aboriginal land unit located in the Ko'olaupoko (Palikoolau) District of windward Oahu. Over 8 miles long, from Ulupau Crater at the end of Mokapu Peninsula to the peak of Puu Lanihuli, Kaneohe can be regarded as a traditional *ahupua'a*, a fundamental geographic unit of aboriginal Hawaiian social, political, and economic organization, comprising a sample of the local natural environment from the offshore coastal waters to the crest of the Ko'olau Mountains. In an early newspaper article on "Land Matters in Hawaii" (*The Islander*, 1875), C.J. Lyons summarized this native concept of basic land division:

> The Ahupuaa ran from the sea to the mountain, theoretically. That is to say the central idea of the Hawaiian division of land was emphatically central, or rather radial. Hawaiian life vibrated from *uka*, mountain, whence came wood, kapa, for clothing, olona, for fishline, ti-leaf for wrapping paper, *ie* for ratan lashing, wild birds for food, to the *kai*, sea, whence came *ia*, fish, and all connected therewith. Mauka [toward the mountain] and makai [toward the sea] are therefore fundamental ideas to the native of an island. Land...was divided accordingly [Lyons 1875:104].

As a setting for aboriginal Hawaiian occupation and exploitation, Kaneohe offered great potential, comprising one of the richest and most varied ranges of marine and terrestrial micro-environments to be found in the Hawaiian Islands. These included the off-shore (open sea) and in-shore (coastal) waters, the littoral area (full extent of tidal variation), the dry strand of Mokapu Peninsula, the lagoon and reefs of Kaneohe Bay, the brackish estuaries and swampy lands where streams enter the bay, the lowland alluvial floodplain and its numerous dissecting streams, the gently rolling forested uplands, the steep talluvial slopes between the uplands and the cliffs, and the sheer cliffs of the Ko'olau Mountains.

The date of the earliest occupation of Kaneohe is unknown, but it was probably as early as A.D. 400-600, the approximate date known for the early Bellows Site (018) a short distance down the windward coast of Oahu at Waimanalo. Perhaps even more so than Waimanalo, Kaneohe was an obvious choice for early settlement because of its exploitation potential. At present, the earliest known date from Kaneohe is c. A.D. 1250, from occupation deposits recently excavated on the east coast of Mokapu Peninsula. This late date is undoubtedly not representative of the earliest occupation; but the lands in Kaneohe, especially the coastal area, have been so extensively modified in historic times that any remains of early sites have most likely long been destroyed.

The early settlers of Kaneohe, whether they came from beyond the islands of Hawaii, or from elsewhere within the islands, brought with them a full cultural kit of materials and methods necessary for the exploitation of the rich environment. Marine resource areas of Kaneohe included offshore and inshore waters, and the lagoon and reef which supported innumerable species of

fish taken by hook and line, netting, and spearing; and a rich littoral area with shellfish, echinoderms, crustacea, and seaweeds which were simply gathered by hand. As well, sea birds were available. Early agricultural activities focused initially on the swampy areas and easily flooded lowlands near the coast, and on the drier low hills between the streams.

The land of Kaneohe was quite favorable to aboriginal Hawaiian occupation, and population increased accordingly. By late-prehistoric and early-historic times, Kaneohe was one of the most populous areas on Oahu, and perhaps anywhere in Hawaii. The early population was concentrated along the coast, in close proximity to the wide range of exploited micro-environments. Early population growth was rather slow at first, with more rapid increase around the 13th or 14th century, probably due to natural intrinsic growth within a particularly favorable environmental setting. This population growth was accompanied by increasing utilization and occupation of the more inland portions of Kaneohe.

Though basically a horticultural people, the aboriginal Hawaiians depended heavily upon the sea as their principal source of protein food. As well as intensively exploiting the various natural marine micro-environments, they created new ones by building and operating numerous fishponds along the coast, usually on the shallow reef near the mouths of freshwater streams. Exploitation of the terrestrial environment included principally agriculture and procurement of natural forest resources. From the upland forests they obtained a wide range of subsistence, industrial, ceremonial, and medicinal products--wood, fiber, bark, wild vegetables, birds, and feral pigs, to name only a few. Agriculture comprised two basic and contrasting types of cultivation: irrigated pondfield cultivation of wetland taro, and dryland swidden (slash and burn) cultivation of sweet potatoes and dryland taro. As well, Hawaiian agriculture incorporated an animal husbandry component based on the raising of pigs, dogs, and fowl.

Extensive irrigated pondfield systems were developed in Kaneohe. Perhaps some of the most complex to be found anywhere in the islands, these pondfield systems stretched along the numerous streams from several miles inland, continuing to the edge of the sea. Taro was grown in the pondfields, while sugarcane, ti, and bananas were raised on the earthen dikes which composed the borders of the pondfields. The low hills separating the lowland streams were planted in sweet potatoes, bananas, pandanus, *wauke* (paper mulberry) and dryland taro.

In the forested uplands, smaller and simpler systems of irrigated pondfields for taro cultivation were built along the numerous small streams. Pandanus and *kukui* were common along the bottoms and lower slopes of the gullies and drainage valleys through which these small streams flowed. Extensive dryland cultivation was practiced on the slopes and broad ridges of the drainage valleys. Plots of forest land were first cleared by cutting and burning, and then planted with such cultigens as sweet potatoes, dryland taro, yams, bananas, *wauke*, *'awa*, and *olonā*. After several years of use, the cultivation plots were abandoned, allowing natural vegetation to recover the land, and new plots were cleared and planted elsewhere.

The early population concentrated along and near the coast, with families residing in permanently occupied, scattered, small hamlets. Inland areas were frequently occupied in connection with upland cultivation and forest exploitation activities, but such occupation was generally only for short periods of time. With growing population came increasing occupation and exploitation of the farther inland portions of Kaneohe, and the gradual development of more permanently occupied inland residential hamlets. By late prehistoric times, the predominant pattern of settlement in Kaneohe was one of dispersed permanent habitation in both coastal and upland areas. This pattern of dispersed permanent residential occupation is that generally accepted as the traditional Hawaiian residential pattern, one which stressed reciprocal exchange of various subsistence products, and other goods and services, between often widely dispersed members of the local community, some living near the coast and engaged principally in marine resource exploitation, and others living farther inland and engaged principally in agricultural activities.

By late prehistoric times, and into the early historic period, Kaneohe was well-populated and extensively cultivated. The productive lands were valued and desired by the chiefs of several islands. At different times, Kaneohe was controlled successively by the high chiefs of Oahu, Maui, and Hawaii. One of the earliest historic accounts, that of Capt. Nathaniel Portlock, described in 1786 the abundance of the Kaneohe area:

> The bay [Kaneohe] all round has a very beautiful appearance, the lowland and valleys being in high state of cultivation, and crowded with plantations of taro, sweet potatoes, sugar cane, etc., interspersed with a great number of coconut trees, which renders the prospect truly delightful [Portlock 1789:74].

The richness and desirability of Kaneohe was further evidenced in 1795 by Kamehameha I who, after having conquered Oahu and distributed the lands to his favored chiefs and warriors, kept Kaneohe as his own personal property.

The historic period wrought increasingly swift and extensive change, both to the people and the landscape. As in many areas of Hawaii, Kaneohe suffered a serious decline in native population from the middle 1830s to 1860s. The first Protestant mission station was established in Kaneohe in 1835. In 1848, at the time of the Mahele (the division of lands between King Kamehameha III and the principal chiefs), most of Kaneohe was given to Queen Kalama. Native Hawaiian occupants retained small cultivation parcels and house lots scattered throughout the coastal lowlands, along the streams, and in the uplands.

The remainder of the 19th century and the early years of the 20th century saw continuing decline of the native Hawaiian population and increasing non-Hawaiian occupation and exploitation of Kaneohe. Westerners both leased and bought outright lands from the government and local landowners, and Kaneohe began to experience extensive modification of the landscape through large-scale commercial agricultural and ranching enterprises. Foreign labor, principally Chinese, and later Japanese and other ethnic groups, was first brought into Kaneohe around the 1860s to work the sugarcane fields. While wetland taro cultivation continued, especially production for commercial markets, many irrigated pondfield systems were shifted to rice cultivation.

The principal forms of land-use involved cultivation of sugarcane, and later pineapple, coffee, and bananas, and the development of extensive grazing lands for cattle. These activities and their associated modifications of the rural Kaneohe landscape continued up until the years immediately preceding World War II, when the rapid urbanization of the Kaneohe area began.

The findings of the archaeological investigations and historical research of the Kaneohe-Kailua Flood-Control Project area conform to the general patterns of prehistoric and historic occupation and exploitation that have been described already. The project area was located in the upland forest area. Though little specific can be said about the prehistoric period, both the survey and the salvage excavation of the single prehistoric site identified within the project area (Site 50-OA-G5-37) support one aspect of the general picture of late prehistoric utilization--short-term residential occupation associated with dryland cultivation and exploitation of natural forest products.

The more numerous historic remains evidence dispersed permanent residential occupation (Hawaiian, and later probably Oriental) and irrigated pondfield cultivation of taro and rice. Cultivation activities involved modification of the prehistoric landscape to an obvious but undetermined extent. Two sites indicated the local manufacture of charcoal. Commercial agricultural activity within the project area is evidenced by the large cleared areas (on the flat ridges) that were once planted in sugarcane, and subsequently pineapple, and the still-remaining remnants of more recent commercial banana cultivation. With the exception of some small areas of banana planting and truck gardening of vegetables on small leased plots, the project area was essentially abandoned by its last inhabitants, principally Japanese families, approximately 40 years ago.

LITERATURE CITED

Lyons, Curtis J.
1875 "Land Matters in Hawaii--No. 1." *The Islander* 1 (18). Honolulu.

Portlock, Nathaniel
1789 *A Voyage Round the World...in the 'King George' and 'Queen Charlotte.'* London: Methuen.

REPORT 2. HISTORICAL RESEARCH

THE HISTORY OF THE LAND OF KANEOHE

by

Marion Kelly

PREFACE

This narrative history has been compiled from the research materials provided by Mrs. Dorothy B. Barrère, by the author, and by Ms. Anne H. Takemoto, a partner in the firm Joerger-Takemoto, which was subcontracted by Bishop Museum to research and write a historic narrative of human use of and incursions into the Kaneohe-Kailua Flood-Control project area and immediate surroundings.*

Problems inherent in researching the history of the specific flood-control project area were avoided in this report by selecting the *ahupua'a* of Kaneohe as the general focus of research, and the immediate site and those *'ili* surrounding it as areas of particular focus. The initial report on the inventory of the area by McCoy, Sinoto, and Cooray (see Report 3) contains a brief sketch, based on notes prepared by Dorothy Barrère, on the history of the four *'ili* in the surrounding area--Hooleinaiwa, Kuou, Halekou, and Mahinui. This material will not be repeated here.

A bibliography provided in Exhibit A lists the sources searched by Takemoto.

Attempts were made to research specific site areas covered by the archaeological work; we were unable, however, to locate information any more specific than that which is presented herein.

* The manuscript report written by Anne H. Takemoto and submitted to Bishop Museum by Joerger-Takemoto is on file in the Department of Anthropology, Bishop Museum.

INTRODUCTION

The District of Ko'olaupoko, in which the *ahupua'a* of Kaneohe is located, was an important district because of its great productivity, both in agricultural produce and fishing resources. As a result, the area around Kaneohe Bay in Hawaiian times was one of the primary population centers on the Island of Oahu. In 1831-1832 the population for the seven *ahupua'a* from Kualoa to Kaneohe was 2,819 (Schmitt 1973:19). Kaneohe Ahupua'a had more than twice the population of the next-highest populated area (Heeia) in the Bay area. Together, Kaneohe and Heeia Ahupua'a contained over half of the Kaneohe Bay area population (Schmitt 1973:19). Indeed, it was for this reason that the Catholic Church obtained land at Ahuimanu in Heeia as early as 1845 and established a school there. At that time the area contained "the largest population center in Oahu outside of Honolulu town" (Mitchell 1972). And Kaneohe, one of the important, if not the most important, *ahupua'a* in Ko'olaupoko District, is mentioned in legends that reach far back into the history of Hawaii.

The population centers of Kaneohe and Heeia are reflected in the *kuleana* awards made in the mid-19th century: Kaneohe Ahupua'a contained 118 awardees of *kuleana* lands that were less than 10 acres each.* Heeia Ahupua'a contained 91 awardees of *kuleana* lands less than 10 acres each. Together, Kaneohe and Heeia contained over four times as many *kuleana* awardees as Kahaluu. Waiahole, Kaalaea, Waihee, and Kahaluu together did not have as many *kuleana* awardees as Kaneohe and Heeia. In addition Kaneohe contained 15 awardees to chiefs of lands over 10 acres each and seven *'ili* that were designated Crown Lands.

It can be safely stated that Kaneohe was a very important *ahupua'a* that was productive and attractive to many people, including chiefs, and to the Crown.

LEGENDS THAT MENTION THE LAND OF KANEOHE IN KO'OLAUPOKO

1. The Legend of Halemano (Fornander 1918 5(2):228-263)

In Chapter Two (pp. 238-241), the legend tells of Halemano and his beautiful wife, Kamalalawalu, trying to escape the unwanted attentions of Aikanaka, the high chief of Oahu. They travelled from Waialua to Kualoa, Ko'olaupoko, then to Kahaluu and finally to Moelana in Kaneohe where there was a large *'awa* (*Piper methysticum* Forst. f.) field.** They hid under the *'awa* leaves and were not found

---

*Data for figures on *kuleana* awardees taken from *Indices of Awards* ...1929:338-411.

**Moelana was a *mo'o 'āina* (a strip of land within an *'ili*) mentioned in the testimony of Piho's *kuleana* award (LCA 2539-B) and in that of Upai's *kuleana* award (LCA 2539). Both refer to Piikoi's *'āina* of Moelana as bordering their *kuleana* lands (Native Testimony vol. 14:63).

by Aikanaka, although many people of Kaneohe were looking for them. They finally escaped to Molokai from Makapuu.

In Chapter Five (pp. 258-263) of the same story, Kamalalawalu left Halemano in Waialua *mauka* and journeyed to Kualoa, Ko'olaupoko. There "...she met Waiahole, a chief of that place who was a single man." They lived there as husband and wife. Two Hawaii chiefs who had heard of her great beauty came looking for her. They were Huia from Puna and Kulukulua from Hilo. They sailed to Makapuu, landed their armies and marched overland through the land of Kaneohe where they "...met the enemy and the fighting began." Oahu's forces were eventually routed and a great slaughter took place at Waiahole. Kamalalawalu was found and taken back to Hawaii by the two chiefs.

2. The Legend of Puniakaia (Fornander 1918 5(1):154-163)

The hero of this legend is Puniakaia.* "Nuupia was the father and Halekou the mother of Puniakaia. The land of his birth was Kaneohe" (p. 154). Today Nuupia and Halekou are two large fishponds located next to Mokapu peninsula, which was divided between the *ahupua'a* of Heeia and that of Kaneohe.

3. Traditional Hawaiian History (Fornander 1919 6(2):239-257)

Tradition states that in the time of a chief called Auanini, while Mua-o-Kalani, a chiefess, and Kaomealani, a chief, were at Kaopulolia in Kaneohe, Oahu, a vessel arrived off Mokapu. The name of the vessel was "Ulupana" and the name of the captain was Molo-Lana, and the name of the captain's wife was Malaea. The names of the people on board the vessel were Olomana, Anini and Holokaniakani. These were not their proper names, however, but names given to them by those chiefs of the territories where they landed. The tradition does not say whether these people went away again, or whether they remained and settled in the country (p. 247).

4. The Story of Peapea (Fornander 1918 5(1):458-463)

Peapea was a nephew of Kahekili, King of Maui. Kahekili sent Peapea to inform Kahahana, King of Oahu, nephew and foster son of Kahekili, that he would like to confer with Kahahana about whether or not Kahekili's claims to land on Oahu had been rejected. Kahahana was living at that time in Kaneohe. It was there that Peapea met him and delivered the message. Kahahana had been advised by his counsellors to reject Kahekili's claims and to forcefully eject Kahekili from Oahu. They met in battle in Honolulu, but Kahekili's forces won and took the whole island in 1783 (Kamakau 1961:136).

After having won the island of Oahu, Kahekili and his warriors established themselves in the most productive lands: Kahekili lived at Kailua and his chiefly followers and supporters lived at Kaneohe and Heeia (Kamakau 1961:138).

---

* Puniakaia means "that which is concerned with fishing."

Naming of Kaneohe

Kaneohe, a place on Oahu. A woman asked another woman, "Is he a good husband?" The second woman replied, "He is a *kane ohe*" [He is like a bamboo knife; this is cruel and heartless] (Sterling and Summers Ms.:126).

Na maka o Kana (The eyes of Kana) [Site 50-OA-G5-23]

Not far upstream from Piho's land (GR 2707) is a hill called Namaka-okana (see Fig. 2). Once there was an ancient *heiau* at the top of the hill, and an old priest lived there, "...who ministered very many ages ago to a mystic hero named 'Kana', who came out of the reign of universal night...." The priest offered sacrificial *luau* in the temple and chanted to Kane Wai, who, upon hearing the priest's plea for aid, "...sent an order to the hidden streams to pour out a copious flow of clear mountain water..." (Parker Ms.:25-26). The hill itself resembled a human skull in its shape, "...and travellers moving on the *pali* road required no extra imaginative effort to discern the outlines of a human face." The marks on the front of the hill gave it the name, "Na Maka o Kana" (Parker Ms. 25-26).

The Plains of Kekele

In the *kula* (plain) below the *pali* on the way to the Mission Station was the area called Kekele. It is said to have been named for a Hawaiian woman. She was beautiful and her favorite flowers and vines were the *hala* (*Pandanus odoratissimus* L.f.), *maile* (*Alyxia olivaeformis* Gaud.), *'ie'ie* (*Freycinetia arborea* Gaud.), and all the fragrant leaves. The *hala* at Kekele was planted for her and it grows to this day (Fornander 1918 4(3):532).

Three Wives of Kane

Alongside Piho's land (GR 2707) runs the stream of Kamo'oali'i.* Into it flows various smaller streams. Above Piho's site there are three important, named streams: Mamalahoa, Kahuaiki and Hiilaniwai (Sterling and Summers Ms.: Map of Ko'olaupoko). The names of these three streams are said to be the names of three wives of Kane. The place where they all meet is called *Hooui a na keia o na wai a Kane*. Kane cannot meet any one of them separately, otherwise they would become jealous of each other. Should they become jealous, they would probably divert the course of their water and the people in the valley would suffer. Therefore, Kane had to meet them all together. At their place of meeting, they enjoyed each other's company and decided on how they could best supply the people with water (McAllister 1933:177).

---

* Literal translation: Chiefly *mo'o* (Pukui et al 1974:233). While the word *mo'o* can refer to a water spirit or to a land division within an *'ili*, the story given in 1953 about the naming of the stream indicates a preference for the water spirit.

Naming of Kamo'oali'i Stream

One story relates the naming of Kamo'oali'i Stream:

> A prince from Kaena Point was to meet a princess from Maui at a certain stream in Kaneohe. The princess arrived first and was met by a very handsome man whom she took to be the prince. But just as the real prince arrived, he saw his princess seized by a half-man, half-lizard and carried into the stream. Thus the name Kamooalii was given to the stream [Mrs. Zuttermeister, as told to her by her grandmother, Honolulu Archives, 1953, quoted in Sterling and Summers Ms.:140].

Traditional history has recorded the land of Kaneohe in several places. It is possible that there were more stories about Kaneohe at one time; as with the history of so many conquered peoples, however, they did not get recorded. Not only was Oahu taken over by the chiefs from Maui and Hawaii, but the Oahu population was drastically reduced by the epidemics of foreign diseases introduced into the islands in early historic times (Schmitt 1968:36-37; Malo 1951:245-246). Traumatic experiences such as these play havoc with the continuity of traditional histories from one generation to the next and their availability when efforts to record them are finally made.

The stories that were preserved indicate that the Hawaiian chiefs and "kings" of times past were involved in events that took place in Kaneohe. Kaneohe was far from being an unknown land.

EARLY DESCRIPTIONS OF THE KANEOHE BAY AREA

As early as 1786, Portlock visited the bay area and described the scene:

> ....The bay all round has a very beautiful appearance, the low land and valleys being in high state of cultivation, and crowded with plantations of taro, sweet potatoes, sugarcane, etc., interspersed with a great number of coconut trees, which renders the prospect truly delightful [Portlock 1789:74].

A visitor in 1845-46 wrote:

> ...[From the foot of the Pali] thence the road passed through a dense coppice of Pandanus trees laden with large fruits and beautiful male flowers in long sheaths " [Bille, Steen Report on the Voyage of the Danish Corvette "Galathea," round the world, in the years 1845-'46-'47. Translated from the Danish by F. Banning, p. 126; quoted by Sterling and Summers Ms. 129].

Within this land of Kekele is the forest of Moelana, referred to "in the old songs and traditions as the sweet land of fragrance and perfume" (Dictionary of Hawaiian Localities, Saturday Press, Oct. 6, 1883).

By 1866, "the sweet land of fragrance and perfume" was beginning to be more of a memory than a reality:

> Kekele is the land just below Nuuanu, so fragrant with the hala blossoms and fruit used for leis. It was a rich land a while ago but now there are not many plants because animals (cattle, horses, etc.) are permitted there. [Pualewa, W.N. "No Ka Aoao Hikino o Koolaupono" Ke Au Okoa, Nov. 12, 1866, Oahu Place Names, quoted by Sterling and Summers Ms.:207].

In 1853 a visitor travelling over the *pali* and through the Kaneohe area wrote:

> ...From the precipice [*pali*], the plains below present the features of a fine landscape. They are marked by heavy undulations, and rent in many places by shallow ravines. Hundreds of cattle may be seen feeding on the rich pasture with which these plains are covered, adding to the landscape an exquisite finish" [Bates 1854:104].

This same traveller wrote about the taro plantations he saw in Ko'olaupoko:

> Some of these [taro] plantations vary in size from a forty-feet square to two or three acres. Like many of the fish-ponds, the size indicates the wealth and rank of the owner. Forty square feet of land planted with *kalo* will afford subsistence for one person during a whole year. A square mile of land planted with the same vegetable will feed fifteen thousand one hundred and fifty-one persons for the same length of time [Bates 1854:104].

A footnote adds the following:

> The above estimate is made by allowing paths, three feet wide, between each piece of ground of forty square feet. The great ease by which the natives sustain themselves is thus explained [Bates 1954:104].

Undoubtedly the writer means to say that the taro gardens are forty feet square (40 by 40 ft), rather than "forty square feet" (4 by 10 ft) as he says in his footnote.

In describing Kaneohe in the late 1930s, Handy says this:

> Kaneohe is one of the most complicated terrace areas in the islands. It can be comprehended only in the light of its stream system. It is still one of the most active communities in planting commercial taro, and a goodly portion of its lowland terraces, tucked away in pockets flanked and often hidden by low

> hills or by the town itself, are still planted in taro (for milling) by Hawaiians who own the land and by Orientals who lease land or are hired [Handy 1940:97-98].

Handy reported that the *kula* lands between the streams were planted in pandanus, *wauke*, bananas, and sweet potatoes. The dry taro plantations among the upper reaches of the streams to the west of the highway were planted in Oriental taro. He maintained that the "number of names of *'ili* and *kuleana* on *kula* lands along the Hiilaniwai* [stream] and its tributaries, however, indicates intensive cultivation of products other than taro" (Handy 1940:99).

The early descriptions of Kaneohe refer to its "beautiful appearance," "high state of cultivation," and forests of "Pandanus trees." Later descriptions indicate a reduction in forest and transformation of the heavily covered land into rolling plains; pastures with "hundreds of cattle... feeding...." Even when these changes were taking place, there were still many taro plantations cultivated by Hawaiians living at Kaneohe. With roaming cattle, however, the *kula* (dry uplands) lands soon became impossible to cultivate.

THE LAND

Land Tenure in the Kaneohe Bay Area

When Kamehameha I apportioned the conquered Oahu lands in 1795 to his warrior chiefs and counsellors (Ii 1959:69-70), he retained the *ahupua'a* of Kaneohe as his personal property. Kamehameha's own tax-collecting god, the *akua poko*, collected tribute from Kaneohe during the Makahiki (Ii 1959:75-76). Most of Kaneohe was inherited as personal lands by Kamehameha's sons Liholiho and Kauikeaouli, Kamehameha II and III (Interior Dept. Records).

Previous to the Mahele of 1848, the king's lands in Pali Koolau (Ko'olaupoko) and throughout Oahu were administered by Chief Boki, and later by his wife, Kuini Liliha, who served as governess of Oahu after Boki left in December, 1829, on his ill-fated voyage to the New Hebrides.** To assist her

---

* Hiilaniwai is translated "cherished water" (Pukui et al. 1974:45). Today this stream is called Kamo'oali'i.

** Boki, as governor of Oahu was responsible for collecting one-fourth of the debts (about $48,000.) of the Hawaiian king and chiefs claimed by the American resident traders in 1829, and for his own personal debts to the foreign merchants. He hoped to be able to pay off all debts with sandalwood collected in the New Hebrides. Unfortunately, the ship he was on was never heard from again, and the second ship failed to bring back any sandalwood (Kuykendall 1938:97).

with the administration of Kamehameha III's Oahu lands, Liliha appointed agents in various parts of the island. Liliha was Governess of Oahu until 1831 when she was removed.* Not all of Liliha's lands were taken away from her, nor all her power at that time. She continued to play the governess role in that district into the mid-1830s. When the Mission Station first opened in 1835, "...high chief Liliha, who officiated as a sort of 'Mother-superior' of the place [Ko'olaupoko] located her 'new teachers' [Missionary Parker and his family] on a little bluff on the edge of a beautiful bay [Kaneohe Bay]..." (Parker Ms.). After Liliha's removal, one of her agents, Kaiakoili,** was appointed as *konohiki* of the Ko'olaupoko District, of which Kaneohe was the most valuable part (Kamakau 1961:303).

Early Kaneohe Ahupuaa Land Records

At the time of the Mahele*** the bulk of Kaneohe Ahupuaa went to Queen Kalama, eleven *konohiki***** and three non-*konohiki*† as follows:

	Name	L.C.A. No.	Acres
1.	Kalama, Hazaleleponi	4452	9,500.00
2.	Piikoi, Kamakee	10605	52.90
3.	Piikoi, Iona	10605	43.50
4.	Hueu	8146	12.38
5.	Kapu	6400	266.41
6.	Kealoha, L.	7587	275.00
7.	Alapai	6748	25.75
8.	Kamakahonua	M.A. 35	52.54
9.	Puupuu	2622	2.06
10.	Kuaana, Ioela	7520	47.00
11.	Haole	M.A. 31	561.50
12.	Kawana, D.	5323	5.801
13.	Harbottle, William††	2937	141.20
14.	Mahoney for Nake†	3121	55.70
15.	A.B.C.F.M. (Mission)	387	31.23
Total			11,072.971

---

* Liliha had participated in a coup that failed and Kamehameha III was forced to remove her from office and from any control over his lands (Kamakau 1961:302-305).

** Kaiakoili was the son of Naeole, the Kohala chief whose family nurtured Kamehameha I in his infancy (Kamakau 1961:68-69).

*** The Mahele was the division of lands between the king and 245 chiefs in 1848. It separated undivided rights to individual parcels of land (*ahupua'a* and *'ili*). At that time the king recorded claims of Crown Lands amounting to somewhat less than 1,000,000 acres, the government about 1,500,000 acres, and the chiefs a little more than 1,500,000 acres (Kuykendall 1938:294).

**** *Konohiki* was the term used for the chiefs who were listed in the Mahele Book.

† Certain privileged persons received large land parcels, but were not listed as *konohiki* in the Mahele Book.

†† Non-*konohiki* privileged awardees who received large parcels of land.

To 117 *kuleana** claimants in Kaneohe Ahupua'a the Land Commissioners awarded 270.390 acres. No *kuleana* claimant received more than 12 acres, and some as little as 0.185 acres. The average *kuleana* award was 2.38 acres.

There were 54 non-awarded claims, of which two (Panalaau, No. 10799, and Maunahina, No. 10213) were *konohiki* listed in the Mahele Book.

Between 1849 and 1915 the Government sold 18 parcels of land to 16 purchasers, two of them buying two parcels each. The total amount of acreage sold was 369.148 acres. The range of parcel size was from 1.20 acres to 103.30 acres; the average number of acres to each purchaser was 23.071.

Early Records of Land Use in Kaneohe Ahupua'a

Testimony given at the time the Land Commissions were awarding *kuleana* lands in the mid-19th century provides interesting information about land use in Kaneohe.

The primary type of land claimed in Kaneohe was taro land, identified in the claims, testimony, and awards as *lo'i* (pondfields). Claims usually ranged from three to about 20 *lo'i*. One claimant listed 80 *lo'i* on three different pieces of land in the *'ili* of Luluku (LCA 2574). Some of the *konohiki* claims included large numbers of *lo'i*, although they often did not specify exactly how many. For example, Alapai, a *konohiki*, received eight acres of taro land (LCA 6748).

The claims and testimony for *kuleana* in the lands of Luluku and Kahooleinaiwi, which are close to the project site, are summarized in the following list:

LAND COMMISSION AWARDS IN THE 'ILI OF LULUKU AND KAHOOLEINAIWI**

Luluku:

LCA 2514 Makaiohua Claim: 6 parcels: (1) 24 *lo'i* at *mo'o'aina* Kamani; (2) 4 *lo'i* at Kahalepao; (3) 2 *lo'i* at Kapuahanui; (4) 4 *lo'i* at Ailehua; (5) 1 *kula* at Kamani; (6) 1 *kula* land at Kapuahanui, all in Luluku (N.R. 3:532).

Testimony: 5 parcels: (1) 4 *lo'i*; (2) 2 *lo'i* at Kapuahanui; (3) 4 *lo'i* in Ailehua; (4) 24 *lo'i* at Kamani; (5) houselot. Received from Kawelau while Liliha was alive (N.T. 14:66).

Award: 1 parcel, 3.69 acres (Aw. Bk. 9:353)

---

* Commoners were awarded *kuleana*, which usually consisted of the land they cultivated for themselves and their family, plus their houselot of 0.25 acres.

**Data taken from research by D. B. Barrère. N.R. = Native Register; N.T. = Native Testimony; F.T. = Foreign Testimony; Aw. Bk. = Award Books (see References).

LCA 2574 Hewahewanui Claim: (1) 29 *lo'i* in *mo'o'aina* of Mamalahoa; (2) 1 *lo'i* in Ailehua; (3) 50 *lo'i* in Kahonukahewa; (4) *kula* land. All in *'Ili* of Luluku (N.R. 3:561).

Testimony: 4 parcels of the above claimed: No. 2 has 8 *lo'i*; No. 3 has 10 *lo'i*.

Award: 3 parcels, 6.70 acres (Aw. Bk. 4:730).

LCA 2589 Palapu (deceased) for Kumehewa
Claim: 2 parcels, including 4 *lo'i* in *mo'o'āina* of Ailehua, 1 *lo'i* in Kahalepao (N.R. 3:568).

Testimony: 3 parcels: (1) *Mo'o'āina* Kahalepao; (2) 4 *lo'i*; (3) 1 *lo'i*. From Kawelau while Liliha was alive (N.T. 14:65; F.T. 14:189).

Award: 1 parcel, 9.79 acres (Aw. Bk. 4:731)

LCA 4223 Kapawa Claim: *Lo'i* and *kula* in one piece in *mo'o'āina* of "Okea" with 11 *lo'i* and orange and lemon trees (N.R. 4:227).

Testimony: Received from Kawelau in time of Liliha (N.T. 14:67).

Award: 1 parcel, 3 acres (Aw. Bk. 3:877).

LCA 4225 Kaneihoe Claim: 5 pieces: 3 contain 11 *lo'i* among them, 1 is *kula* land, and 1 a houselot (N.R. 4:227).

Testimony: 4 pieces, *kula* land dropped (N.T. 14:68). Received from Kawana about 1839 (F.T. 14:193).

Award: 2 parcels, 2.914 acres (Aw. Bk. 4:721).

LCA 4484 Keoho Claim: 10 *lo'i*, *kula* land and houselot, all in Luluku (N.R. 4:308).

Testimony: 7 *lo'i* in two parcels in the *mo'o'āina* of Ailehua: (1) 6 *lo'i*; (2) 1 *lo'i* (N.T. 14:61).

Not Awarded

LCA 4490 Kawelau Claim: 16 *lo'i*, 2 fallow *lo'i*, a *kula* land and houselot (N.R. 4:309).

Testimony for 2 parcels: (1) 2 *lo'i* and houselot; (2) 1 *lo'i* (N.T. 14:65).

Award: 1 parcel, 2.51 acres (Aw. Bk. 4:708).

LCA 4491 Kuapuu — Claim: 11 *lo'i*, 7 fallow *lo'i*, houselot, and *kula* land (N.R. 4:309).

Testimony: 2 parcels: (1) *mo'o'āina* and *kula* land; (2) houselot. Received from Kanihookamoku in time of Liliha. Borders on Luluku-Kuou (N.T. 14:61).

Award: 2 parcels, 4.266 acres (Aw. Bk. 9:355).

LCA 7619 Kikane — Claim: 7 *lo'i* in Ili of Luluku, in *mo'o'āina* of Kapuahanui and Kahalae; a *kula* land in *mo'o'āina* of Kapoana; several *kala* trees, 1 houselot, and 1 sweet potato garden at Ulupau (Mokapu). Received from Kaiakoili in time of Liliha (N.R. 5:417).

Testimony identified 2 parcels: (1) *mo'o'āina* of Kapoana with 27 *lo'i* and houselot; (2) 1 *lo'i* received from Kawelau when Liliha was alive (N.T. 14:461; F.T. 14:194).

Award: 1 parcel, 2.70 acres (Aw. Bk. 3:879).

Kahooleinaiwi:

LCA 2539 Upai — Claim: 1/2 of all *lo'i* (other half to sister's son) and 13 coconut trees (N.R. 3:545).

Testimony: 5 *lo'i* and 1 houselot in one piece (N.T. 14:63).

Award: 1 parcel next to Piho's land, 1.85 acres (Aw. Bk. 3:874).

LCA 2539-B Piho — Claim: 5 *lo'i*, 2 dry gardens and *kula* (N.R. 3:545).

Testimony: 5 *lo'i* and houselot. Received from Kaiakoili when Liliha was alive (N.T. 14:63).

Award: 1 parcel, next to Upai, 1.85 acres (Aw. Bk. 3:874).

The documentation is greater for the *'ili* of Luluku than it is for the *'ili* of Kahooleinaiwi. Still, included is interesting information about the names of the *mo'o 'aina* within the *'ili*, the numbers of taro *lo'i* being cultivated by the farmers and the lack of agreement in many cases between the claim put forth, the information provided by the testimony, and the final land included in the award.

Some of the disagreement can be explained by the *kuleana* law passed in 1850. It was permitted that the claimant be allowed only the land which he cultivated to support himself and his family and a 1/4-acre houselot. This excluded *kula* lands and incidental gardens that may have been cultivated in the uplands from time to time. No land was awarded on which the farmer might cultivate crops intended for the market. Thus, the small farmers were excluded from the growing market-economy. That was the province of the chiefs and the king. And it wasn't long before the chiefs' lands and Crown lands were turned

over to people who developed large sugar plantations. One of the awards (LCA 6400 to Kapu, a *konohiki*) mentions one of the parcels of land being claimed as "Kula and old lo'i land, southeast of a large cane-field and makai of the main road in the 'ili of Mahinui " (Awards Book 9:672).

Piho's Grant 2707

The land on which the excavated mound (Site 50-OA-G5-37) is located, and the land immediately surrounding the mound, is identified on a map of Kaneohe (Registered Map No. 2053) (Fig. 2-1) as land purchased from the Government by Piho (GR 2707) in 1860 (*Index*...1916:55).

The name Piho also appears in the *kuleana* land records as the awardee of LCA 2539-B. Piho's mother-in-law was a sister of a man by the name of Upai, a *konohiki* named in the Mahele award book as having been awarded one half of the *'ili* of Kahooleinaiwa, the other half having been relinquished by him to the government (Native Register Vol. 4:616 dated 2/11/1848). For reasons not made known, Upai failed to receive his half of the *'ili* (LCA 10,935, not awarded), and instead the claims he had placed for a small parcel of land for himself (LCA 2539) and an equal amount of land for his sister's son-in-law Piho (LCA 2539-B) were awarded.

According to the testimony taken by the Land Commissioners, previous to their making the *kuleana* awards, Upai had been living on a small parcel of land with his sister. Together they had planted coconut trees and grew taro in the *lo'i*. The land had been given to Upai by the land agent Kaiakoili while Liliha was still alive (before 1839). In filing his claim, it is apparent that Upai had already divided his parcel of land between his sister's son-in-law (1.85 acres) and himself (1.85 acres). Each parcel is described as having contained 5 *lo'i*, plus some *kula* land. The boundary of Upai's land was described as Piho's *lo'i* on three sides (*mauka*, Koolauloa, and *makai*) and Piikoi's *lo'i* of Moelana* on the Kailua side. The actual location of the *kuleana* award to Upai and Piho has never been clear. One map (Registered Map No. 2053; Fig. 2-1) tentatively located Piho's *kuleana* downstream from the location of Piho's Grant, but the location is not certain. None of the early maps locate Upai's *kuleana*.

Government land became available for purchase begining about 1849. In 1860 Piho purchased a piece of land containing nearly seven acres. This land is located on early maps (Registered Maps Nos. 585 and 2053; Figs. 2-1, 2-2) between two streams, Kuou and Kamooalii, and south of their confluence. It seems unlikely that Piho would purchase from the government the same pieces of land that were awarded him and his "uncle." It is more likely that he purchased another parcel of land, perhaps one that was close to his original *kuleana*.

---

* The precise location of Moelana is not clear, but it was mentioned as being part of the plain lands of Kekele below the *pali* (see p. 2-3), and it was mentioned as a place where *'awa* grew in large quantities in the legend of Halemano (see p. 2-1).

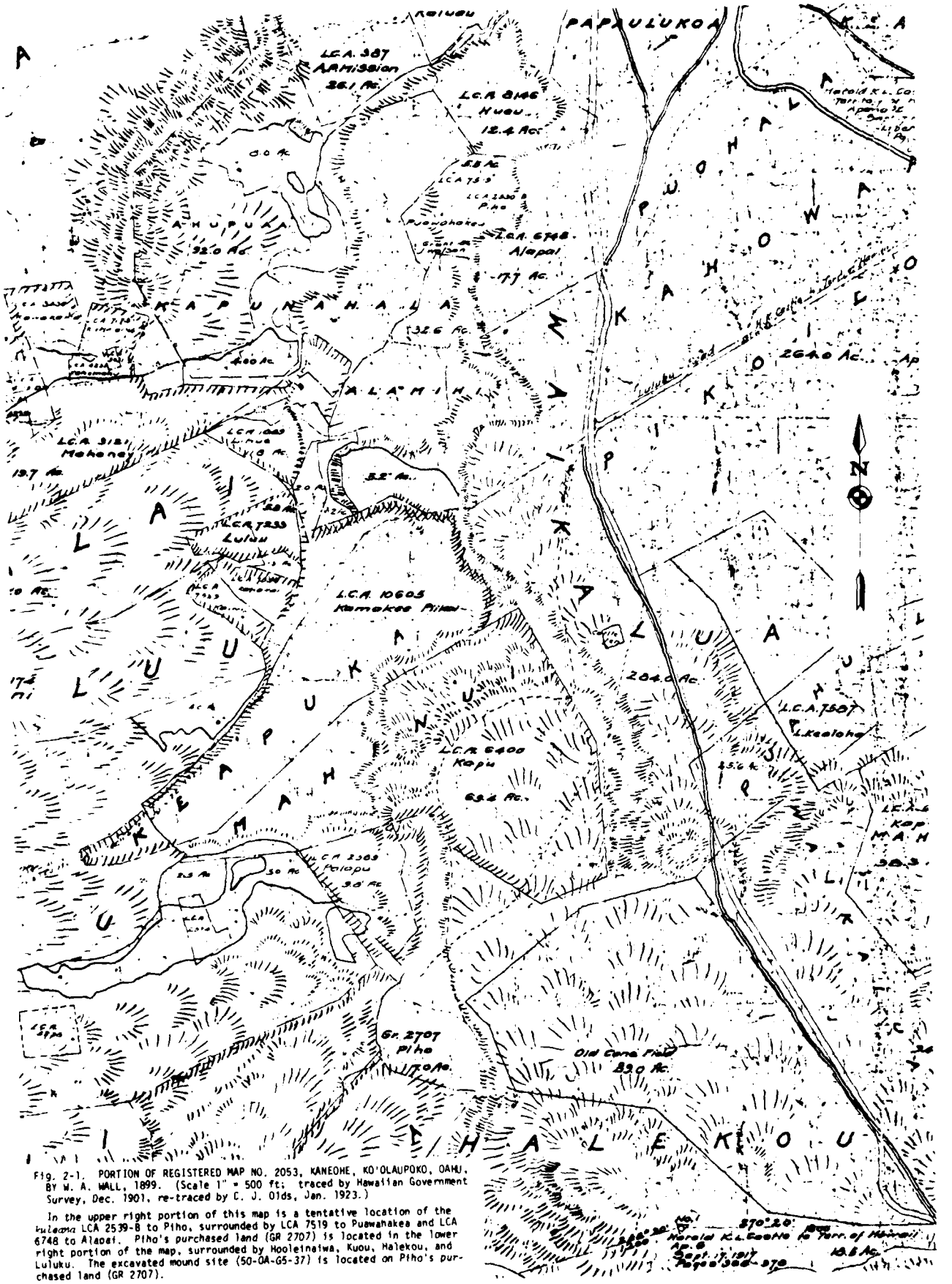


Fig. 2-1. PORTION OF REGISTERED MAP NO. 2053, KANEOHE, KO'OLAUPOKO, OAHU, BY W. A. WALL, 1899. (Scale 1" = 500 ft; traced by Hawaiian Government Survey, Dec. 1901, re-traced by C. J. Olds, Jan. 1923.)

In the upper right portion of this map is a tentative location of the *kuleana* LCA 2539-B to Piho, surrounded by LCA 7519 to Puawahakea and LCA 6748 to Alapai. Piho's purchased land (GR 2707) is located in the lower right portion of the map, surrounded by Hooleinaiwa, Kuou, Halekou, and Luluku. The excavated mound site (50-OA-G5-37) is located on Piho's purchased land (GR 2707).

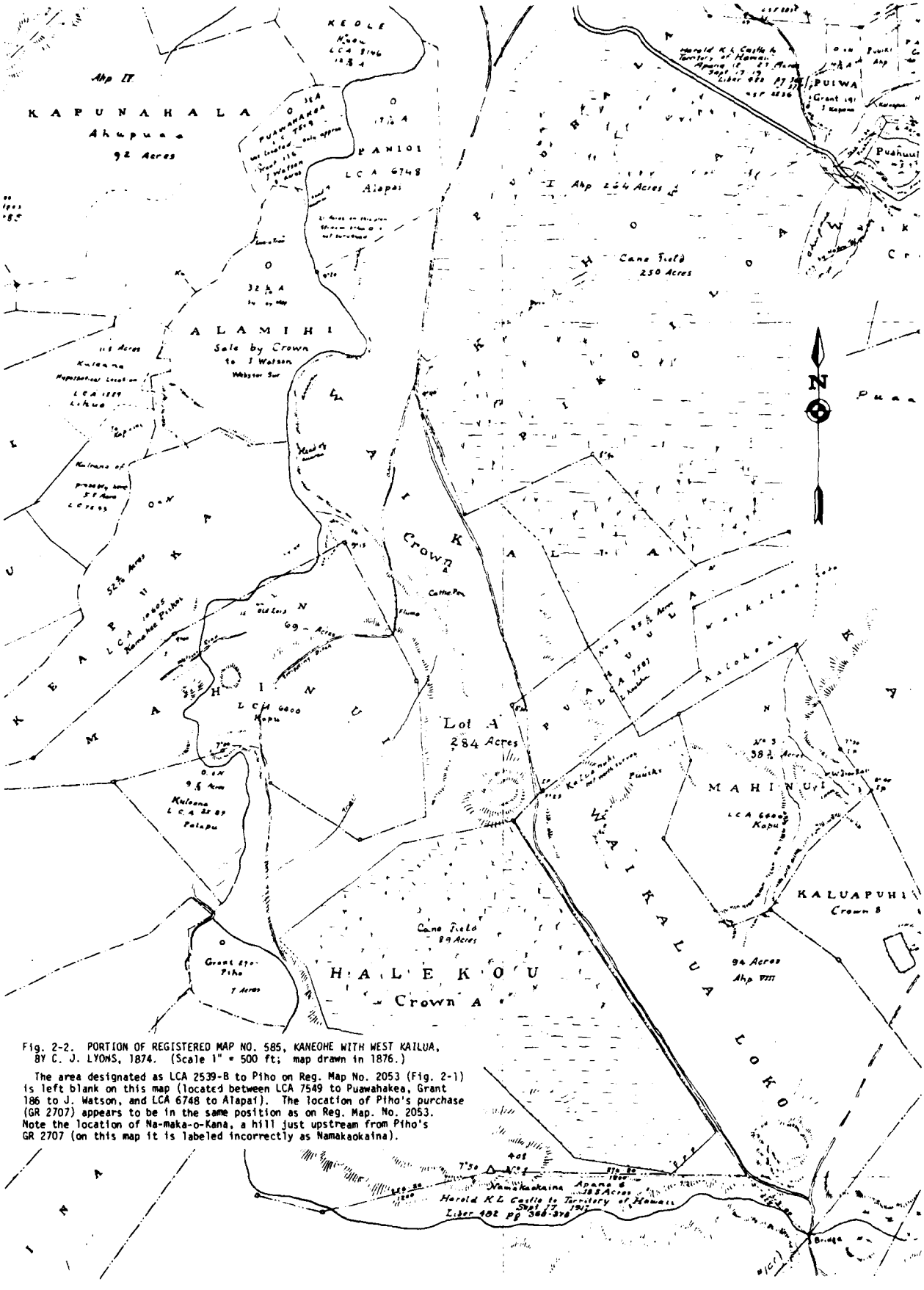


Fig. 2-2. PORTION OF REGISTERED MAP NO. 585, KANEOHE WITH WEST KAILUA, BY C. J. LYONS, 1874. (Scale 1" = 500 ft; map drawn in 1876.)

The area designated as LCA 2539-B to Piho on Reg. Map No. 2053 (Fig. 2-1) is left blank on this map (located between LCA 7549 to Puawahakea, Grant 186 to J. Watson, and LCA 6748 to Alapai). The location of Piho's purchase (GR 2707) appears to be in the same position as on Reg. Map. No. 2053. Note the location of Na-maka-o-Kana, a hill just upstream from Piho's GR 2707 (on this map it is labeled incorrectly as Namakaokaina).

According to Takemoto's report, the son of Upai and Piho both deeded their *kuleana* to M. Malaea, Piho's daughter, in 1869 (Bureau of Conveyances, Liber 28:236). In 1874 Piho divided his purchased land (Gr. 2707) with his wife Hanae; he claimed six *lo'i* for himself and gave her four. Grant 2707 ultimately went to Piho's daughter, Malaea, as stated by Mele Kaulani in the court suit, and in a deed in 1912 to J. Alfred Magoon (Bureau of Conveyances, Liber 372:141) (Takemoto Ms.).

After Mele Kaulani was declared owner of LCA 2539, 2539-B, and Grant 2707 in a circuit court decision, she deeded the land to her attorney, J. Alfred Magoon in 1912. Magoon sold the land to Bernhard Rudolf Banning in 1913. Upon Banning's death in 1923, all property was turned over to the Magoon trustees. In 1931, they sold the Banning estate to Harold K. L. Castle (Bureau of Conveyances, Liber 1144:39) (Takemoto Ms.).

From the foregoing, it can be assumed that Piho and his wife Hanae and their family were growing taro on their land in the terraces that are still there today. Perhaps even Piho's daughter, Malaea, continued to do likewise, although this is not clear from the records.

The sites on Piho's property (Gr. 2707) may be the remains of house foundations used by Piho or his daughter. Or they may have been used by people who worked the area before Piho purchased it.

During the period of time when the Land Commissioners were taking testimony and making awards to *kuleana* claimants, there were four major epidemics that swept through the land "in rapid succession in 1848 and 1849: measles, whooping cough, diarrhea and influenza. Together these four diseases killed more than 10,000...persons in little more than a twelve-month period" (Schmitt 1968:37). It is possible that this seven-acre farm had been cultivated by Hawaiians before Piho purchased it from the government. Located as it was, near the stream, it was probably excellent taro land that could easily support a man and his family.

None of the informants contacted remembered any families living on Piho's farm, nor did they recall any grave site there. During the period when the Homesteads were opened up in 1917, and thereafter, many of the people living in the area were Japanese farmers. Some of them had participated in Libby, McNeil & Libby's large pineapple operation.

One informant remembered a plantation somewhere in the general area that had been run by Germans who came to Kaneohe to grow cassava root (*Manihot*), but the environment was too damp, and the rainfall too high. The plantation was located toward the *pali* from the project site (Tape: Miller).

There is little information on the specific project area, but it is most likely that the sites found in the area of the Site 50-OA-G5-37 excavations were all on Piho's land (Gr. 2707); it is impossible to say whether the sites were connected with farmers cultivating that land before Piho, or whether they were connected with Piho's residence. Without additional data we cannot determine which was the case. It is possible for the land to have been used to grow crops by the homesteaders who moved into the area around the 1914-1915 period. But it is unlikely that they would have built the habitation features (Sites 50-OA-G5-45, -46) or other sites on Piho's land.

This particular parcel of land was probably not touched by the massive pineapple intrusion of the 1910s and -20s, because it is too low. Some homesteaders did plant pineapples, to sell to Libby, McNeil & Libby and sometimes to a small cannery that operated in Kaneohe town about a block *makai* of the main road, on William Henry Road (Tape: Miller).

One thing that seems fairly certain about this land is that it experienced heavy flooding in the past. Minor floods came up to the top of the bank where the farms were, but in 1921 or 1923 a heavy flood inundated the area, according to informants (Tapes: Miller; Honda; Haitsuka). People were forced to vacate their homes. The flood destroyed the rice, but there was little damage to taro. The water just rose steadily and covered everything. When it receded, there was not too much damage (Tape: Haitsuka).

Nearly all informants told about the charcoal-making that took place in the area. Many farmers made charcoal. Some of the rice farmers had cement areas where they cleaned the rice. Others had merely a hard-packed area of ground where they laid down a large canvas and cleaned the rice.

During the pineapple days, Castle leased many acres of land to Japanese farmers to grow pineapple for the cannery at Kahaluu. The concentration of land in the hands of a few large landholders permitted about 3,000 acres in the bay area to be cultivated in pineapple within a brief period of three or four years, starting with 1,000 acres in about 1911. When pineapple retreated, most of this land was abandoned; some of it went into other crops grown by small farmers, and some of it went into pastureland. Small pieces of land with terraces and irrigation ditches are still to be found tucked away along the stream banks where urbanization has not yet arrived. They stand as mute evidence of the industry of the Hawaiian farmers.

LITERATURE CITED

Award Books recorded by the Board of Land Commissions to Quite Land Titles in the Hawaiian Islands. Microfilm copy, Hawaii State Archives.

Bates, G. W.
1854 *Sandwich Island Notes*. Harper & Bros. New York.

Bureau of Conveyances Records, State Office Building, Honolulu, Hawaii.

Foreign Testimony recorded by Board of Land Commissions to Quiet Land Titles in the Hawaiian Islands. Microfilm copy in Hawaii State Archives.

Fornander, Abraham
1918-1919 *Hawaiian Antiquities and Folklore*. Bishop Mus. Memoirs. Vols. 4, 5, & 6. Bishop Mus. Press.

Handy, E. S. C.
1940 *The Hawaiian Planter*, Vol. 1. Bishop Mus. Bull. 161.

Ii, John Papa
1959 *Fragments of Hawaiian History*. Bishop Museum Press. Honolulu.

Index of All Grants and Patents
1916 Koolaupoko District, Oahu.

Indices of Awards made by the Board of Commissioners to Quiet Land Titles
1929 *in the Hawaiian Islands.* Territorial Office Bldg. Honolulu.

Interior Department Records, Hawaiian Kingdom. Hawaii State Archives.

Kamakau, S. M.
1961 *Ruling Chiefs of Hawaii.* Kamehameha Schools Press. Honolulu.

Kuykendall, Ralph S.
1938 *The Hawaiian Kingdom, 1778-1854.* U. Hawaii Press. Honolulu.

Malo, David
1951 *Hawaiian Antiquities.* Bishop Museum Spec. Pub. 2 (Second Edition). Honolulu.

McAllister, J. Gilbert
1933 *Archaeology of Oahu.* Bishop Mus. Bull. 104. Honolulu.

Mitchell, Donald
1972 "E Pali Ana no Koolaupoko." *Kalama* 2(5): January.

Native Register of *kuleana* claims recorded by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Microfilm copy in Hawaii State Archives.

Native Testimony recorded by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Microfilm copy in Hawaii State Archives.

Parker, Henry H.
Ms. Remeniscences: a Fragment. Typescript in Hawaiian Mission Children's Society Library. (n.d.) Honolulu.

Pukui, Mary Kawena, Samuel H. Elbert, and Esther T. Mookini
1974 *Place Names of Hawaii.* U. Hawaii Press. Honolulu.

Portlock, Nathaniel
1789 *A Voyage Round the World...in the 'King George' and 'Queen Charlotte,'* London.

Schmitt, Robert C.
1968 *Demographic Statistics of Hawaii, 1778-1965.* U. Hawaii Press. Honolulu.

1973 *The Missionary Censuses of Hawaii.* Pacific Anthropological Recs. No. 20. Dept. Anthropology, Bishop Mus.

Sterling, Elspeth, and Catherine C. Summers
Ms. The Sites of Oahu: Koolaupoko, Vols. 1 and 2 (1962). Notebooks on file in Dept. Anthropology, Bishop Mus. Honolulu.

Takemoto, Anne H.
Ms. Historical/Cultural Essay Report on Upper Kamo'oali'i-Kaneohe Stream. Joerger-Takemoto, January 1976.

EXHIBIT A

BIBLIOGRAPHY FURNISHED BY ANNE H. TAKEMOTO*

Secondary Sources

Kanahele, Clinton
1940 "Occupational Analysis of Kaneohe Region." Master of Education Thesis (1940). University of Hawaii, Honolulu.

McAllister, J. Gilbert
1933 *Archaeology of Oahu.* B. P. Bishop Mus. Bull. 104. Honolulu.

Pukui, Mary Kawena, Samuel H. Elbert, and Esther T. Mookini
1974 *Place Names of Hawaii.* Honolulu: University of Hawaii Press.

Sterling, Elspeth, and Catherine C. Summers
Ms. The Sites of Oahu (1962). In Dept. Anthropology, B. P. Bishop Museum.

Government Documents

Board of Water Supply, City and County of Honolulu.
A. J. Tyler to L. J. Watson, 8 December 1960. Comments on the memoranda of Mr. Lee and Mr. Mink regarding additional well at Kuou Springs.

John Francis Mink. "Water Supply and Demand in Southern Oahu." Paper presented at the Board of Water Supply Conference on April 30, 1974.

Ry-yik Wang. "Analysis of Pumping-Test Data of Kuou Wells, Oahu." January, 1969

Bureau of Conveyances Records, State Office Building, Honolulu, Hawaii.

Department of Public Works. City and County of Honolulu.
Search of Title.
Kamooalii-Kaneohe Stream Flood Control.

Search of Title.
Kamooalii Stream Debris Barrier.

First Circuit Court. State of Hawaii.
Mele Kaulani vs. David L. Kahaleaahu and James F. Morgan.
Equity E 01808.

Minnie Look aka Minnine Lock Lim vs. Mele Kaulani.
Law 14669.

Foreign Testimony recorded by Board of Land Commissions to Quiet Land Titles in the Hawaiian Islands. Microfilm copy in Hawaii State Archives.

*Historical consultant, Joerger-Takemoto

Indices of Awards made by the Board of Commissioners to Quiet Land Titles
1929 *in the Hawaiian Islands.* Territorial Office Bldg. Honolulu.

Interior Department. Kingdom of Hawaii. Files in Hawaii State Archives.
Land.
Honolulu, November 20, 1849.
Letter to Keoni Ana, Min. of Int., from Kuhalahala.

Honolulu, September 12, 1874.
Letter to W. L. Green, Min. of Int., from Kepipi.

Honolulu, September 17, 1874.
Letter to the Min. of Int. from John Watson from Richard F. Bickerton.

Honolulu, March 23, 1875.
Letter to W. L. Moehonua, Min. of Int., from C. J. Lyons, 1st Ass't. Government Surveyor.

Letters.
Honolulu, November 27, 1875.
Letter to Mr. Gulick, Clerk of Interior Office from C. J. Lyons, Assistant, Office of Government Survey.

Honolulu, May 29, 1885.
Letter to P. C. Jones, Esqr., Agent, Kaneohe Plantation, from Charles Gulick, Min. of Int.

Honolulu, June 2, 1885.
Letter to P. C. Jones, Kaneohe Plantation, from J. A. Hassinger, Chief Clerk.

Kaneohe Plantation. Files in Hawaii State Archives.
Journal from Kapakuhaili in the account with Charles C. Harris. January 1866 to January 1867.

Records. January 1865 to January 1867.

Land Court 669. State of Hawaii.
Application.

Decree of the Land Court.

Report of the Examiner.

Land Court 1002. State of Hawaii.
Report of the Examiner.

Native Register of *kuleana* claims recorded by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Microfilm copy in Hawaii State Archives.

Native Testimony recorded by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Microfilm copy in Hawaii State Archives.

Royal Patent. Kingdom of Hawaii. In Hawaii State Archives.

Newspaper Articles

Allen, Gwen
Honolulu Star-Bulletin. "Historic Kaneohe Was Early Missionary Site." October 22, 1958.

Daily Hawaiian Herald
"Burning of the Kaneohe Sugar Mill." October 6, 1866.

Pacific Commercial Advertiser
"Notes of the Week: Burning of a Sugar Mill." October 13, 1866.

Pali Press
June 13, 1958. p. 6.

Zalburg, Sanford
Honolulu Advertiser. "From Waimanalo to Kaneohe, 32,000 People." July 29, 1956.

Taped Interviews

Henry Haitsuka 10/17/75

Eugene Y. Honda 10/31/75

Richard C. Miller 11/19/75

REPORT 3. RECONNAISSANCE SURVEY

ENVIRONMENTAL INVENTORY STUDY FOR KANEOHE-KAILUA FLOOD-CONTROL PROJECT*

CULTURAL SURVEY

by

Patrick C. McCoy

and

Aki Sinoto

BOTANICAL SURVEY

by

Ranjit Cooray

*Originally prepared by the Department of Anthropology, Bernice P. Bishop Museum, for the U.S. Army Corps of Engineers-Pacific Ocean Division, under Contract No. DACW84-72-C-0007. Submitted to Corps of Engineers in April 1972 as Ms. 033072.

PREFACE

This report presents the results of a 10-day preliminary walk-through site survey of the Kaneohe-Kailua Dam Project area on windward Oahu, Hawaii, conducted for the U.S. Army Corps of Engineers (Contract No. DACW84-72-C-0007). The report is primarily descriptive, with few far-reaching interpretations, in view of the project's preliminary nature.

The project team consisted of Yosihiko Sinoto, Museum supervisor; Ranjit Cooray, botanist; Patrick C. McCoy, field director; Aki Sinoto, field foreman; and two field assistants--Toni Han and Yoko Ito. The work of the latter two and the volunteer help of Neal Oshima and Eric Komori are gratefully acknowledged.

The authors extend special appreciation to Dorothy Barrère, Bishop Museum Associate, for her volunteer work in compiling pertinent historical information on the survey area. We also express gratitude to Etsugoro Kamisato, Kumeo Oshima, and Henry H. Wong (Kaneohe Ranch), who provided us with bits of verbal information on the post-1900 history of the area.

A number of U.S. Army Corps of Engineers (Pacific Ocean Division) personnel were most cordial and helpful throughout the project: Planning Branch--John Belshé and Ruby Ibaraki (Environmental Resources Section); James Clark and Harvey Young (River Basin Engineering Section); Foundations, Materials and Survey Branch--Robert Yunker and other staff members.

The following Bishop Museum personnel are acknowledged for their technical assistance in the completion of the report: Peter Gilpin, field photography and printing of the report photos, and Janet Gordon, editing.

Patrick C. McCoy

Aki Sinoto

March 1972

INTRODUCTION

An agreement between the U.S. Army Corps of Engineers and Bernice P. Bishop Museum enabled a first-phase, walk-through survey of the Kaneohe-Kailua Flood Control Project area, located in the central region of Kaneohe Ahupua'a in the district of Ko'olaupoko and encompassing a number of *'ili*.* This area falls within latitudes 21°23'10" and 21°25' and longitudes 157° 47'30" and 157°49', on the U.S.G.S. Kaneohe Quadrangle Sheet #6 (scale 1/24,000). The fieldwork was conducted between 10 and 21 January 1972.

The archaeological survey constituted part of the Corps' Environmental Inventory Study, aimed at:

1. Identifying, locating, and preparing an inventory of all cultural remains (archaeological and historical);
2. Preparing an inventory of the biota, with major emphasis on botany;
3. Recommending preservation (or alternative treatment) of unique cultural or natural features; and
4. Recommending incorporation or use of cultural and natural features in the recreational area around the dam reservoir.

This site survey represents the first archaeological research in the area. Prior to this work no sites had been reported along the middle and upper reaches of Kamo'oali'i and Kuou streams.** The Kaneohe-Kailua area remains imperfectly known archaeologically, as there has been little investigation since McAllister's early (1933) survey of *heiau* and well-known sites on Oahu.

Ethnographic information for the same area is practically nonexistent, and ethnohistorical information is limited essentially to brief descriptions of land and land-use in Land Commission Awards records.

---

*_ahupua'a_ and _'ili_ are Hawaiian designations for land divisions: _ahupua'a_--a land unit, usually wedge-shaped, extending from the sea to the mountains; _'ili_--divisions within an _ahupua'a_.

**Kamo'oali'i Stream--a traditional name from a Hawaiian legend that relates the seizure of a princess by a lizard (*mo'o*) man, who escaped with her into this stream (Sterling and Summers Ms.:140).

ENVIRONMENTAL SETTING

The study area (Fig. I-1, foldout at end of volume) is at the base of the Ko'olau Range on the windward, wet side of Oahu. Mean annual rainfall varies between 60 and 80 in. a year and is determined by the location relative to the sharply rising Ko'olau Range. Numerous springs and streams originate at the foot of the mountains and dissect the coastal plain below.

Kamo'oali'i and Kuou Streams (Fig. 3-1) are the major drainages in the project area. They appear to have been initially consequent streams and, later in time, both consequent and subsequent. The younger courses follow less resistant beds, which in this area are principally Quaternary age, consolidated and unconsolidated, noncalcareous, alluvial sediments (Stearns and Vaksvik 1935:map). Weathered volcanics (Haiku) and poorly cemented marine conglomerates are found in the stream beds.

The present topography consists of low, linear, dome-shaped ridges of more resistant alluvium separated by stream tributaries. Along the middle reaches of the streams there are flat, open terraces covered with high grasses. These terraces are variable in number and kind; the maximum grouping appears to be three, and there are both erosional (nonpaired) and constructional (paired) terraces.

The floral component of the environment consists primarily of introduced, exotic species; indigenous plants are rare. A more detailed report on the botany of the area follows the presentation of the archaeological and historical information.

The fauna noted was few in both species and numbers. Terrestrial animals, limited to a few mongooses and field mice, were rarely seen. A few lizards and geckoes were observed. African land snails were found in abundance throughout the area. In the upper areas, some species of leech (*Hirudinea*) were seen. As for insects, the usual varieties of mosquitoes, flies, butterflies (Monarch), bees, wasps, and dragonflies were noted. There were also several common, garden varieties of spiders throughout the area. Avian fauna was the most abundant. Commonly seen were:

Barred dove	*Geopelia striata striata*
Brazilian cardinal	*Paroaroa cucullata*
House sparrow	*Passer domesticus*
Red cardinal	*Richmondena cardinalis*
Mejiro or white eye	*Zosterops palpebrosus japonicus*.

More rarely seen were cattle egret (*Bubulcus ibis*) and Shama thrush (*Copsychus malabricus*). In addition to these, we saw a species of hawk (probably a member of one of the North American accidentals known to be in the State) and some domesticated peacocks.

The aquatic life seemed very limited. In the streams were some freshwater fish, mainly *tilapia* and guppies, and small crayfish (both *Macrobrachium grandimanus* [Randall] and *Procambarus clarkii* are known from this area). The amphibians were limited to tadpoles, frogs, and toads.

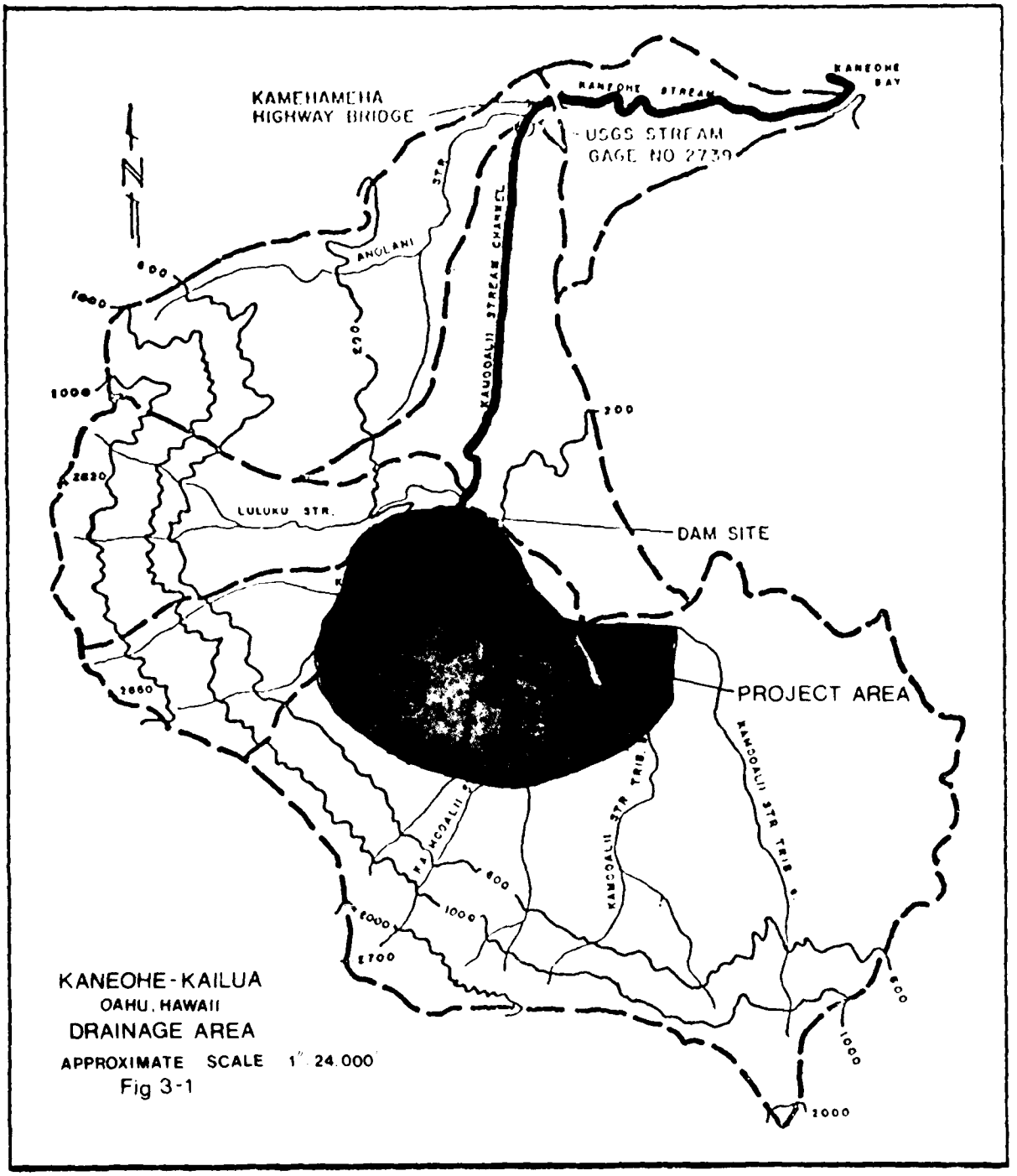


Fig. 3-1. DRAINAGE AREA MAP OF SURVEY AREA.

BRIEF HISTORICAL BACKGROUND OF THE AREA

The post-contact history of the survey area and adjacent lands has never been compiled, and what little written information exists is scattered. The historical sketch presented here, then, is necessarily general and brief. More information of the post-1900 period may be revealed through diligent search of various records and questioning of older, knowledgeable, local people. A more intensive historical investigation will be recommended for the Phase II project (mapping and excavation of selected sites recorded in this survey).

The principal sources of historical information have been records in the State Archives (especially Land Claims Awards), an old survey map of Hawaiian land units and boundaries, and local people living on the Old Pali Highway near Hawaiian Memorial Park. A circa-1910 photo of the Kaneohe-Kailua area is shown in Fig. 3-2. We are especially grateful to Dorothy Barrère for her volunteer aid in reviewing and summarizing the pertinent information in land-claim records. Her research covers the period from c. 1850 up to the end of the 19th century. Data elicited from informants, although sparse, provides some interesting details from 1900 to the present.

The number of *'ili* in the project area is unknown, since a large section near the *pali* is labelled "various *'ili*" on early maps. It is certain that parts of the *'ili* of Ho'oleinaiwa, Kuou, Halekou, and possibly Mahinui, are included (Fig. 3-3). Dorothy Barrère provided the following information on each of these *'ili*.

HO'OLEINAIWA

Half of the *'ili* was awarded to Upai in the Mahele (1848), but he did not claim this award, which would have amounted to some 50 acres. Instead, he made only a modest claim to 1.85 acres, leaving another 1.85 acres in the same *mo'o 'āina** to be claimed by his son-in-law Piho. In 1860 Piho bought two government lots--4.35 and 2.61 acres--in the *'ili* (see Registered Map 2053, Fig. 2-1). No other record of *lo'i** were found for this *'ili*.

KUOU (*mauka* portion only)

The *'ili* of Kuou was also reserved as private lands by Kamehameha III. There was one *kuleana* award in Kuou and three nonawards. Kamehameha IV sold the *mauka* portion of Kuou, 169 acres, to David Watson (Map 2053 says "J.") in 1862; 30 acres were inaccessible *pali* lands. The Watson family's Kuou lands passed to Joseph Mendonca in 1894, and in November of that year he sold to the Kaneohe Ranch Co., Ltd., of which he was a founder. Kaneohe Ranch Company sold to Nannie Harris Brewer Rice.

---

* *mo'o 'āina*--narrow strip of land, smaller than an *'ili*.
lo'i--irrigated pondfield, especially for taro, but also for rice.

Fig. 3-2. EARLY VIEW OF KANEOHE FROM OLD PALI ROAD
(c. 1900-1910; photographer, Alonzo Gartley;
BPBM Neg. No. 2641).

HALEKOU

The *'ili* of Halekou was reserved by Kamehameha III as one of his private lands when he warded the *ahupua'a* of Kaneohe to his queen, Kalama. There were no *kuleana* awards in Halekou.

C.C. Harris claimed the *'ili* of Halekou was part of the *ahupua'a* lands he had purchased from Charles Kanaina, heir of Queen Kalama, in 1871. His daughter, Nannie Harris Brewer Rice, inherited his property, but it did not include Halekou or Kuou, as they were adjudged *'ili kūpono** lands.

MAHINUI

This *'ili* of 266.41 acres was awarded to Kapu (LCA 6400) in five *'āpana** by name only. The *mauka* parcel is included in this survey. Perhaps it was in

---

**'ili kūpono*--a nearly independent *'ili* land division within an *'ahupua'a*, paying tribute to the king and not to the chief of the *'ahupua'a*.
'āpana--piece or portion of land.

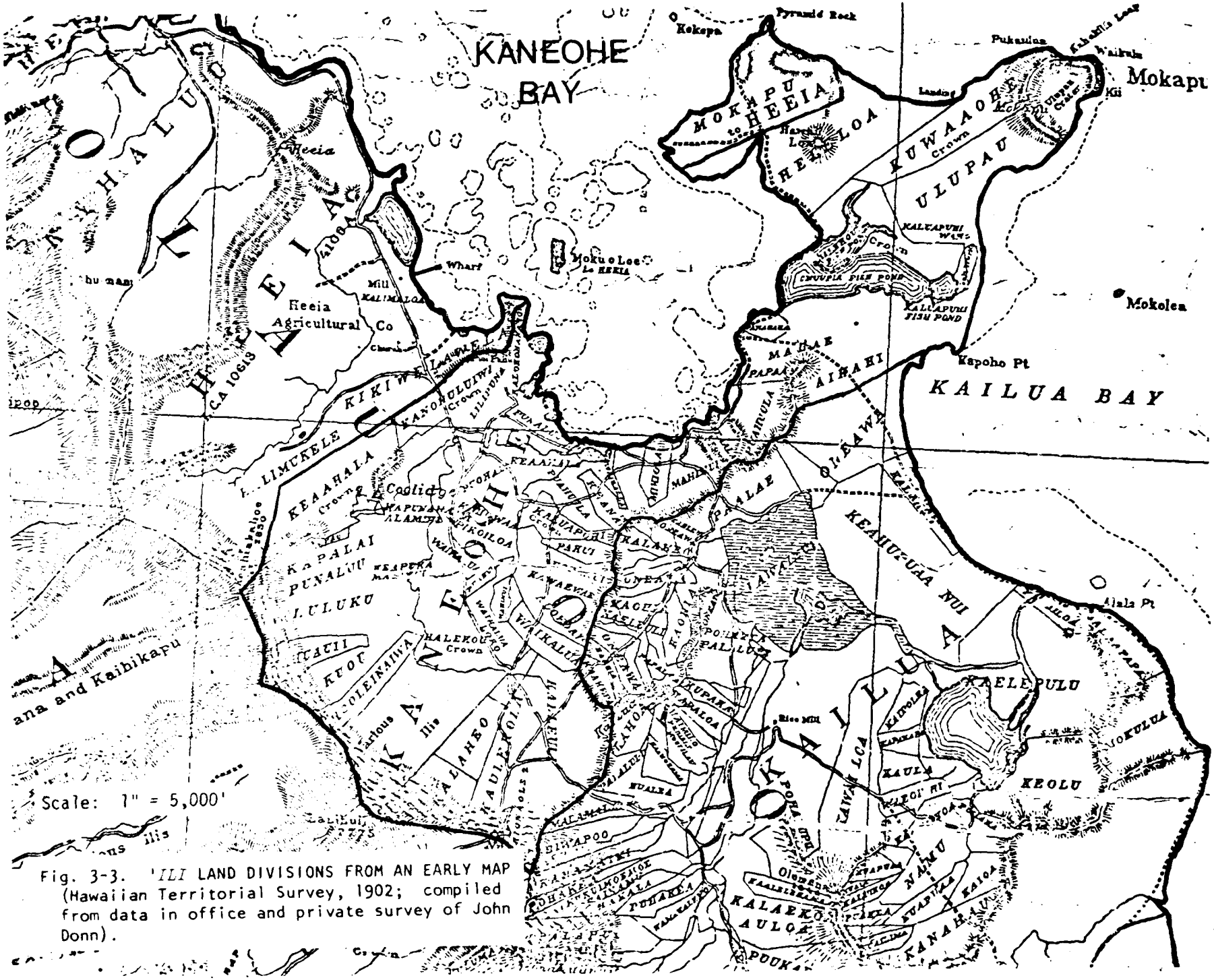


Fig. 3-3. 'ILI LAND DIVISIONS FROM AN EARLY MAP (Hawaiian Territorial Survey, 1902; compiled from data in office and private survey of John Donn).

this parcel that Kapu gave Kane a melon patch, which the latter claimed but did not receive by award.

Kapu was a chief of some rank, as is evidenced by his Mahele Award of not only Mahinui, but of two other pieces of land, in Waikiki, Oahu, and in Lahaina, Maui. He deeded his Kaneohe land to Queen Emma in 1865, for the sum of $1.00--further evidence of his chiefly status, and as an indication of relationship to her. Queen Emma's estate eventually became the property of The Queen's Hospital, and the Mahinui lands were leased off and on before and after that time. The *mauka* portion of Mahinui was leased to Morris Rose in 1878, and in 1882 he assigned his lease to Nannie Harris Brewer [Rice]. She in turn leased this land directly from Queen Emma in 1882 for a period of 10 years. Morris Rose was the superintendent of the sugar plantation owned by C.C. Harris, Nannie's father.

The ways in which these *'ili* were used (alteration of the landscape through farming and ranching, for example) are important in assessing both the nature and distribution of historical remains and plant associations. Historical evidence is again not specific to the survey area but is limited to brief descriptions for the general Kaneohe region. Broad land-use categories were summarized by Mrs. Barrère for the latter half of the 19th century, and are described below.

Taro was planted from time immemorial along the streams, especially in Luluku and lower Keapuka, including Alamihi.

Sugarcane was planted in Kaneohe, perhaps as early as the 1840s, though this is doubtful. At any rate, between the time Queen Kalama was formally awarded the *ahupua'a* in 1852 and her demise in 1871, her lands in Kaneohe were known as the "Kaneohe Plantation." In that year, C.C. Harris bought Queen Kalama's lands and greatly expanded the plantation before his death in 1881. A description of the "plantation" in 1884 shows the extent of the expansion, as well as its diversification:

> Kaneohe Sugar Plantation, Mrs. N.R. Brewer proprietess, M. Rose manager...10,000 acres, 500 acres under cultivation, 200 with sugar and 300 with rice, the remainder grazing land on which are 3,000 head of cattle, capacity of mill three tons per diem, estimated yield for 1884 500 tons, men employed seventy-five [Bagot, in McKenney's *Hawaiian Directory* 1884:149].

The government *'ili* of Kuou-mauka, sold to John Watson in 1862, was his third land purchase in Kaneohe and was the base for full-scale ranching in the *ahupua'a*. When Nannie Harris (then Mrs. Rice) sold her Kaneohe holdings to H.K.L. Castle in 1917, he retained the name "Kaneohe Ranch Company," the outgrowth of the original Watson enterprise, to designate all the lands.

In an interview (February 22, 1972), Herbert Ewaliko of the State Land Department said that there were several small dairy ranches operating under lease from the Kaneohe Ranch Company in the late 1800s and early 1900s. He also stated that there had been some attempts made to establish coffee plantations in the *mauka* areas near the *pali*, and that scattered fields of pineapple had been planted throughout the *mauka* lands. It was for one of these that the *heiau* in Luluku had been destroyed (McAllister's Site 340 [1933:177]). Lack of

labor at needed seasons doomed the coffee plantations, and a disease caused by a "bug" ruined pineapple crops, he said. Apparently full-grown coffee trees and occasional "wild" pineapples are still to be found in the area.

Coffee had been planted very early in Kaneohe, however. Rev. Parker said in 1846:

> There are a few coffee plants in this district. A few bushels of corn are annually raised, and some sweet and a few Irish potatoes; tobacco is cultivated to some extent. Awa is at present a profitable article to produce and is much cultivated [Wyllie 1848:16].

To this background can be added a few notes on the last 50 years or so. Mr. Etsugoro Kamisato and Mrs. Kumeo Oshima (personal communication) described the Libby-McNeil pineapple plantation that operated in the vicinity of the Old Pali Highway up to about the 1920s. (Both are members of a group of 13 Japanese families who lived and worked in the area at that time.) The eastern extremity of the project area was formerly planted in pineapple (Fig. 3-4, foldout at end of volume). Mr. Henry H. Wong (Kaneohe Ranch Company) said that the last *'ili* in the survey area (in the vicinity of the debris catcher at the confluence of the Kamo'oali'i and Kuou streams) was abandoned about 40 years ago. The last taro patches, in that same locality, were abandoned 20 to 25 years ago. Various farmers leased land. One made charcoal from guava trees in the upper area (see description of Sites G5-53, -61). Some of the earlier commercial banana patches in Kaneohe were located in the upper survey area; they were small and did not involve much land clearing and leveling. Cleared terraces, with random piles of rocks (Site G5-58) are evidence of these earlier plantations.

ARCHAEOLOGICAL SURVEY

FIELD TECHNIQUES

Since this was a first-phase project, limited to a few days, the survey was of a preliminary nature and more extensive than intensive. Most of the field time was concentrated on the higher terraces along the tributaries of Kamo'oali'i Stream, since our initial reconnaissance indicated this to be the most favorable area for both living and agriculture.

The survey area extends from Waikalua fishpond on the coast to approximately 2.75 miles inland. Below the confluence of the Kuou and Kamo'oali'i Streams, it covers only the immediate banks of Kaneohe Stream; this entire stretch has been developed and no sites remain. The area above the confluence was divided into Lower, Middle, and Upper sectors for convenience in description and comparison (Fig. 3-4, foldout at end of volume).

For the purposes of orientation and mapping, we obtained aerial photos (1" = 100'), which were invaluable in view of the dense vegetation, within which one could easily become lost. The high quality of photographs enabled us to locate, with reasonable accuracy, sites which would otherwise have been very difficult to find. Once located, sites were briefly described and sketched on

Museum site survey forms. All measurements are in the metric system and were taken directly on the features by means of metric tapes. Reference measurements, such as the distance from natural landmarks (streams, vegetation, etc.) were often paced or approximated. All orientations were based on magnetic north and were determined by the use of a hand-held, U.S. Army Corps of Engineers model, pocket compass.

Sites were numbered following the Bishop Museum site-recording system, which uses a four-part designation. For Site 50-OA-G5-37, for example, 50 indicates Hawaii, the 50th state; OA represents the Island of Oahu; G is the district (Ko'olaupoko), and 5 indicates the *ahupua'a* (Kaneohe). The last number, 37, is the individual site designation, and is sequential within each *ahupua'a*. The sites were numbered and flagged with fuchsia-colored flagging ribbons. The relatively well-preserved remains were photographed both in black and white and in color.

CLASSIFICATION OF FEATURES

A tentative classification of features is presented in Table 3-1. Categories are both descriptive and functional. As with most typologies, there are several features that require excavation to determine their function.

DESCRIPTION OF SITES

Site numbers are sequential except for G5-11, which had already been assigned the number before this project was started. The lower numbers, G5-37 to -48, indicate sites located in the lower areas; G5-49 to -52 identify those in the middle areas, and G5-53 to -66 are for the sites in the upper areas near the upper limits of the project area (see Fig. 3-4, foldout at end of volume).

G5-11 Waikalua Fishpond

Site G5-11 was recorded by J.G. McAllister (as Site 349) during his early survey of Oahu sites. His description was brief:

> Waikalua fishpond, adjacent to Waikalua, Kaneohe. The rebuilding of the pond has been completed [McAllister 1933:178].

Sterling and Summers added that "the wall was 1420 feet long of waterworn basalt 3 to 4 feet high but somewhat wider. The pond covers 11 acres" (Ms.:152). The pond seems to have been modified since 1933 as it now appears smaller.

G5-37 Oblong Earthen Mound

Located about 20 meters E of Site 38, G5-37 is a unique and interesting site--it is an oblong earthen mound measuring about 12 meters long, 1.4 meters high, and tapering from 2.5 to 2 meters in an E-W orientation. Although quite overgrown with creepers and grasses, the whole mound and its features seem to be in good condition. A paved, L-shaped, stone platform tops this mound, 1.3 meters from the western extremity (Fig. 3-5). The maximum length and width of

Table 3-1. SITE LIST AND NUMERICAL DISTRIBUTION OF FEATURES.

DESIGNATIONS	SITE NUMBERS, G-5-: 11	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	NUMERICAL FREQUENCY
ENCLOSURES																													*			1
PLATFORMS		*	*																										*			3
EARTHEN MOUNDS		*																														1
RETAINING WALLS				*												*									*		*					4
STONE OUTLINES, ALIGNMENTS					*	*														*				*								4
TERRACES, COMPLEXES									*	*	*				*				*		*	*	*					*				9
SEEPAGE WELLS							*	*																								2
FLOOD CONTROL DITCHES								*				*					*													*	*	5
STONE MOUNDS, PILES																							* *									2
ARTIFICIAL DEPRESSIONS		*	*											*																		3
CHARCOAL MAKING OVENS																		*								*						2
MODERN BURIALS													*																			1
FISH PONDS	*																															1
	Total Sites-31																									Total Features						38

Site Number	Description
50-OA-G5-11	Waikalua Fishpond
37	oblong earthen mound
38	septagonal platform and artificial depression
39	segment of retaining wall along stream bank
40	stone alignment
41	circular stone outline with porcelain
42	seepage well (?)
43	seepage well and flood-control ditch
44	terrace, historic dump site
45	agricultural terrace
46	terrace
47	flood-control ditch and other features in *kukui* grove
48	bones, human skeleton
49	circular depression
50	terrace complex
51	retaining wall
52	flood-control ditch
53	stone and concrete oven for charcoal manufacture
54	large terrace complex
55	large circular stone outline
56	terrace complex near lower edge of H-3 right-of-way
57	terrace complex near lower edge of H-3 right-of-way
58	possible terrace & two mounds (rock piles)
59	stone alignment with some features
60	retaining wall
61	charcoal oven
62	retaining wall of large stones
63	terrace complex by large mango tree
64	enclosure and platform
65	ditch system
66	flood-control ditch

the platform are both 1.7 meters and the height varies from 5 to 10 cm. On closer inspection, this L-shaped platform seems to be composed of two adjacent, smaller, rectangular platforms. This site is the only one of its kind reported in Hawaii. It is very difficult to establish age, function, and origins without excavation; however, the uniqueness indicates intrusive origins--most likely Chinese, rather than Hawaiian. The earthen mound may be an historic Chinese burial mound, although this would be only a guess at present.

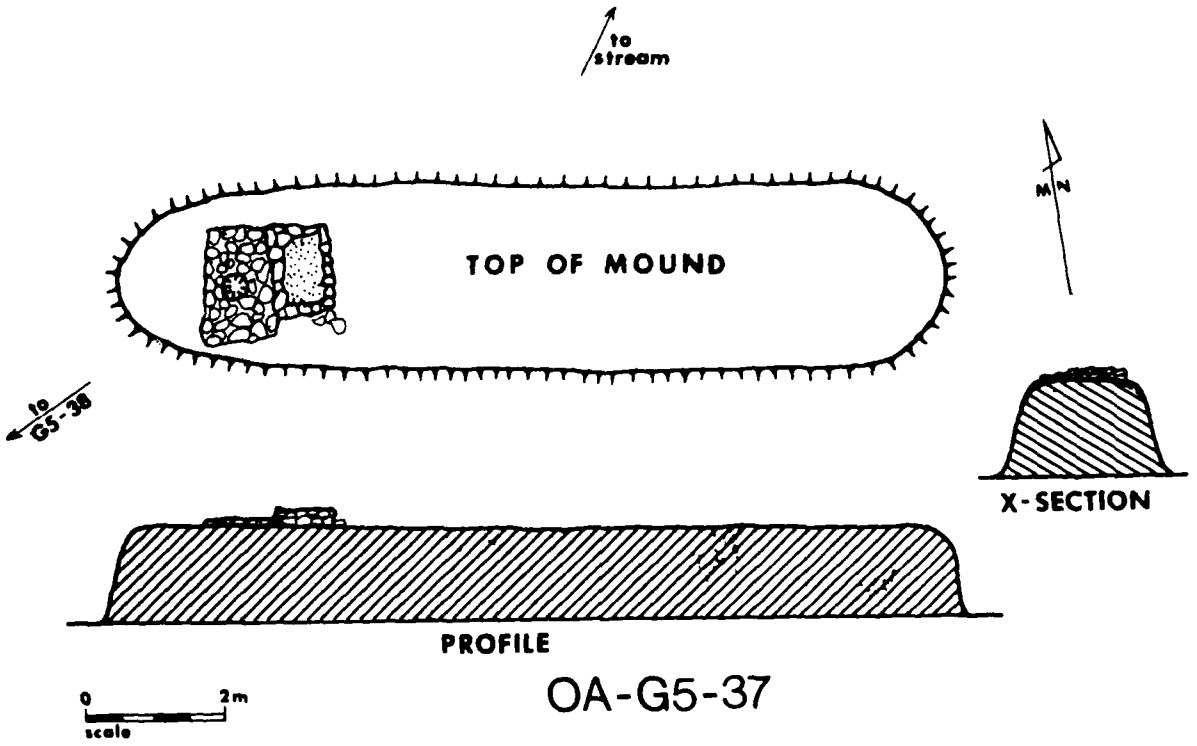


Fig. 3-5. PLAN AND PROFILE OF SITE 50-OA-G5-37.

About 8 meters to the S of the mound, where a natural terrace forms a high bank, is a trough-shaped, excavated pit, 4 to 5 meters long in an E-W direction, 1.8 meters wide, and, at the central deepest point, about 1 meter below ground level. This feature may have functioned as a seepage catchment, but it is not of native Hawaiian form. Its cultural origin as well as its relationship to G5-37 and to the other adjacent sites is difficult to define.

G5-38 Platform and Depression

This site is located within the dam-ponding zone near the confluence of two tributaries of the Kamo'oali'i Stream in close proximity to Sites -37, -39, -44, and -45. It is situated below a natural terrace excavated at a right angle to form higher southern and eastern banks of an earthen rectangular enclosure (Fig. 3-6).

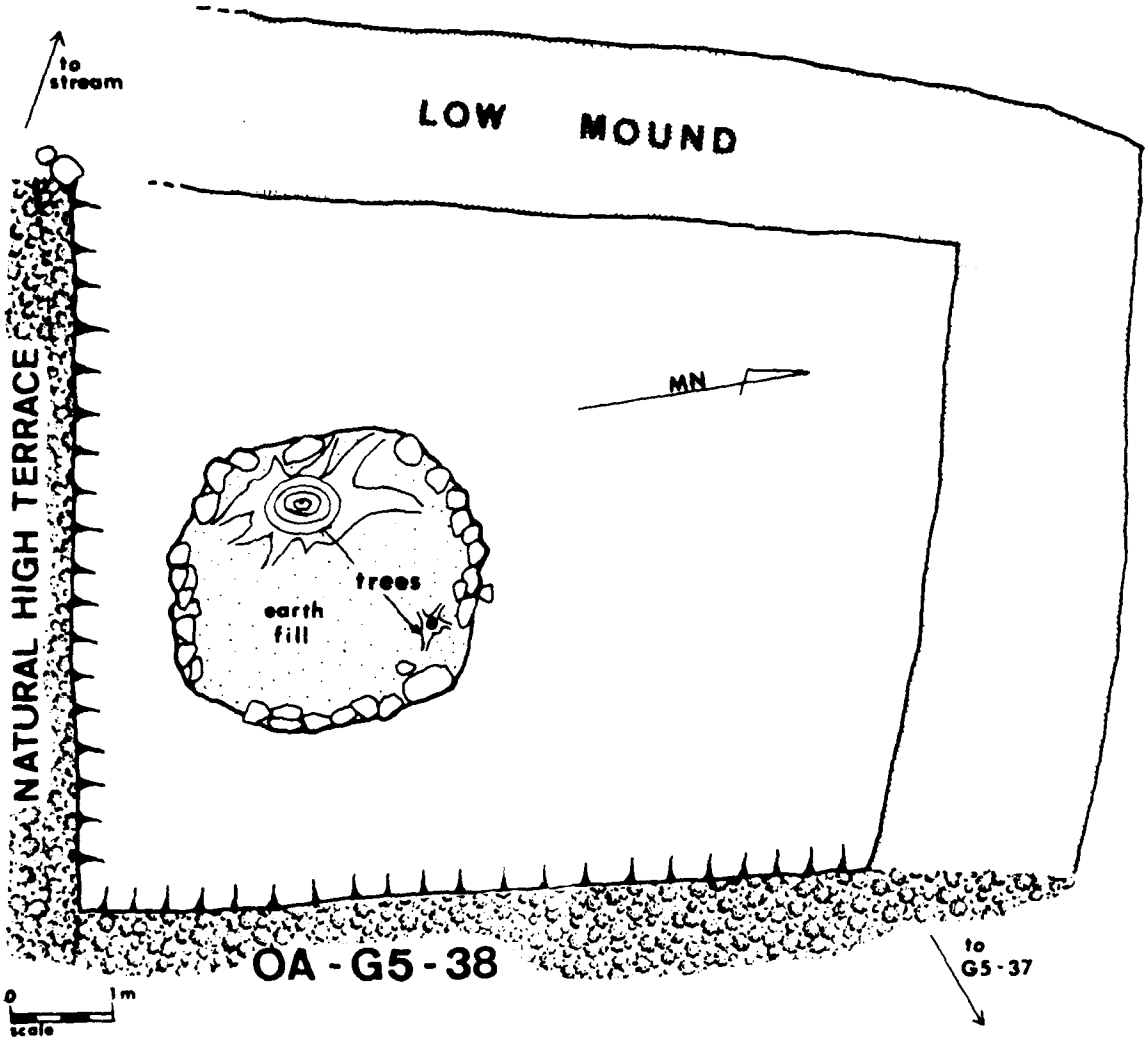


Fig. 3-6. PLAN OF SITE 50-OA-G5-38.

These banks measure 7 meters long by 1.1 meters high and 7.5 meters long by 70 cm high, respectively. The northern and western banks--6.2 meters by 25 cm, 8.5 meters by 40 cm, and both 2 meters wide--are formed by artificially mounded, low, earthen ridges completing the other half of the rectangle. A small, roughly circular platform situated within the SE corner of this depressed area measures about 2.9 meters in diameter and about 38 cm in height. The perimeter is a single row of stones of not more than 20 cm wide. The platform fill, inside this border, is earth and rock. At present, this structure is septagonal; however, the original shape is difficult to discern without excavation because of disturbances caused by roots of the guava (*Psidium guajava*) and Java-plum (*Eugenia cumini*) trees growing atop the structure. Two segments of the outer stonework are quite intact and show the construction technique, but the others seem badly disturbed and displaced. The size and situation of the platform seem to indicate a religious shrine, possibly for a family, or

agriculture. Whether it was contemporaneous with the nearby features is difficult to establish at this time, although it is probably of Hawaiian origin. A similar site was found near Limahuli Stream near Haena, on Kauai. Site 50-39 holds good excavation potential.

65-39 Retaining Wall

An intact segment of a retaining wall reinforcing the embankment of the eastern-most tributary of Kamo'oali'i Stream, this site is situated N of 50-38. The natural bank is 1.2 meters high, but only the top 80 cm is reinforced by a single thickness of uniformly rounded stones, 15 to 20 cm in diameter, stacked five layers high (Fig. 3-7). Its function is to protect this tongue of land against stream erosion near the confluence of two Kamo'oali'i tributaries.

Fig. 3-7. SECTION OF STONE RETAINING WALL, SITE 50-65-39, ALONG S BANK OF KAMO'OALI'I STREAM (BPBM Neg. No. 84a[illegible]2).

65-40 Stone Alignment

This site is an alignment of stones paralleling the flow of the eastern-most tributary of Kamo'oali'i Stream, and is set back about 3 meters from the edge of the stream bank. Although the two extremities are ill-defined, the overall length is approximately 25 meters and its axis is oriented 20° E of N. Along its length stand several young [illegible]-nut trees [illegible] and at about three places, stone outlines encircle the bases of these trees. At a point near the middle of this alignment, a segment of a wall, 88 cm in height and built with three layers of stones, remains intact for about 2 to 3 meters. This alignment was probably a terrace border, [illegible] flooding of the stream.

G5-41 Stone Alignment

Site G5-41 is a crude stone "circle" around a large *ulei'aki* (*Schinus terebinthifolius*) tree, and a continuing single course of stones on either side. The overall alignment is 2 meters long and is made up of small, dispersed stones set into the ground. It is oriented 10° W of N. The "enclosure" around the tree is similarly constructed and measures 90 cm in diameter. Two Chinese porcelain bowl fragments were found to one side, buried to about the same depth as the adjacent stones. The porcelain provides a minimal, relative date for the site, which in its other characteristics appears to be non-Hawaiian.

G5-42 Possible Seepage Well

Situated on a high, steep bank about 5 meters above a tributary of Kamo'oali'i Stream, about 4 meters SW of G5-41, this site is a U-shaped cut excavated perpendicularly into the upper face of the bank. It measures 2 meters on all three sides; the opening flares slightly to 2.7 meters and has a depth of 1.45 meters near the opening. The bottom, near the back of the cut, seems built up with eroded soil falling from the top of the bank and collecting there. The axis perpendicular to the bank is oriented due E-W. This feature is most likely a seepage catchment well of probable Hawaiian origin possessing similar characteristics to those found from other areas, such as Makaha and Halawa Valleys on Oahu.

G5-43 Seepage Well and Flood-Control Ditch

This site is a well preserved seepage catchment situated at the base of a steep slope covered with *hau* (*Hibiscus tiliaceus*) trees about 15 meters from a stream. It is ovoid and the two axes measure 2.2 and 1.95 meters, with a central depth of about 1 meter. The longer axis is oriented 30° E of magnetic N. The inner wall is reinforced with a single thickness (about 25 cm) of round stone lining. At the northern end is an opening measuring 80 cm in width, with a large slab lying across it. Some of the stones near the opening seem to have fallen, indicating an opening that was once more built-up. At the opposite end behind the stone lining is a hole 50 cm in diameter, 65 cm deep, and slanting inward to appear on the inside of the well below the first layer of stones. At spots along the top edge of the stone lining remain some traces of what appears to be *kaneki puna*, or coral cement. This use of cement, as well as the stone lining and the ovoid shape, rather than the more commonly Hawaiian rectangular shape, indicate historic origins of this seepage well. It is quite probable that a cruder Hawaiian type of well, such as G5-42, had existed here previously, but may have been historically renovated. Renovation of older features is known elsewhere, as in Makaha Valley, Oahu. Located about 3 meters NE of this well and running parallel (150° E) to the base of the slope is a flood-control ditch measuring 62.7 meters in overall length, 15 to 70 cm in depth, and 1.6 to 2 meters in width. One end appears to be near the opening of the well, the other at a point 2 meters above the present stream bed.

G5-44 Stone Alignment

This is a possible terrace outlined by a short (1 meter) stone alignment on the E margin of a slight rise or "mound." The site is 3 meters back of the

E bank of Kamo'oali'i Stream near the confluence with Kuou Stream and 12 meters SW of Site G5-38. Scattered porcelain, glass, and metal on the site suggest a late Chinese occupation--probably pre-1950 taro farmers. The function of the feature is not clear.

G5-45 Agricultural Terrace and Possible Individual Garden Plots

G5-45 is a terrace site immediately S of G5-38. It consists of a natural terrace bank (the second above Kamo'oali'i Stream at this point) 80 cm to 1 meter high, reinforced in sections with a rock retaining wall for a distance of 12.65 meters. The wall is crude and made up of rounded stones set into the middle and base of the slope. There is one break in the wall (oblique to the face of the bank) near the eastern extremity, which suggests a pathway. Below the bank is the first natural stream terrace, on which are one good stone alignment and a scattering of other stones. The alignment, oriented 25° E of N, is 7.9 meters long and joins the terrace wall described previously. It is a single course of partially buried, small, irregularly shaped stones. The "wall" appears to be a border since all of the scattered rock was found W of it. The curvature of small alignments (2 to 4 stones) suggests possible garden plots. Further clearing and mapping are required to show the full extent and nature of the site.

G5-46 Terrace

This is a terrace on the margin of an abrupt slope on the E bank of Kamo'oali'i Stream. The terrace is defined by three intersecting stone alignments, the best and longest of which parallels the bank and stream. It is 12.8 meters long and oriented directly along magnetic N. On the N, a short alignment of 1.7 meters intersects the long wall at nearly a right angle. The S wall is approximately 7.7 meters long and curved at the point where it merges with the long wall. The alignments are made up of rounded stones of 20 to 40 cm average diameter. The function of the terrace is not apparent at this time.

G5-47 Flood-Control Ditch

Site G5-47 is one of several excavated ditches along Kamo'oali'i Stream. Situated on the E bank, it intersects the stream on both ends (Fig. 3-8). On the upstream or S end it is 1 to 2 meters above the stream bed, while on the downstream or N end it joins at the same level. The ditch transcends the interior margin of a flat terrace where it ends abruptly against a sharply rising slope. On the S the ditch is narrow and shallow (c. 1 meter in each dimension) and expands in breadth and depth to the N. The course of the ditch, near where it intersects the stream on the S, is not clear and is probably due to post-abandonment silting and erosion of that end. One point on the W bank is lined with rocks. A second artificial channel intersects the large one on the S and appears to empty into Kamo'oali'i Stream on the downstream side. It is less than 1 meter wide and 20 to 30 cm deep. Two additional "gullies," less clear-cut, were found in the center of the terrace and join the stream on one end only.

The characteristics of the large ditch demonstrate clearly that it was a flood-control channel designed to handle high water and divert it from flooding the terrace. Taro (*Colocasia* sp.) and *'ape* (*Alocasia* sp.) on the terrace suggest a remnant community of a former agricultural plot. The ditch is probably not too old since the side walls are hardly eroded and it is still quite open.

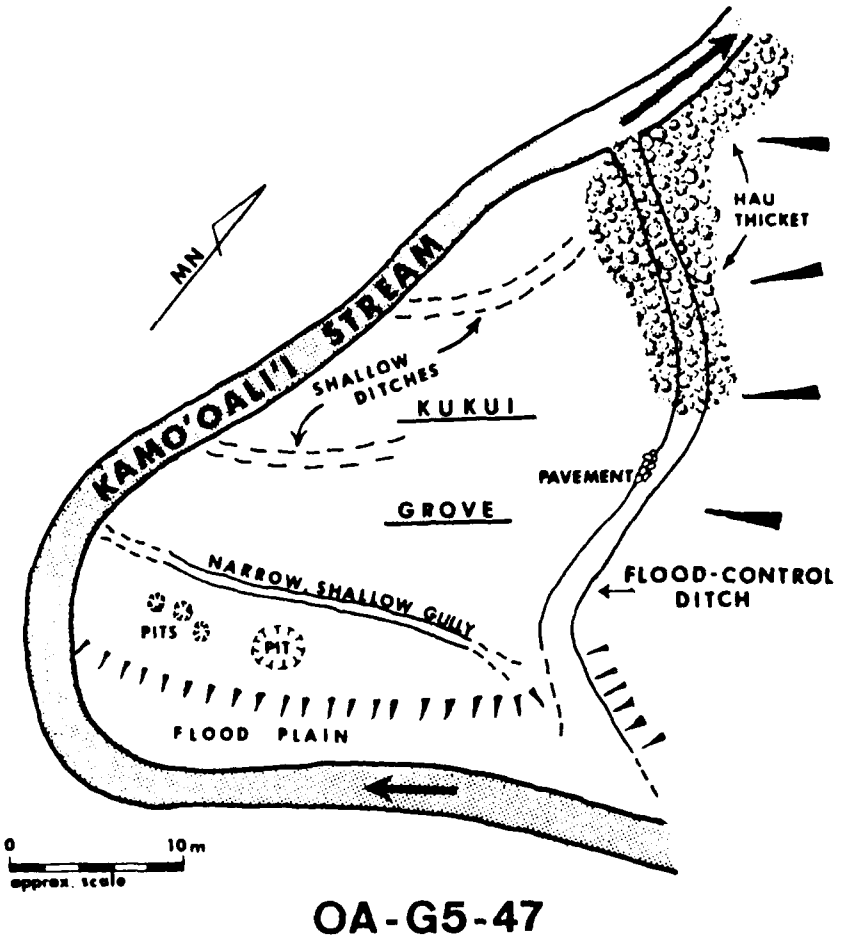


Fig. 3-8. PLAN OF SITE 50-OA-G5-47.

Associated with the ditch are several excavated pits on the S end of the terrace. The largest is 2.3 meters in diameter and 40 cm deep. Two to three adjacent pits are about one third that size; all are partially filled with various sizes of rock from flooding. They are tentatively identified as agricultural features since they closely resemble known agricultural pits in SE Polynesia.

G5-48 Modern Burial with Partial Human Skeletal Remains

This is a rather modern burial accidentally found by members of the Continental Drilling Company while bulldozing a test trench in a slope in the vicinity of the Kamo'oali'i and Kuou Stream confluence. The skeletal remains were found at a point 2.5 meters below the present slope level in an artificially excavated hole 2.2 meters in length, 60 cm at the widest place, and 70 cm in height. After the body was deposited, the hole was filled in with gravel and

soil. After this loose fill was removed, the shovel marks were still visible within the roof of the hole. Curiously, the remains were resting on the contact between two different geological stratifications in the soil, accentuated by a dark streak of manganese.

Metal nails and remnant fragments of wood suggest a coffin burial. Five glass buttons, a metal snap, and a fragment of a walking stick were found together with the skeletal remains. Since they indicate a late date of the burial, the Kaneohe Police Department and the State Health authorities were notified and the remains were turned over to their jurisdiction. Although the remains seem to represent a primary burial, the absence of the skull, some arm bones, parts of the pelvis, and fresh breaks seen on the recovered pieces indicate disturbance, probably caused by the bulldozer.

G5-49 Circular Depression

This feature is located on the top of a ridge protruding about 25 meters out into a bog/clearing from the lower edge of the modern banana patch. It is surrounded by a dense thicket of guava, pandanus, and a few Java-plum trees. The ridge is 8 meters wide; the depression is 2 meters from the eastern edge and 3 meters from the western edge. This circular feature has a diameter of 3 meters and the central, deepest point measures 40 cm. It was possibly an agricultural feature, although its cultural origin and date are not known.

G5-50 Terrace Complex

This site is located 10 meters to the E of one of the upper tributaries of the Kamo'oali'i Stream near a modern, wooden bridge along a jeep road. Two terraces with unreinforced sloping dirt banks about 11 meters long and 80 cm high define a third flat terrace. The formation of the land in this immediate area lends support to the assumption that these are natural high banks man-altered for the purposes of agriculture. There are also several other possible terraces nearby which appear more natural in form than the three noted. The origin of these terraces is debatable, although, in any case, the crude nature of construction suggests a short-term use.

G5-51 Retaining Wall

This is a short segment of a retaining wall located at the foot of a steep bank that leads up to a large clearing on the proposed H-3 freeway right-of-way zone. It seems to be the remnant of a larger wall retaining the bank of Kamo'oali'i Stream. It is a single wall, 5 meters long and 75 cm high, built with three to five layers of uniform stones; 6 meters S of this feature is a large, low clearing.

G5-52 Flood-Control Ditch

This is located in the same area as G5-51, but several hundred meters downstream within a large *kukui* grove. Its overall length is 60 meters, with a width of 0.7 to 1.5 meters and, because of silting and erosion, its depth varies greatly, from 20 to 80 cm. It starts at the river bank 2 meters above

the stream bed and follows the slope of the land downward until it ends up in a low alluvial flat.

G5-53 Stone and Concrete Oven for Charcoal Manufacture

This modern feature is an oval dome with stone lining in the inner walls and a concrete dome ceiling with an iron plate sandwiched between the concrete. The whole structure, except for the upper part of the dome, is dug into a slope. It measures 6.4 meters long, 3.6 meters wide, and 2.25 meters high to the apex of the dome. There is one opening measuring 1.55 meters by 60 cm and the wall thickness is built out to 55 cm here. The rest of the structure has a thickness of about 18 cm. At the back, opposite the entrance, is a small rectangular opening 20 cm wide by 15 cm high and going back 30 cm into the wall; this was probably the chimney. The sides are lined with uniformly round stones and some larger basal stones. From the floor to the concrete ceiling are six to eight layers of stones of single thickness. Above the walls on either side are located three vent holes 12 cm in diameter. On the basis of large amounts of charcoal present on the floor and accounts of informants, we verified that the function of this structure was a charcoal-making oven of recent historic origin.

G5-54 Large Terrace Complex

This site, located near G5-53 in the upper limits of the project area, is the most extensive multiple-feature site found during the project (Fig. 3-9). More clearing is necessary to define the full extent of this site. At present six or more large, rock-wall-reinforced terrace areas can be seen. In addition, there are more than 10 other features that include smaller individual plots, terraces, platforms, and retaining walls.

Three Kamo'oali'i tributaries flow through the complex, providing ample irrigation, and join at the lower margin of the complex. These streams divide the complex into two areas. One is a long, narrow strip defined on both sides by the stream gullies, and most of the smaller terraces are located here. On the opposite bank is a larger, somewhat higher, flat area with the larger terraces. Although purely hypothetical at this time, the locations of the smaller terraces suggest wet cultivation as opposed to the larger terraces which appear more suited for dry cultivation. It is quite possible that the upper reaches of this complex were destroyed during the construction of a jeep road that goes through there. Detailed mapping and test excavations will be important for this agricultural complex.

G5-55 Large, Circular Stone Outline

This site is located about 500 meters downstream from the previous large complex, sitting atop the edge of a rise about 20 meters E of the stream. It is a large circle defined by a double thickness of large stones 0.8 to 1 meter thick and 20 cm high. It appears to be badly disturbed with displaced stones and many breaks in the circle; at one point, there is a 3-meter gap. Its diameter measures about 7 meters. The cultural origin and date of this structure are uncertain. It is not typically Hawaiian.

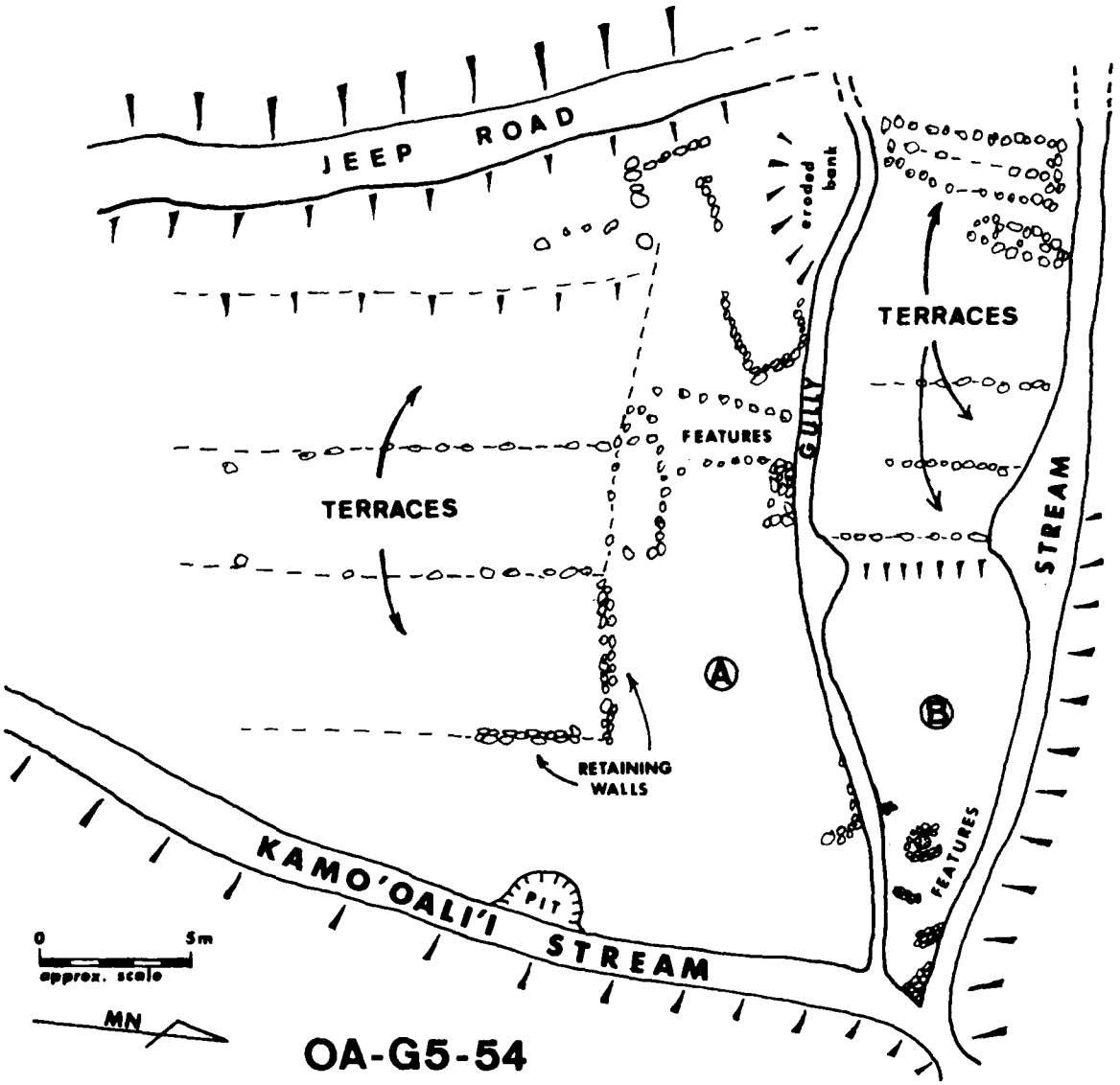


Fig. 3-9. PLAN OF SITE 50-OA-G5-54.

G5-56 Terrace Complex

This complex is located very close to the lower boundary of the right-of-way for the proposed H-3 freeway. It is comprised of four separate features situated on a flat at the base of a rise. They seem to be small terrace outlines with some disturbance. A jeep road runs nearby, so that some destruction may have occurred from its construction.

G5-57 Terrace Complex

Probably associated with the G5-56 complex, this appears to be a large site, roughly in the shape of a quadrilateral, with several interrelated and interconnected features. The outer perimeter measures 4.3 by 18.7 by 17.3 by 25.5 meters. This quadrilateral runs downward along the slope of the land and ends at the flat fronted by the old jeep road. Most of the features fall within the lower half of this area, which is covered by a grove of *kukui* and mountain apple (*Eugenia malaccensis*) trees--sometimes also called Malay apple. The origin, date, and function of this site are unknown, but some of the features suggest agricultural forms.

G5-58 Possible Terrace and Two Rock Mounds or Piles

These features are located directly across the jeep road from Site G5-57, described above. An ill-defined alignment of stones 11 meters long with a width of 20 cm suggests a badly disturbed terrace. Two piles of small stones 1.65 meters apart and 1 meter from the stream bank are located 11.8 meter due S of this alignment. The larger pile measures 2 meters in diameter with a height of 25 cm, and the smaller measures 1.3 meters by 20 cm. A bottle and a drinking glass were found on top of this mound. Since this whole area appears to be a now abandoned, early banana patch, historical origin is indicated. In addition, one of our informants told us of field-clearing practices that involved making such piles of stones.

G5-59 Stone Alignment with Some Features

This site, in the same banana patch as Site G5-58, is probably a badly disturbed terrace border. Sporadic stones define two alignments, 3.8 and 6.5 meters long, respectively, with a width of about 15 cm. A mound of small stones lies in the middle of the longer alignment. A few other stones can be seen in a poorly defined alignment nearby.

G5-60 Retaining Wall

This is a poorly defined, discontinuous stone wall on the W bank of Kamo'oali'i Stream at the inland margin of the first terracette above the stream. The wall is constructed of various-sized stones and is 60 cm (maximum) high. The flat "bench" behind the wall was planted in bananas in modern times.

G5-61 Stone and Concrete Oven for Charcoal Manufacture

This site is identical to G5-53 (see description) except that the dimensions are slightly smaller.

G5-62 Retaining Wall

This is an L-shaped retaining wall located 15 meters E of G5-61. Its perpendicular situation in relation to the stream suggests its being a terrace border. The longer portion of the wall (12.1 meters long) is oriented 110° W, but the remaining stonework measures only 7.6 meters in length. It is built

of two layers of large, rectangular stones, 30 cm high, which slant in to retain the higher earth bank. The other portion of the wall--2.7 meters long, 20 cm high, and 1 meter wide--shows a marked difference in construction, utilizing small stones.

G5-63 Terrace Complex

This complex--located across the stream from G5-62 and on a point of land defined by a sharp bend in the stream--is comprised of two separate, very crude features that indicate small terraces and stone-bordered plots. A jeep road passes nearby indicating the possibility of recent disturbance.

G5-64 Enclosure and Platform

This site is located at the edge of a large *kukui* grove near several small grassy clearings. Four stone walls roughly define a four-sided structure measuring 30 cm high by 2.9, 2.4, 3.2, and 2.9 meters. The condition of the site indicates some disturbance, probably natural, due to roots, etc.

Attached to the exterior of the SE wall is a low (10 cm), rectangular platform 2.1 meters in length by 1 meter in width, which borders a depression or pit 50 cm square. Another stone platform, 35 cm in height and L-shaped, lies 3.5 meters from the NE wall. The base of the L, nearest the enclosure, measures 2.4 meters in length; the longer arm, oriented 30° E, measures 6.5 meters long, and both are 1.5 meters wide. Intact sections indicate a two-layer construction of stones. On the eastern side of the longer segment, 4.5 meters from the base of the L, is an indentation 80 cm square.

The size of this site and the probable association between the enclosure and the platform suggest a religious function rather than an agricultural or habitational one. Its cultural origin is probably Hawaiian.

G5-65 Ditch System

North of the *kukui* grove mentioned in the description of site G5-64 is a steep embankment about 3 meters high, which divides this upper area from the lower flood plain created by the stream flowing below the eastern side of the grove. Located atop this embankment is a ditch 30 meters long, 2 meters wide, and 50 cm deep. It starts at the lower margin of the *kukui* grove near the stream and parallels the embankment until the steepness modifies to a gradual slope. The ditch fronts a natural flat terrace area W of the *kukui* grove.

Two possible walls located along the ditch on the extremities of this terrace suggest its possible agricultural function, in addition to the various taro and *'ape* that grow in the ditch and throughout the whole terrace area as well.

Another, smaller channel flows perpendicularly into the larger ditch about 10 meters from the latter's point of origin, but further investigation showed this channel to be natural.

A cut 5 meters deep and 4 meters wide was made into the face of the embankment about midway through its course. This is probably an artificial agricultural feature as indicated by stones reinforcing the top of the embankment above the cut, and the large *'ape* plants which still thrive inside. The situation of this ditch suggests its dual function as a flood-control device and a possible irrigation system. Its cultural origin and age are not known.

G5-66 Flood-Control Ditch

Located in a thin strip of dense vegetation along the base of the bluff near Sites G5-64 and -65, this apparent flood-control ditch runs along a stream skirting the foot of this high, steep bank. On the other side of this strip of vegetation is a large, grassy clearing which tapers to an apex at the upstream end. The ditch, starting somewhere adjacent to this part of the clearing, measures 1.5 meters wide and 0.8 to 1.2 meters deep; its length could not be determined, however, because of the dense thickets of *hau*, which blocked all progress.

CONCLUSIONS

Although the survey was of limited scope, and relatively few sites were found, several conclusions can be derived regarding the use of the area in time and space. Further conclusions are dependent on a second-phase study involving plane-table mapping and excavation of certain sites.

The survey revealed a discontinuous and dispersed pattern of site distribution, principally along the tributaries of Kamo'oali'i Stream. Few sites were found in the remaining area, and none at any great distance from a flow of water. The density of sites was greatest at two extreme points--one near the confluence of the Kamo'oali'i and Kuou Streams, and the other on the upper margin of the survey area. Surface evidence suggests that the two clusters are discontemporaneous.

Scattered porcelain and glass sherds on several of the lower sites are almost certainly evidence of Chinese taro and rice farmers, known to have occupied the immediate vicinity as recently as 20 to 25 years ago.

Some of the sites in the upper area appear to be older--terraces and stone constructions appear to be Hawaiian and there is no porcelain or glass--yet it is doubtful that any are of precontact age.

An indicator-plant/site relationship was observed early in the fieldwork. Sites were commonly, but not universally, found associated with a grove of *kukui*-nut trees. There is no readily apparent explanation. Both the project botanist, Ranjit Cooray, and Douglas Yen (B.P. Bishop Museum ethnobotanist) are of the opinion that the nuts of this tree tend to collect and propagate themselves on flood terraces, especially where there is a plot of plants (taro, for example) to trap the nuts. The size and distribution of the *kukui* trees in the project area indicate post-site-abandonment growth.

Available evidence, then, suggests little or no aboriginal use other than, perhaps, agricultural, of the lower area. The extent and intensity of agricultural use is difficult to determine without excavation and soil analyses, since many large, natural terraces lacking stone retaining walls would serve equally well for cultivation purposes, including the open flats said to have been taro fields in modern times.

Several stone alignments in the upper area suggest possible residential sites, but none of the typical Hawaiian stone house platforms were located, suggesting short-term occupations. Cursory inspection of the upper end outside the study area indicates more sites and, perhaps, a greater density still farther inland against the *pali*.

The flood-control ditches are evidence of high-water problems in the past, similar to those confronting the modern population; they are a simple and pragmatic solution to a local environmental problem. Their antiquity and cultural identity are in question, but the state of preservation suggests no great age; they were probably made by early 20th century Chinese taro farmers. Hawaiians may not have planted on these sites, but if they did, it may have been seasonal during the drier months.

The minimal use of this inland area is precisely what had been anticipated in view of the distance from the coast and the lack of a large, well-defined valley. This inland pattern can not be related to anything on the coast since a detailed inventory was not undertaken there prior to commercial and residential development. The number of *heiau* and fishponds, however, suggest a fairly dense population, which would be comparable with the settlement patterns on most Pacific islands--heavy concentrations in the coastal areas and decreasing density toward the mountains.

Areal comparisons are limited because of the paucity of survey data for the general Kaneohe-Kailua area. The H-3 freeway survey on the windward side of Oahu, when completed, will provide some comparative data. Brief inspection of sites around Luluku Stream, farther W of the proposed dam, revealed higher-quality stone construction (tighter walls and more elaborate features) than along Kamo'oali'i and Kuou Streams. One striking aspect of the study area was the poor quality and simple nature of sites in contrast to elaborate, multiple-feature sites in other area on Oahu and outer islands. It clearly reflects marginal use by a few people.

RECOMMENDATIONS

Evaluations are purely subjective, being based solely on the cursory inspection of surface features.

In view of the development planned for the project area, recommendations are made for further investigations of significant sites:

1. Further clearing of certain sites to determine extent;
2. Detailed mapping of the entire area;
3. Excavation, mainly in the form of test-pitting; and
4. Restoration where feasible.

The recommendations differ according to the potential for destruction for each site.

GROUP 1 - SALVAGE ARCHAEOLOGY

Imminent destruction by the dam construction, the subsequent innundation of the reservoir (lower area), and proximity to the H-3 right-of-way necessitates prompt salvage activities on the following sites.

G5-37 Oblong earthen mound. Its uniqueness in not only this area, but in all of Hawaii, in addition to the possibility of its containing a burial(s), calls for excavation necessary either in part or in whole.

G5-38 Platform and artificial depression. Because of its well-preserved condition, uniqueness of form, and possible religious significance, this site should be excavated.

G5-45 Agricultural terrace. The extent of this site necessitates further clearing, plane-table mapping, and test-pitting.

G5-47 Flood-control ditch and other features in *kukui* grove. Plane-table mapping is recommended in view of the size, well-preserved condition, and the inclusion of possible agricultural features.

G5-56, -57 Terrace complexes. The proximity of these sites, constituting a small complex on the lower right-of-way boundary for the proposed H-3 freeway, dictates the need for detailed mapping and test excavations to clarify the use/function of the individual features.

GROUP 2 - PRESERVATION POTENTIAL

Feasible incorporation of three upper-area sites into the planned recreational park can be established upon completion of further investigation.

G5-54 Large agricultural terrace complex of considerable extent and complexity.

G5-55 Unique, large circular stone outline.

G5-64 Unique, religious enclosure and platform.

BOTANICAL SURVEY

by
Ranjit Cooray

INTRODUCTION

Aerial photographic studies indicate a mosaic of vegetation in the survey area of the Kamo'oali'i drainage basin. Three major structural cover types were distinguished--herbaceous, scrub, and forest. A fairly small proportion of the project area is under banana cultivation.

Ground reconnaissance indicates that nearly 80 percent of the area is occupied by introduced plants such as *Brachiaria mutica* (a grass), *Andropogon virginicus* (broomsedge), *Eugenia cuminii* (Java plum), and *Psidium guajava* (guava). The remainder of the area supports mixed stands of native and exotic plants.

Most of the area, except for the steep slopes, has been under rice, taro, pineapple, or banana cultivation in the past. Some areas were possibly used as grazing ground for cattle.

The floristic survey indicated that the study area could be divided into three areas, as shown in Fig. 3-10. The NW and SE zones have few or no native plants; the vegetation in these two zones is composed almost entirely of exotic species. The middle zone is botanically richer in native species of plants, which are mostly confined to the steeper slopes; scattered individuals of many native plant species are present in this zone.

FLORA LOCATED DURING SURVEY

Major cover types and a plant list for some typical plant associations in the cover types are presented below. The letters in the first column indicate whether a species is native (N) or exotic (E); native includes both endemic and indigenous. The letters in the second column give the potential life-form of the plant species.

B - Banana
G - Grass
H - Herb
R - Succulent herb
S - Shrub
T - Tree
V - Vine

Herbaceous Cover Types

tG Tall Grass Covers
In Depressional Areas:

Brachiaria - Commelina -- Paedaria association. Species present:

E H *Brachiaria mutica* (Forsk.) Stapf (synonym: *Panicum purpurascens* Raddi)
E H *Commelina diffusa* Burm. f.
E V *Paederia foetida* L.

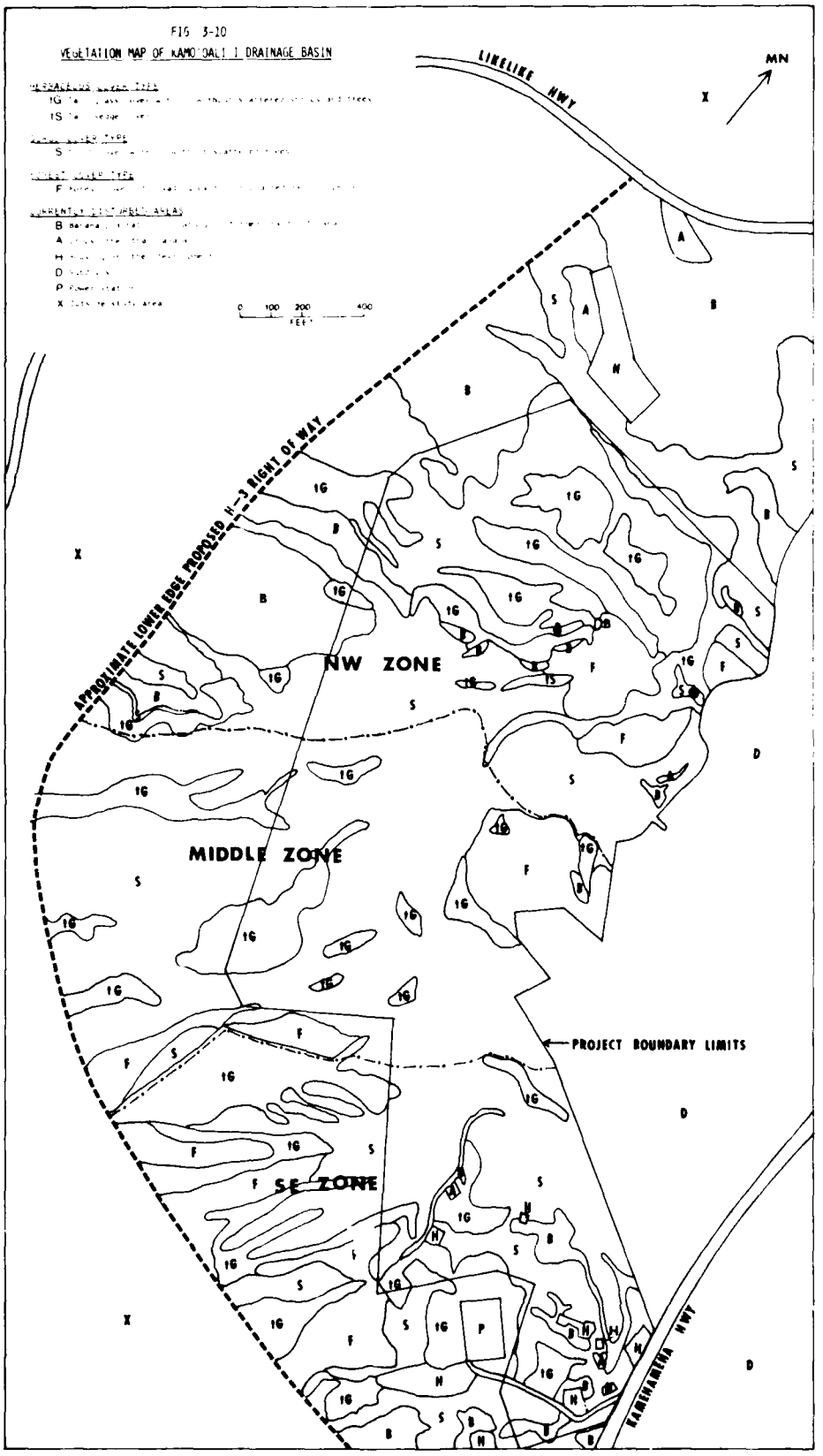


FIG 3-10
VEGETATION MAP OF KAMO'OALI'I DRAINAGE BASIN
HERBACEOUS COVER TYPE
1G
1S
SHRUB COVER TYPE
S
FOREST COVER TYPE
F
CURRENTLY DISTURBED AREAS
B
A
H
D
P
X
0 100 200 400
FEET
LIKELIKE HWY
MN
APPROXIMATE LOWER EDGE PROPOSED H-3 RIGHT OF WAY
NW ZONE
MIDDLE ZONE
SE ZONE
PROJECT BOUNDARY LIMITS
KAMEHAMEHA HWY

N S *Hibiscus youngianus* Gaud.
E.g., in core sites* I-7, I-6 and I-17.

Coix - Brachiaria - Commelina association. Species present:
E H *Coix lachryma-jobi* L.
E H *Brachiaria mutica* (Forsk.) Stapf (synonym: *Panicum purpurascens* Raddi)
E H *Commelina diffusa* Burm. f.
E.g., in core sites I-9, I-19, I-16, I-12.

In Moderately to Well-Drained Areas:

Andropogon - Emilia - Nephrolepis association. Species present:
E H *Andropogon virginicus* L.
E H *Emilia sonchifolia* (L.) DC.
E H *Nephrolepis hirsutula* (Forst.) Presl.
E H *Conyza bonariensis* (L.) Cronq.
E H *Spathoglottis plicata* Bl.
E H *Cassia leschenaultiana* DC.
E H *Stachytarphyta jamaicensis* L. Vahl.
E H *Waltheria americana* L.
E H *Centella asiatica* Urban.
E H *Digitaria decumbens* Steud.
E H *Desmodium triflorum* (L.) DC.
E H *Hyptis pectinata* (L.) Poit.
E H *Paspalum conjugatum* Berg.
E R *Agave sisalana* (Engelm) Perrine
E V *Paederia foetida* L.
E.g., in core sites I-15 and well-drained area near I-17.

tS Tall Sedge Covers
In Depressional Areas:

Scirpus - Aspidium - Commelina association. Species present:
N H *Scirpus californicus* (C.A. Meyer) Steud.
N H *Aspidium unitum* Sw.
E H *Commelina diffusa* Burm. f.
E H *Jussiaea suffruticosa* L. var ligustraefolia (HBK.) Griseb.
E H *Paspalum conjugatum* Berg.
E.g., in core site I-8.

S Scrub Covers
Bordering Depressional Areas:

Hibiscus - Psidium - Paedaria association. Species present:
N S *Hibiscus tiliaceus* L.
E T *Psidium guajava* L.
E S *Leucaena leucocephala* (Lamarck) De Wit
E T *Syzygium jambos* L.
E V *Paederia foetida* L.
E T *Eugeni cuminii* (L.) Druce.
E R *Musa* sp.
E.g., in core sites I-14, I-11.

---

* U.S. Army Corps of Engineers geological core-sampling sites.

Along Stream Beds, Dominated by Exotic Plants:

Psidium - Aleurites - Oplismenus association. Species present:

E T *Psidium guajava* L.
N T *Aleurites moluccana* (L.) Willd.
E T *Eugenia malaccensis* L.
E T *Eugenia cuminii* (L.) Druce.
E S *Leucaena leucocephala* (Lamarck) De Wit
E R *Musa* sp.
E V *Paederia foetida* L.
N S *Hibiscus tiliaceus* L.
E H *Oplismenus hirtellus* (L.) Beauv.
E H *Commelina diffusa* Burm. f.
E H *Paspalum conjugatum* Berg.
E N *Coix lachryma-jobi* L.
E V *Dioscorea bulbifera* L.
E V *Mucuna gigantea* (Willd.) DC.
E T *Syzygium jambos* L.
E H *Costus speciosus* Smith
E H *Phaeomeria magnifica* (Rosc.) K. Schum.
E S *Pipturus albidus* (H and A) Gray
E H *Cyclosorus dentatus* (Forsk.) Ching
E H *Brachiaria mutica* (Forsk.) Stapf
E H *Nephrolepis hirsutula* (Forst.) Presl.
E S *Rubus rosaefolius* Sm.
E H *Colocasia esculenta* (L.) Schott.

E.g., core sites I-11, I-14, and flood plains of streams.

Along Stream Beds, Dominated by Native Plants:

Cordyline - Hibiscus - Psidium association. Species present:

E S *Cordyline terminalis* (L.) Kunth
N S *Hibiscus tiliaceus* L.
E T *Psidium guajava* L.
E T *Eugenia cuminii* (L.) Druce.
E T *Syzygium malaccensis* L.
N T *Aleurites moluccana* (L.) Willd.

E.g., in one locality bordering stream, close to archaeological site G-60.

On Sloping and Well-Drained Areas, Predominantly with Exotic Plants:

Psidium - Eugenia - Paspalum association. Species present:

E T *Psidium guajava* L.
E T *Eugenia cuminii* (L.) Druce.
E T *Eugenia malaccensis* L.
E S *Leucaena leucocephala* (Lamarck) De Wit
E T *Grevillea robusta* A. Cunn.
E T *Macadamia integrifolia* Maiden and Betche
E S *Schinus terebinthifolius* Raddi
E S *Syzygium jambos* L.
E T *Brassaia actinophylla* Endl.
E T *Psidium cattleianum* Sabine.
E H *Andropogon virginicus* L.
E H *Emilia sonchifolia* (L.) DC.
E H *Nephrolepis hirsutula* (Forst.) Presl.

E H *Spathoglottis plicata* Bl.
E H *Cassia leschenaultiana* DC.
E S *Stachytarphyta jamaicensis* (L.) Vahl.
E S *Waltheria americana* L.
E H *Centella asiatica* (L.) Urban.
E H *Conyza bonariensis* (L.) Cronq.
E H *Gleichenia emarginata* (Breck) W.J. Robinson
E H *Digitaria decumbenes* Steud.
E H *Desmodium triflorum* (L.) DC.
E H *Paspalum conjugatum* Berg.
E H *Paederia foetida* L.
E H *Commelina diffusa* Burm. f.
E H *Ageratum conyzoides* L.
E H *Eupatorium riparium* Regel.
E.g., core site I-1 and most disturbed areas adjoining grass-cover areas.

On Sloping and Well-Drained Areas, Predominantly with Native Plants:

Pandanus - Psidium - Oplismenus association. Species present:
N T *Pandanus tectorius* Sol.
E T *Psidium guajava* L.
N T *Metrosideros collina* (Forst.) Gray (several varieties)
N S *Scaevola gaudichaudiana* Chem.
N S *Wikstroemia oahuensis* (Gray) Rock
E H *Gleichenia emarginata* (Breck) W.J. Robinson
E H *Nephrolepis hirsutula* (Forst.) Ching
N T *Aleurites moluccana* (L.) Willd.
E T *Syzygium jambos* L.
E T *Eugenia cuminii* (L.) Druce.
E V *Paederia foetida* L.
E H *Cyclosorus dentatus* (Forsk.) Ching
E H *Oplismenus hirtellus* (L.) Beauv.
E.g., on the steeper slopes and ridges of the middle zone; probably a less-disturbed area.

F Forest Covers
On Low-Lying to Well-Drained Areas Dominated by Exotic Invaders:

Eugenia - Psidium - Mangifera association. Species Present:
E T *Eugenia cuminii* (L.) Druce.
E T *Psidium guajava* L.
E T *Mangifera indica* L.
N T *Aleurites moluccana* (L.) Willd.
E T *Eugenia malaccensis* L.
N T *Pandanus tectorius* Sol.
N T *Hibiscus tiliaceus* L.
E S *Leucaena leucocephala* (Lamarck) De Wit
E H *Polypodium scolopendria* Burm. f.
E R *Musa* sp.
E V *Paederia foetida* L.
E H *Oplismenus hirtellus* (L.) Beauv.
E H *Commelina diffusa* Burm. f.
E H *Coix lachryma-jobi* L.
E V *Dioscorea bulbifera* L.
E T *Cocos nucifera* L.

E V *Mucuna gigantea* (Willd.) DC.
E T *Syzygium jambos* L.
E T *Brassaia actinophylla* Endl.
E H *Nephrolepis hirsutula* (Forst.) Stapf
E H *Cyclosorus dentatus* (Forsk.) Ching
N H *Psilotum nudum* (L.) Griseb.
E R *Agave sisalana* (Engelm.) Perrine
E.g., in most forest-cover areas, *Aleurites* is confined to the stream beds, but the other species range from very-wet to well-drained situations.

On Slopes Planted with Exotic Species:

Araucaria - Eucalyptus association. Species present:
E T *Araucaria heterophylla* (Salisb.) Franco
E T *Eucalyptus* sp.
E T *Macadamia integrifolia* Maiden and Betche
E H *Paspalum conjugatum* Berg.
E T *Psidium guajava* L.
E T *Spathodea campanulata* Beauv.
E T *Carica papaya* L.
E.g., small areas on slope next to housing.

B Cultivated Areas under Banana (includes only areas under intensive cultivation). Species present:

E R *Musa* sp.
E H *Brachiaria mutica* (Forsk.) Stapf
E V *Paederia foetida* L.
E H *Commelina diffusa* Burm. f.
E H *Oxalis martiana* Zucc.
E T *Psidium guajava* L.
E S *Leucaera leucocephala* (Lamarck) De Wit
E H *Cyclosorus dentatus* (Forsk.) Ching
E H *Centella asiatica* (L.) Urban.
E H *Cassia leschenautiana* DC.
E S *Stachytarphyta jamaicensis* (L.) Vahl.
E H *Emilia sonchifolia* (L.) DC.
E H *Eupatorium riparium* Regel.

In addition to the species listed above, several species are found along the trail sides:

E S *Indigofera suffruticosa* Mill.
E H *Amaranthus spinosus* L.
E H *Hyptis pectinata* (L.) Poit.
E H *Mimosa pudica* L.
E H *Phyllanthus niruri* L.
E H *Eleusine indica* (L.) Gaertn.
E H *Anagallis arvensis* L.
E H *Erechtites valarianaefolia* (Wolf) DC.
E V *Ipomoea* sp.
E S *Desmanthus virgatus* (L.) Willd.
E H *Solanum nigrum* L.
E H *Panicum maximum* Jacq.
E S *Pluchea odorata* (L.) Cass.
E H *Pennisetum setaceum* (Schwartz) Rich.
E H *Triumfetta bartramia* L.

E H *Triumfetta semitriloba* L.
E S *Crotolaria mucronata* Dev.
E T *Macaranga* sp.
E H *Axonopus affinis* Chase
E H *Bidens pilosa* L.
E H *Salvia* sp.
E H *Sonchus oleraceus* L.
E H *Plantago lanceolata* L.
E H *Sporobolus africanus* (Poir.) Robyns et Tourn.
E H *Sacciolepis indica* (L.) Chase
N H *Pityrogramma calomelanus* (L.) Link
E H *Kyllinga monocephala* Bottb.
E S *Jasminum sambac* (L.) Ait.
E S *Bambusa* sp.

PROBABLE IMPACT OF PROJECT ON FLORA

Construction and Earth-Moving Equipment

The construction of the dam would require the use of heavy construction equipment, which would result in the destruction of large areas of the vegetation cover. The destruction of the plant cover and exposure of the soil would cause serious soil erosion and consequent water pollution in the streams and Kaneohe Bay.

Several of the core sites would require clearing of the vegetation for access of coring equipment. The vegetation that would be destroyed during this process would be almost all exotic. Although several tangled masses of *hau* shrub (*Hibiscus tiliaceous*) are also in these areas, this native plant species is abundant all over the island of Oahu and would not be endangered.

The middle zone, planned as a recreation area, has steep slopes with several stands of *Pandanus* (*hala*) and several species of native plants scattered along the lower edges of the slopes. The use of heavy construction equipment in this area would be seriously destructive to the native plant cover. Since it is not essential to have paved roads into the picnic area, all effort should be taken to design suitable access with minimum destruction of the vegetation. Clearing of the vegetation for an access road to the lookout and parking areas would not affect any native plant stands.

Especially in the NW zone, much of the present vegetation would have to be removed for access roads and core sites during the construction period. During that time, considerable soil would have to be exposed, and dead vegetation would be evident. In the entire lower area, the dam construction will involve the removal of soil and vegetation, causing a major scar that will take considerable time to restore with vegetation cover.

One endemic and one indigenous species were found in the area scheduled to be under water after the dam is completed--the endemic is *Hibiscus youngianus* Gaud., and the indigenous is *Scirpus californicus* (L.A. Meyer) Steud. They appear not to be common and should therefore be carefully moved to another compatible area that will not be affected by the work.

Exotic species in the NW zone will be suppressed during site preparation; but they, and possibly many other weedy species, would quickly reestablish after completion of the project. Unless planted and cared for by man, however, it is unlikely that native species will have any chance of getting reestablished in the disturbed areas.

Inundation of Area Behind Dam

An area now in dry land or marsh would be permanently submerged. The introduction, either accidental or intentional, of such water weeds as *Eichornia crassipes*, *Salvinia*, and *Pistia stratiotes* would cause a serious hazard. Problems directly associated with water weeds have been reported for many man-made lakes and reservoirs. The weeds multiply rapidly and would make the reservoir a breeding ground for mosquitoes and other pests. Sedimentation would increase; then the aquatic animal life--especially fish--would be endangered. Once established, water weeds are difficult and expensive to remove. All effort should be taken to prevent introduction of these noxious exotics.

People and Vehicles

All the access roads to the project area are presently used by motorcyclists, who have forced new trails through the vegetation cover. Several such trails are in the middle zone, in which most of the native plants presently reside. Only the stands of natives and the few scattered individuals that are confined to the steeper slopes or the edges of the slopes of this zone have not yet been destroyed by the cyclists. Such destruction, by relatively light-weight, two-wheeled vehicles, emphasizes the massive destruction potential by heavy earth-moving and construction equipment, during the construction phase, and later, by too many cars in the relatively fragile areas containing the native plants.

RECOMMENDATIONS

1. Preserve most of the middle zone (scheduled to be the recreation area) in its present state. Should there be reason to add tree cover to enhance the area, plant native tree and shrub species in preference to exotics.

2. Prohibit motorcyclists from the recreation area except on standard roads established for the general public.

3. Make accessible to students and scientists the remnant stands of native plants in the middle zone, and protect them from destruction by unknowing and/or uncaring members of the public.

4. Where possible--although recognizably time-consuming and expensive--use hand clearing for trails in the middle zone, to prevent large-scale destruction by heavy equipment.

5. Around the lake behind the dam, landscape with native tree and shrub species to replace the present exotics, thus adding to the conservation of Hawaii's unique biota.

LITERATURE CITED

Bagot, Frederick (ed.)
1884 *McKenney's Hawaiian Directory*. Oakland: L.M. McKenney & Co. p. 149.

McAllister, J.G.
1933 *Archaeology of Oahu*. B.P. Bishop Mus. Bull. 104. Honolulu.

Stearns, Harold T., and Knute N. Vaksvik
1935 *Geology and Ground-Water Resources of the Island of Oahu, Hawaii*. Territory of Hawaii, Division of Hydrography. Bull. 1. Honolulu.

Sterling, Elspeth, and Catherine Summers
Ms. The Sites of Oahu (1962). Notebooks on file in Dept. Anthropology, B. P. Bishop Museum. Honolulu.

Wyllie, R.C.
1848 *Answers to Questions*. Proposed by R.C. Wyllie and addressed to all the Missionaries in the Hawaiian Islands, May 1846. Hawaii (Kingdom) Dept. Foreign Affairs. Honolulu.

REPORT 4. INTENSIVE SURVEY

ARCHAEOLOGICAL INVESTIGATIONS ALONG UPPER KAMO'OALI'I STREAM, KANEOHE, OAHU*

by

Patrick C. McCoy

* Originally prepared by the Department of Anthropology, Bernice P. Bishop Museum, for the U.S. Army Corps of Engineers-Pacific Ocean Division, under Contract No. DACW84-73-C-0018. Submitted to the Corps of Engineers as Ms. 060473 in July 1973.

PREFACE

In January 1972 a preliminary Phase I cultural and botanical survey was undertaken by the Department of Anthropology, Bernice P. Bishop Museum, in the Kaneohe-Kailua Flood Control Project area, including the locations of a proposed dam, reservoir, and recreational facilities. Recommendations for further archaeological work were made, based on the findings of the site survey (McCoy, Sinoto, and Cooray, Report 3). In the interim period, slight modifications were made in those recommendations, based on further appraisals of sites following field trips by Museum and U.S. Army Corps of Engineers staff members. Sites G5-47, -56, and -57 were not investigated in the second phase of fieldwork, as originally suggested, because in the second analysis they did not seem to warrant further investigation.

Mapping and test excavations were carried out on seven sites: G5-37, -38, -45, -46, -54, -55, and -64 during a three-week period beginning on February 26, 1973. Site G5-55, not included in the original recommendations, was added because of the information it might provide on habitation in the lower study area. The findings of that work, conducted for the U.S. Army Corps of Engineers (Contract No. DACW84-73-C-0018), are presented in this report.

The field crew consisted of Patrick C. McCoy, field director, and four assistants--Tony Maiava, Jennie Peterson, Elaine Rogers, and Charles Spilker. Peter and Julia Sahlins regularly volunteered their services. Other volunteer help included Aki Sinoto, Toni Han, Timothy Lui-Kwan, Myra Tomonari, and Nick Dunning. Rob Hommon, Bishop Museum archaeologist, assisted in mapping during the last few days of the project. Yosihiko Sinoto and Douglas Yen of the Museum visited the sites and provided ideas on the possible functions of some features. To all of the crew, I am indebted for their help and tolerance in completing the work during a rainy period that was anything but inspiring.

Dr. John Belshé, contracting officer, and his assistant, Ruby Ibaraki, were most kind in providing maps of the project area and in their offers to assist in other ways.

The illustrations were prepared by Mary Rosendahl. Jennie Peterson catalogued the few artifacts recovered. Volcanic-glass dating was done by Mark Childs of the University of Hawaii. The draft copy of this report was typed by a volunteer, Judy Sato.

INTRODUCTION

Test excavations were undertaken on seven sites during a three-week period in February and March, 1973. Four of the sites are clustered on a spit of land bordered by the tributaries of Kamo'oali'i Stream, near its confluence with Kuou Stream (Fig. 3-4, foldout at end of volume). The other three sites, all near the upland margin of the proposed recreational area, are more dispersed and show no signs of being related in time to the lower site complex (Fig. 4-1).

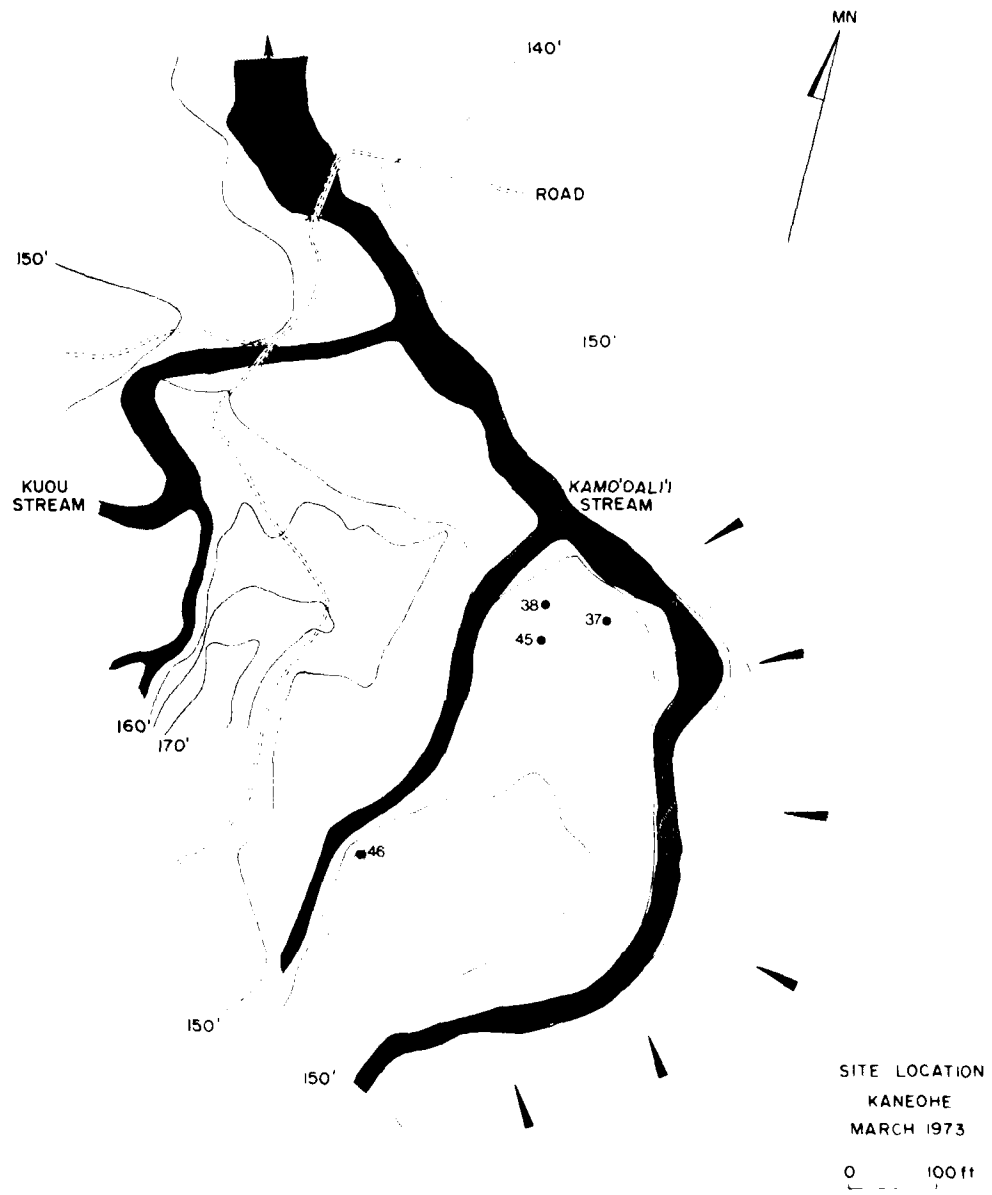


Fig. 4-1. MAP OF LOWER SITE COMPLEX.

Preliminary to excavation, all sites were cleared and mapped with a plane table and telescopic alidade. The approach to excavation, explicated in the site descriptions following, differs according to the layout and content of each site. Excavations, though small, are sufficient to make informative statements about each site, and to assess whether or not further salvage work is necessary.

RESEARCH OBJECTIVES

The overall objective of the research was to test propositions, for the middle reaches of Kamo'oali'i Stream, of site antiquity and cultural affiliations set forth in the first report on the preliminary survey. Briefly, the first analysis proposed that the cluster of sites in the dam site and near the confluence of Kamo'oali'i and Kuou Streams was historic while those in the uplands were possibly precontact Hawaiian. If this basic proposition could be shown to hold true, then it would suggest abandonment of upland areas for permanent habitation and new or expanded use of broad, alluvial flats farther downstream for taro and rice production in the historic period.

ENVIRONMENTAL SETTING

The project area, located at the windward base of the Ko'olau Mountains, is wet. As a consequence, the area supports a heavy growth of tropical plants, most of which are now introduced, exotic species (Cooray, in McCoy, Sinoto, and Cooray, Report 3). *Pandanus* and *kukui* trees are the most common survivors of the indigenous flora. Large banana plantations cover much of the slopes below the almost vertical cliffs of the Ko'olau Mountains. Streams are actively dissecting the slopes, yet there are no valleys, suggesting that the process is relatively recent, geologically. The predominant sediments in the area are unconsolidated alluvial deposits.

SITE G5-37

SITE DESCRIPTION

Site G5-37 is a long, narrow, roughly rectangular earth mound located on the W bank of the major tributary of Kamo'oali'i Stream near its confluence with Kuou Stream. The terrace is covered with Java plum, guava, *kukui*, *haole koa*, *Pandanus*, and various unidentified grasses and ferns. The *kukui*, Java plum, and guava form a canopy that allows relatively little penetration of sunlight. The floodplain on the other side of the stream is planted in a small truck garden.

FORMAL CHARACTERISTICS

The mound is 12 meters long and 2.2 meters wide on top, with the dimensions expanding to 17.7 by 6.3 meters at the base. In the center it is about 1.5 meters high. The ends are slightly rounded, probably because of post-use erosion, and are asymmetrical; the W end is higher and wider than the E (Fig. 4-2). The mound slopes slightly to the E. At the center the sides slope sharply at a 35- to 40-degree angle to ground surface (Fig. 4-3). On top of the mound near the center is a low, roughly rectangular, stone platform, 1.8 by 1.6 meters, which in the first analysis was thought possibly to mark the location of a burial (Fig. 4-2).

PLAN OF EXCAVATION

Two excavations were undertaken simultaneously on the mound. A 1-meter-wide trench, 9.3 meters long (designated T-1), was put in across the mound at the widest point in the center. Excavation was begun simultaneously from the base of each side (Fig. 4-4). This approach was deemed the best method for defining the stratigraphy immediately and allowing us to see what features, if any, were contained in the mound. Aimed at determining the function of this feature, the second excavation (T-2) was put through the stone platform.

The T-1 excavation was done with pick and shovel, except when stone or charcoal concentrations were encountered. Trowels were used in the excavation of the stone platform. In the absence of deposits with many artifacts, none of the material was screened. Examination of excavated material was careful enough, however, to recover a number of small volcanic-glass flakes averaging about 1 cm long. Both excavations were done in natural stratigraphic layers.

STRATIGRAPHIC DESCRIPTION AND INTERPRETATION

Six stratigraphic layers are apparent in T-1 at the center of the mound (Fig. 4-5). The two cultural layers, III and V, are separated by a sterile clay deposit, IV. The bottom layer, VI, is a sterile clay-loam of unknown thickness, forming the base of the mound. In profile, this basal layer itself assumes the form of a mound, suggesting that it is the remnant of an older, natural terrace or another geomorphological feature. Lenses of weathered, well-sorted, fine alluvium within Layer VI suggest that it is a depositional feature. A series of small, overlapping lenses on the S side of the mound, on the upstream side, suggest, moreover, that that side of the mound, particularly, has been subjected to repeated stream-cutting and filling (Fig. 4-5).

On top of the natural, raised mound (Layer VI) is a homogeneous clay-loam (Layer V) containing a series of post-molds. Five are visible on the W face of the excavation (Fig. 4-5); three others were found in the excavation of T-1, all near the southern terminus of Layer V, which truncates on the edges of the top surface of the original, natural mound. The horizontal extent of Layer V is 4 meters, sufficiently wide to have supported a structure of some type.

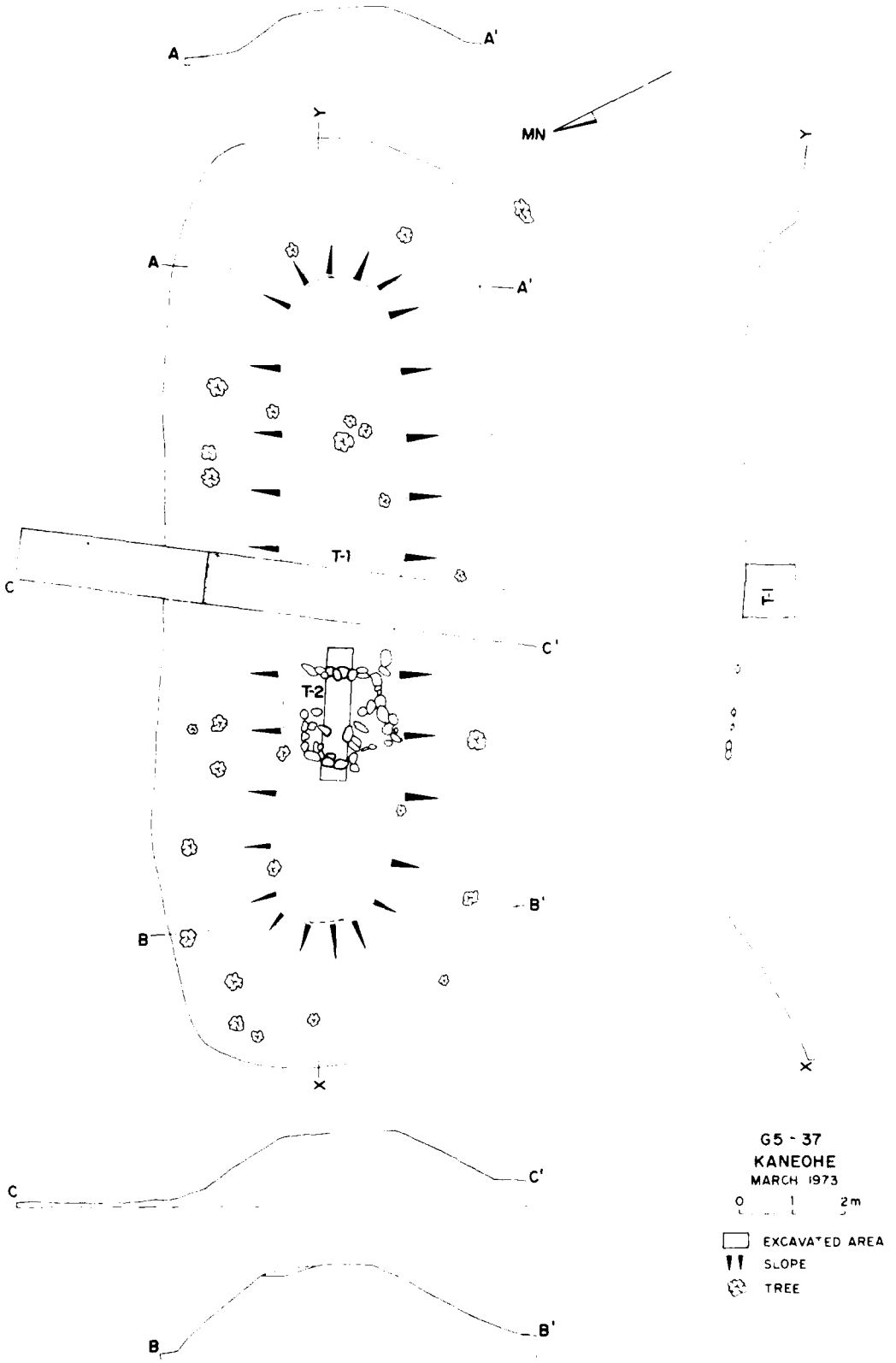
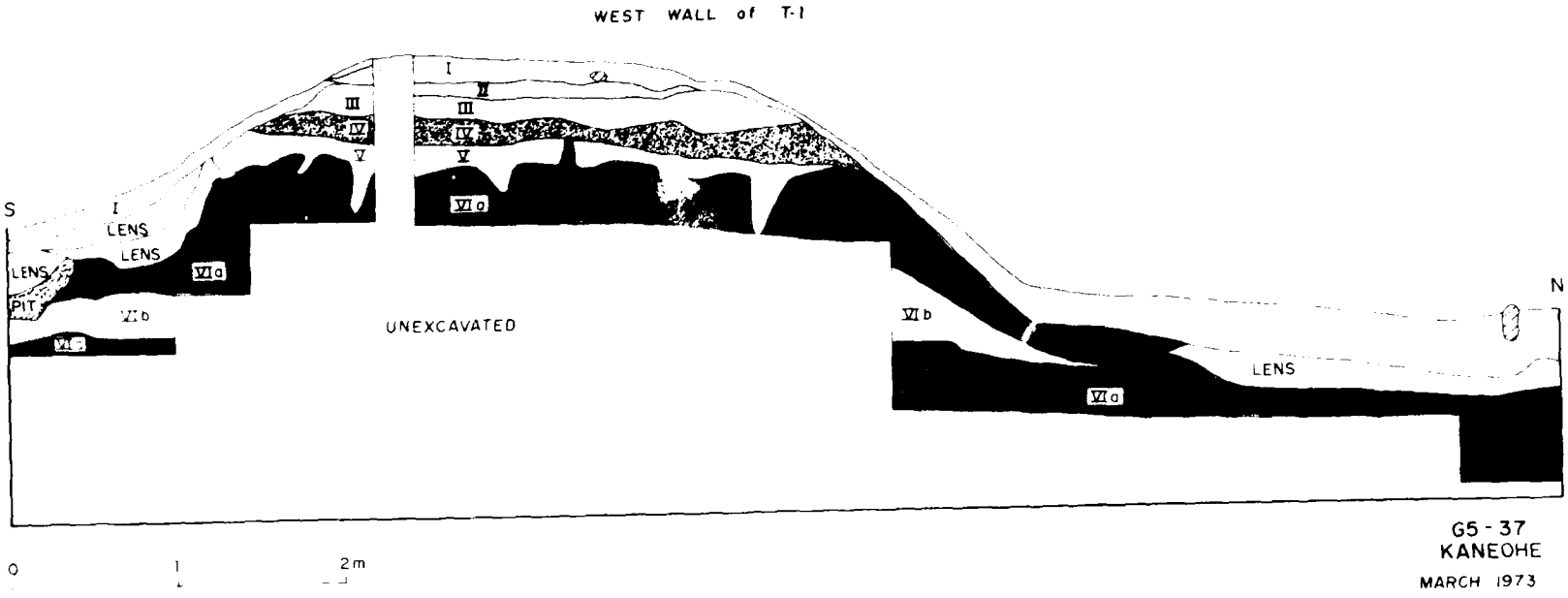


Fig. 4-2. PLAN AND PROFILES OF SITE G5-37.

Fig. 4-3. VIEW ALONG N SIDE OF MOUND (SITE G5-37) FROM THE W (BPBM Neg. No. OA(a) 74-15).

Fig. 4-4. T-1 EXCAVATION ON THE S SLOPE OF SITE G5-37 (BPBM Neg. No. OA(a) 72-15



I	humus, dark-yellowish-brown clay-loam*
II	dark-yellowish-brown, yellowish-brown clay
III	very dark-grayish-brown clay-loam
IV	dark-yellowish-brown clay-loam
V	dark-yellowish-brown, brown clay-loam
VI	dark-reddish-brown clay-loam

* All colors are based on Munsell Color Chart; colors were taken wet.

Fig. 4-5. STRATIGRAPHIC PROFILE OF W FACE OF T-1, SITE G5-37.

A thin clay deposit, Layer IV, caps cultural deposit V and truncates similarly near the edges of the present mound. It is overlain by Layer III, the second cultural deposit, which is also limited horizontally to the top of the mound. From near the center of the mound to the S edge is a concentrated charcoal deposit, 2 to 3 cm thick. The limited extent of this feature suggests that it is not the result of a natural burn of vegetative cover on the mound; rather, it appears more likely to be the remains of a cleaned-out earth oven. A thin clay deposit (Layer II) of even more limited horizontal extent overlies it. Layer I, a clay-loam/humus deposit, is developed over the entire mound.

A feature consisting of a vertical configuration of stones was found in approximately the center of the mound on the W wall. The upper surface is at the interface of Layers I and II and the feature extends down to the bottom of Layer IV. The outer stones on the E edge of the feature were aligned in a face of sorts, indicating that the stones were purposefully stacked. The function of this feature is unknown.

The T-2 excavation revealed the same stratigraphic sequence, with an absence of stone fill in the eastern half of the platform. The western side covers a large artificial pit, the diameter and depth of which were not determined in our small excavation. The pit extends vertically from Layer I into Layer VI.

In sum, the stratigraphic evidence points to multiple periods of use of the mound, separated in time. In the first cultural period the mound supported some type of structure. The second cultural phase (Layer III) is denoted by charcoal and volcanic-glass flakes, several of which show bulbs of percussion and striking platforms, indicating occupation on the mound or nearby. The final period of use is represented by the small stone platform on the surface and by the pit below.

CULTURAL MATERIALS

Artifacts recovered in the T-1 excavation are limited to one non-utilized basalt flake in Layer V and 16 volcanic glass fragments in Layer III. Several of the latter flakes show bulbs of percussion and striking platforms, but no use-wear could be detected in microscopic examination of the edges. The flakes, like most of those recovered in Hawaiian sites except near known source areas, are small (0.5 to 1.4 cm). Their size suggests that, to be functional, these tiny flakes must have been inset in a wooden handle of some sort. Three pieces of green glass and 14 pieces of metal were found on the W side of the T-2 excavation between stones in the platform.

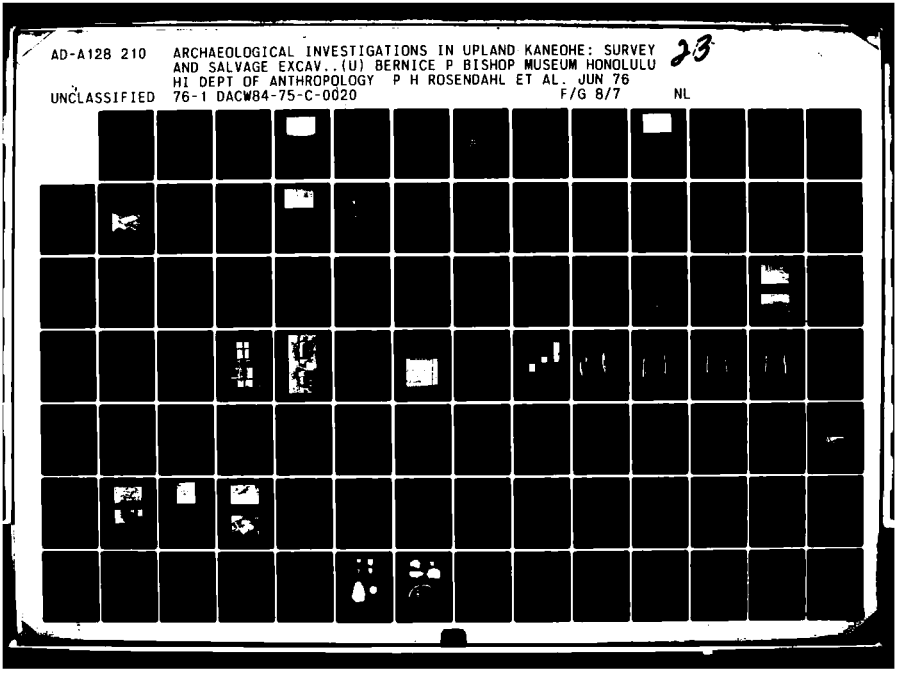
DATING

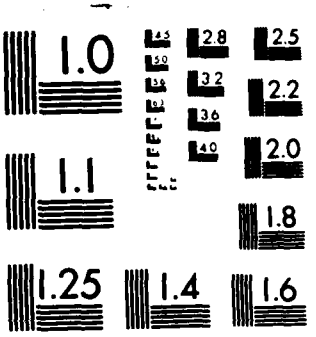
Absolute dates are available for the two cultural deposits, Layers III and V. A radiocarbon date of 1325 A.D.--625±105 B.P.* was obtained from a charcoal sample (I-7114) collected in the center of the mound between postholes in Layer V.

* B.P. = Before Present, i.e. before 1950.

AD-A128 210 ARCHAEOLOGICAL INVESTIGATIONS IN UPLAND KANEOHE: SURVEY AND SALVAGE EXCAV..(U) BERNICE P BISHOP MUSEUM HONOLULU HI DEPT OF ANTHROPOLOGY P H ROSENDAHL ET AL. JUN 76

UNCLASSIFIED 76-1 DACW84-75-C-0020 F/G 8/7 NL





Five volcanic-glass hydration dates clustering around A.D. 1650 were obtained for Layer III: A.D. 1647±48, 1680±65, 1632±18, 1674±27, 1591±25. These latter dates seem reasonable in terms of the position of Layer III and its separation from Layer V by a sterile deposit.

CULTURAL COMPARISONS

The earth mound on Site G5-37 is a unique feature in Hawaii and, so far as is known, in the rest of Central and Eastern Polynesia. Earth mounds of comparable length, but much lower and narrower, called *miro oone*, are known from Easter Island, but they were used for dancing rather than habitation. The star-shaped mounds and pigeon mounds of Western Polynesia are the only earthworks of comparable size in Polynesia, but in plan and function they differ from the present site.

SITE G5-38

GENERAL DESCRIPTION

Site G5-38 is a partially excavated, almost square depression in the SE corner of which is a low, stone-lined earth mound (Fig. 4-6). The longest side of the depression, on the W, is 9.2 meters; the shortest, on the N, is 7.3 meters. The other two sides are 8 meters long. A low embankment formed by mounded dirt from the excavation of the depression forms the N and W sides; the E and S sides are the margins of a natural terrace.

The mound is roughly circular in shape and partially lined by stones (Fig. 4-6, 4-7). The alignment on the S side is 2.45 meters long and 25 cm high, consisting of three courses of stones. An almost equally good alignment, 1.95 meters long, borders the N side of the mound. Guava and Java-plum trees on top of the mound have disturbed the alignments, particularly on the W end, but it appears that these were never as well-built as on the N and S sides.

PLAN OF EXCAVATION

In view of the wall conditions just noted, a trench (T-1) was put across the mound, oriented roughly N-S. The original trench was 3.5 meters long and 50 cm wide, but it was extended another 50 cm on each end when more stones were encountered at the base of the N and S walls. The position of the trench was determined in part by a large Java-plum tree on the W end, which had to be avoided. The mound was excavated in natural stratigraphic levels to a maximum depth of 50 cm in the center.

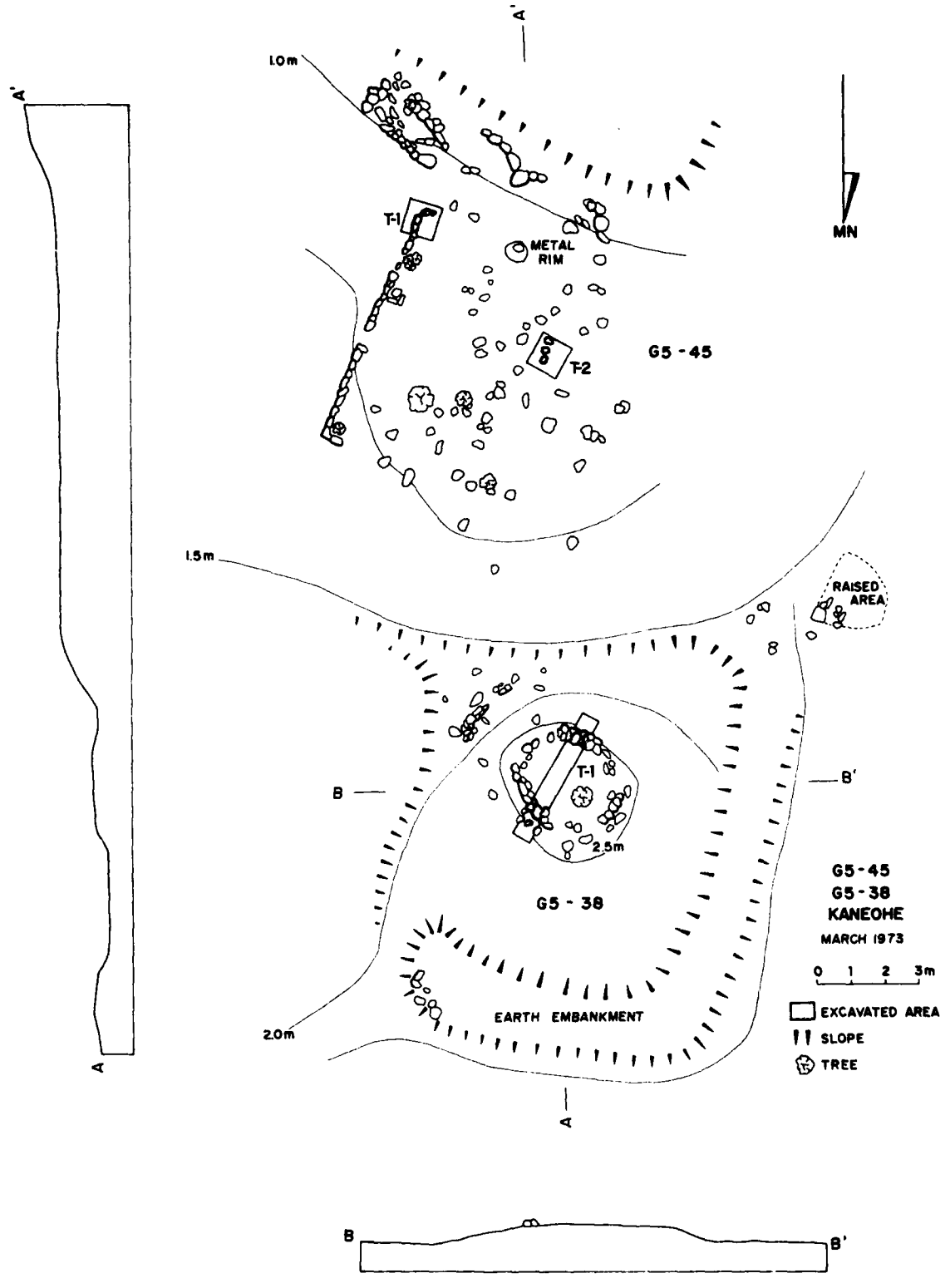


Fig. 4-6. PLAN AND PROFILES OF SITES G5-38 AND G5-45.

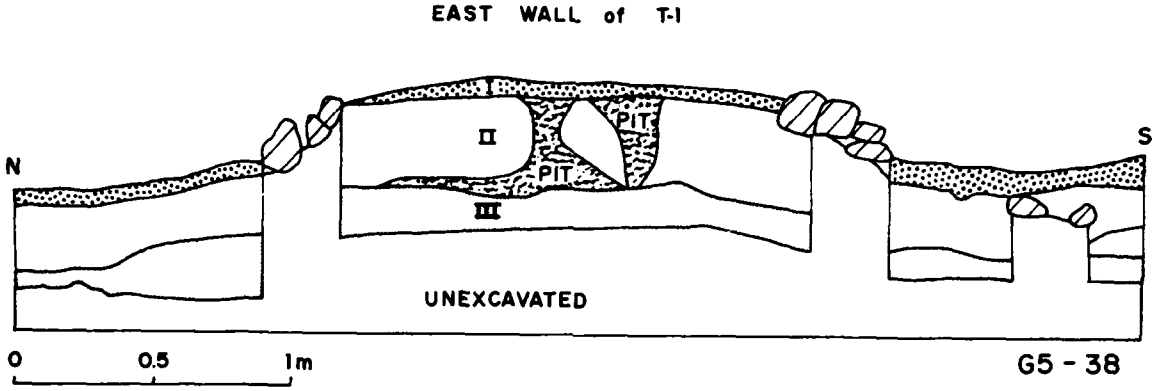
Fig. 4-7. VIEW OF STONE-LINED MOUND (SITE G5-38) FROM THE N (BPBM Neg. No. OA(a) 72-23).

STRATIGRAPHIC DESCRIPTION AND INTERPRETATION

Excavation of the mound revealed three natural soil layers, all of which were sterile. A profile of the mound (Fig. 4-8) indicates that the mound was formed first, and that it was later lined by stones on the sides, probably to retard erosion. The top of the basal layer, III, is a roughly smoothed, slightly curved surface, suggesting that it had been contoured to form a low mound. There is no observable weathered surface at the interface of Layers II and III, from which it is inferred that Layer II was deposited shortly after the contouring of the Layer III surface. A thin 00 and A1 horizon is developed on top of the mound, covering part of the stone alignments. The two pits in Layer II are the result of tree-root growth.

FUNCTIONAL INTERPRETATION AND AGE

No artifacts or materials for dating were recovered in the excavation to provide clues for determining the function and age of the site. The depression and mound are both artificial features, and, from all indications, are components of a single functional unit. There are no stratigraphic or pedological clues to suggest use of the site for agricultural or storage purposes, and no evidence to indicate use for habitation. In terms of agriculture there is no logical reason to cut a depression and built a single, small, earth mound and surround the site with an embankment. The depression, furthermore, is the worst possible location for a storage pit, since it collects moisture. The most feasible explanation



I humus, brown-clay, loam
II dark-brown, brown-clay, loam
III dark-brown clay, loam

Fig. 4-8. STRATIGRAPHIC PROFILE OF EAST WALL OF T-1, SITE G5-38.

for site usage, offered by D.E. Yen (personal communication), is that the depression with the embankment was constructed to contain pigs. In this view the mound would have provided a piece of dry ground to get out of the muddy wallow in the low area. The earth embankment is not sufficiently high to contain pigs, however, which means that a wire or wooden fence would have been a necessary addition to the enclosure. A fence means historic age, which, by assuming association with the historic habitation on Site G5-45 on the basis of proximity, would appear to be a reasonable supposition. If the site is a pig enclosure, it departs from the widespread Hawaiian high-walled stone enclosure, but again, assuming historic age, it is predictable to expect deviations from traditional Hawaiian models.

SITE G5-45

SITE DESCRIPTION

On a flat terrace 3 meters S of Site G5-38 is a relatively intact stone alignment and a scatter of other stones designated Site G5-45 (Fig. 4-6). The alignment is a 7-meter-long, single course of partially buried stones, joined on the N and S ends by a few stones sufficient to indicate corners. Whether or not walls extended any greater distance on these two sides is not clear. The S side of the site is the bank of a natural terrace, at the base of which are several small, disconnected stone alignments. Two short, parallel alignments, extending up that slope obliquely, border a worn area that appears to be a pathway.

PLAN OF EXCAVATION

Excavation on Site G5-45 was limited to two 1-meter-square test pits, one (T-1) in the SE corner of the long stone alignment, and the other (T-2) in the center of the scattered stones (Fig. 4-6). As predicted, no midden deposit was found in either excavation. Further testing was, therefore, deemed unnecessary.

STRATIGRAPHY

The profiles of both excavations are uniform in showing two sterile clay-loam deposits overlain by a developing A-horizon soil. Minor undulations, visible in the profiles (Fig. 4-9) have no cultural significance.

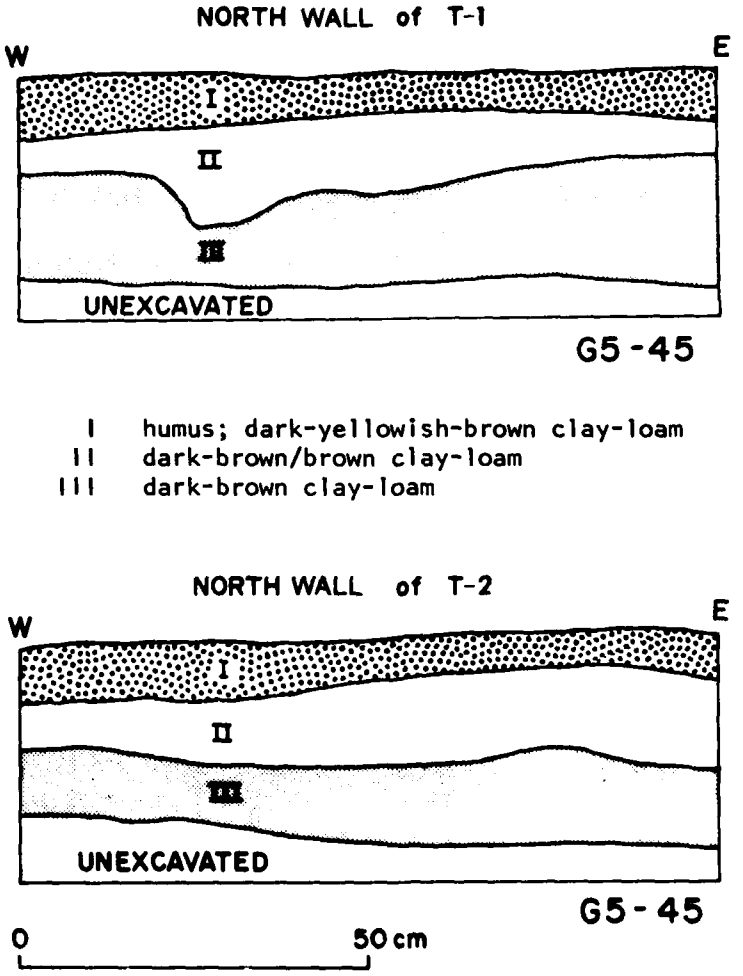


Fig. 4-9. STRATIGRAPHIC PROFILES ON N WALLS OF T-1 AND T-2, SITE G5-45.

CULTURAL MATERIALS

Fragments of unidentifiable oxidized iron, 11 round-headed nails, two pieces of clear glass, a piece of plastic, and a piece of copper wire were found in Layer I of T-1. A basalt flake, 3.7 by 2.2 by 0.8 cm, with one apparently polished edge, was the only artifact recovered in Layer II. Cultural items in the T-2 excavation consisted of: 27 pieces of clear glass from a plate, two pieces of porcelain, more round-headed nails and oxidized iron, and three unidentified, large, circular iron disks clustered together just below ground surface (Fig. 4-10).

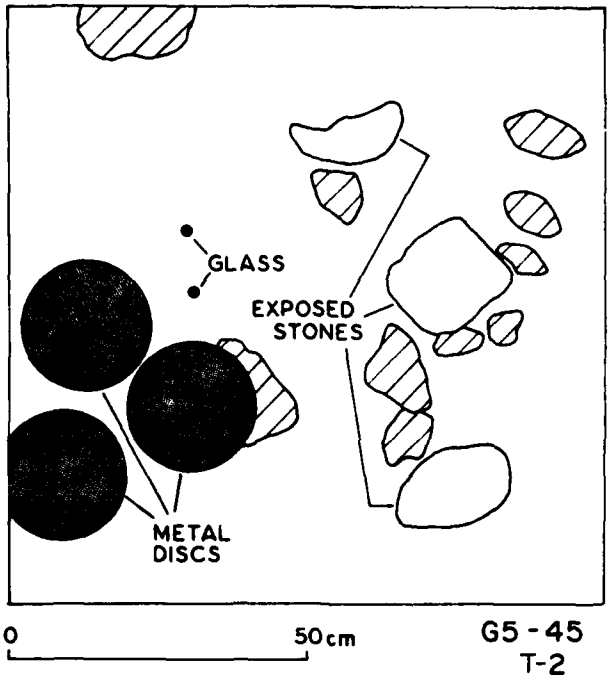


Fig. 4-10. PLAN OF LAYER I, T-2, SITE G5-45.

A larger collection of 16 historic items was gathered on the surface in the immediate site vicinity. It includes two complete bottles, both made by machine and lacking embossing. The smallest, 10.8 cm high, has a short neck and slightly flared lip and resembles bottles used for medicinal purposes. The other bottle is 24 cm high and has a similarly short neck and slightly flared lip. Its function is unknown. Another bottle is represented by part of the neck, base, and 10 smaller pieces. The letters P and C, each enclosed by a square, can be seen on the side of the base. It appears to be a cola or beer bottle. Four other pieces of glass were found. Ceramic wares include parts of six vessels: a blue-on-white porcelain plate or shallow bowl, one fragment of a green-on-white cup, and a solid-white porcelain cup. Three small porcelain bottle stoppers, with wire inserted through an opening in the top part for attachment, were found together with the ceramics and much of the glass; the stoppers might have been used on sake bottles. One piece each of iron and plastic complete the surface collection.

FUNCTIONAL INTERPRETATION AND AGE

The long stone alignment and corners suggest the outline of a house, or, perhaps, the porch *lanai* of a house. Nails, bottles, bowls, and other items on the site support this interpretation. Artifact types suggest a very late-nineteenth- or early-twentieth-century date.

SITE G5-46

SITE DESCRIPTION

Located on a raised promontory on the second terrace above the E bank of a tributary of Kamo'oali'i Stream, Site G5-46 would have offered a spectacular view of the Ko'olau *pali* and ocean prior to the encroachment of large mango and Java-plum trees, and dense thickets of *haole koa* which now cover the site. A large stone outline, 12 by 9.5 meters, open to the E side, occupies virtually all of the available space on the northern extremity of the promontory (Fig. 4-11). The long wall, on the W, parallels the terrace bank; it is eroded in the central section to a point on the S where first one alignment and then a second, c. 2.5 meters farther S, intersect it at nearly right angles. The three walls enclose an open area, 7 by 2.5 meters, that is provisionally considered to be a porch area. Many of the stones in the northern alignment of this feature are covered with a thin veneer of mortar, as are several stones on the N wall of the larger outline. The E side of the site, denoted on the plan map (Fig. 4-11) by a dotted line, is a low bank that appears deliberately cut in the northern part. There is no indication that the bank was ever lined with stones.

PLAN OF EXCAVATION

The approach to excavation consisted initially of putting test trenches (T-1 and T-2) through the walls as a means of determining (1) how the stone courses were set; and (2) what, if any, cultural deposit had built up against the walls.

After a paving of pebbles and mortar was found in these two excavations (Fig. 4-12), further probings were made in the center of the outline to determine the horizontal extent of the paving. A third, controlled excavation was undertaken on the E end of the porch area.

STRATIGRAPHY

Excavation in T-1 to a maximum depth of 25 cm was sufficient to reveal a soil profile consisting of three layers; the middle layer (II) contained the mortar and pebble paving. Location of the wall stones in Layer II demonstrates the contemporaneity of the wall and pavement (Fig. 4-13). The pavement varies slightly in its makeup--in some areas waterworn pebbles (4-to-10-cm average diameter) are interspersed with mortar at the same level; in other sections,

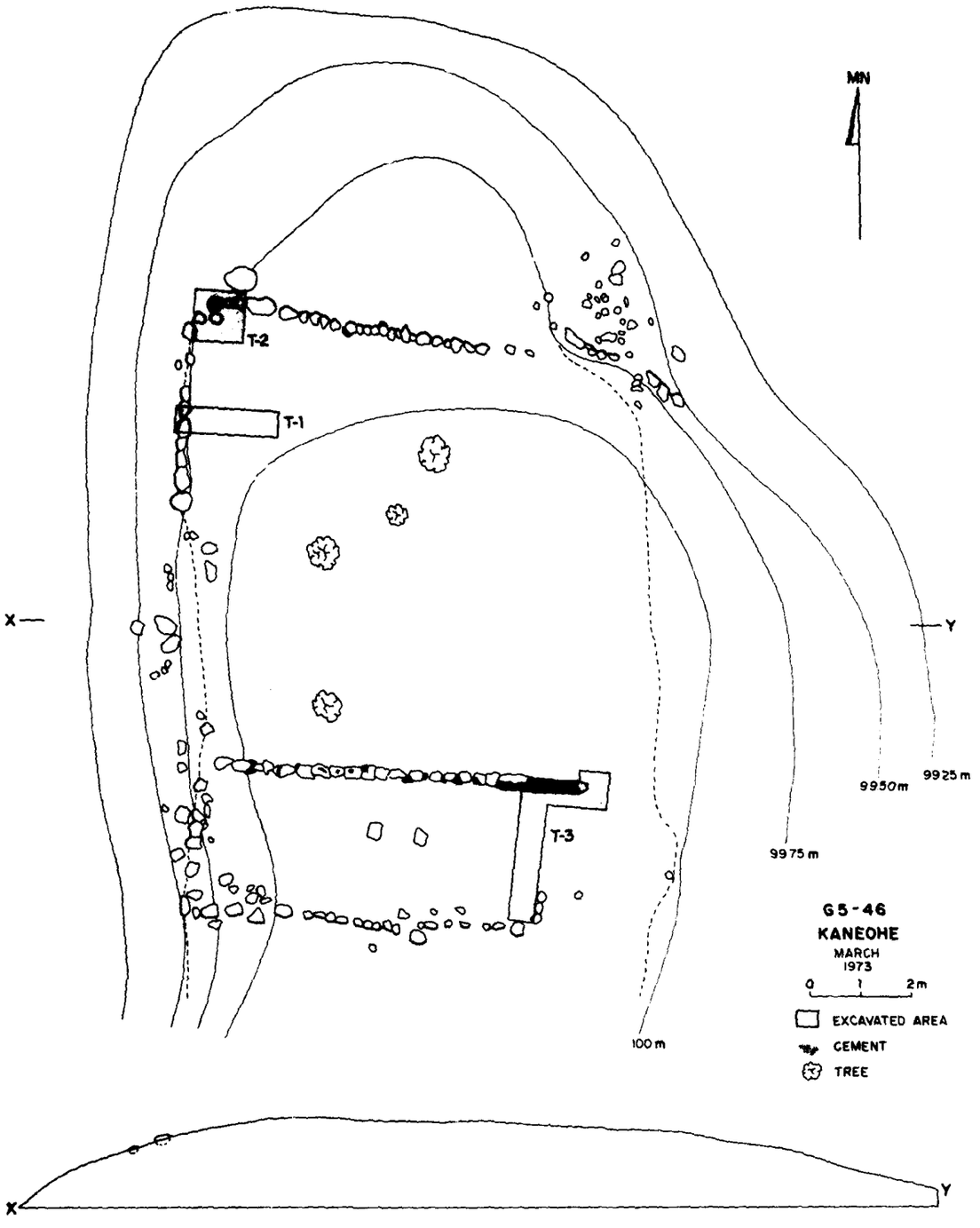
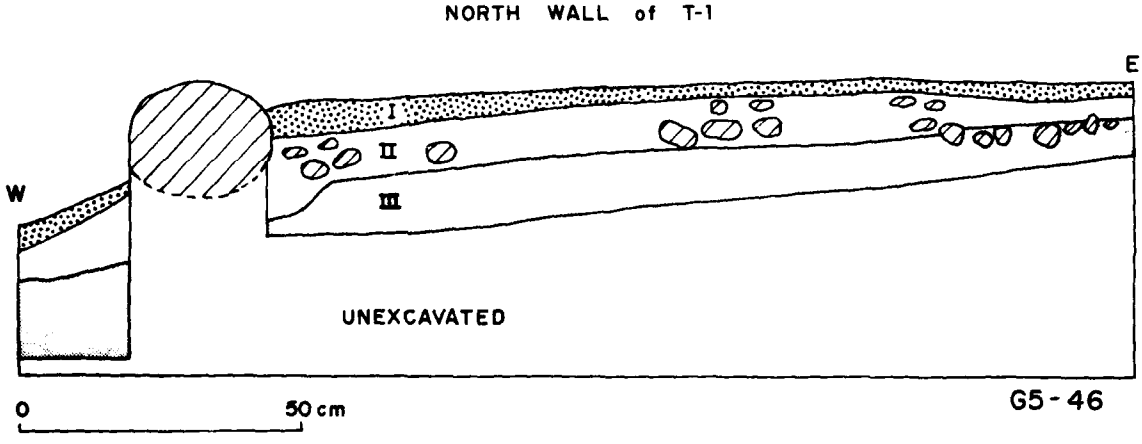


Fig. 4-11. PLAN AND PROFILE OF SITE G5-46.

Fig. 4-12. MORTAR AND PEBBLE PAVEMENT ALONG W WALL, SITE G5-46 (BPBM Neg. No. OA(a) 73-6).



I humus, dark-reddish-brown loam
II dark-reddish-brown loam
III yellowish-red silty-loam

Fig. 4-13. STRATIGRAPHIC PROFILE OF N WALL OF T-1, SITE G5-36.

contiguous to the above, mortar was poured directly over a basal layer of the same pebbles. It is interesting to note that the mortar is thin (1 to 2 cm) and nowhere does it spread out unevenly between openings in the pebble layer beneath. The T-3 excavation in the porch area revealed a pebble pavement of larger stones, averaging 10 cm in diameter; that pavement, from random probings, appears to be continuous over the porch area and homogeneous--i.e., there is no mortar pavement in this area. Like the pavement in T-1 and T-2, the stones are remarkably uniform in size, indicating selection for certain size class.

CULTURAL MATERIALS

Two pieces of glass--one clear, the other green--were found on the surface toward the center of the site. Other historic artifacts were found in the T-3 excavation, just below the sod line. They include: a blue-gray piece of porcelain, one piece of green glass, one piece of brown glass, and three parts of a kerosene lantern--the piece that holds the wick (still intact), the metal rim around that part, and the screw that regulates the height of the wick.

FUNCTIONAL INTERPRETATION AND AGE

The size of the stone outline, presence of paving, and domestic artifacts inside the stone outline indicate that Site G5-46 was used for habitation. The artifacts and mortar establish the period of the site as historic. None of the artifacts are distinctive enough to specify the time period more precisely, but the pavement of mixed pebbles and mortar (of poor quality) might indicate very late-nineteenth or early-twentieth century, at a time when some of the old cultural patterns (pebble pavement) still persisted. An alternative thesis, which would not necessarily negate the proposed date, is that the particular family was unable to obtain more mortar because of their economic situation or other reasons.

SITE G5-54

SITE DESCRIPTION

The largest site investigated during the project, Site G5-54 covers an area approximately 50 by 25 meters at the confluence of two tributaries of upper Kamo'oali'i Stream (Fig. 4-14). A third erosional gully bifurcates the site, but there is some reason to believe that this geomorphic feature post-dates abandonment of the site. Site G5-54 is an agricultural terrace complex which, for the most part, represents utilization of natural benches with only slight modifications in retaining walls and some leveling of surfaces. There are none of the solidly built stone facings that characterize many Hawaiian agricultural terraces.

Reconstruction of the site layout is complicated, not only by the poor quality of stone work in terraces, if present at all, but also by the gully

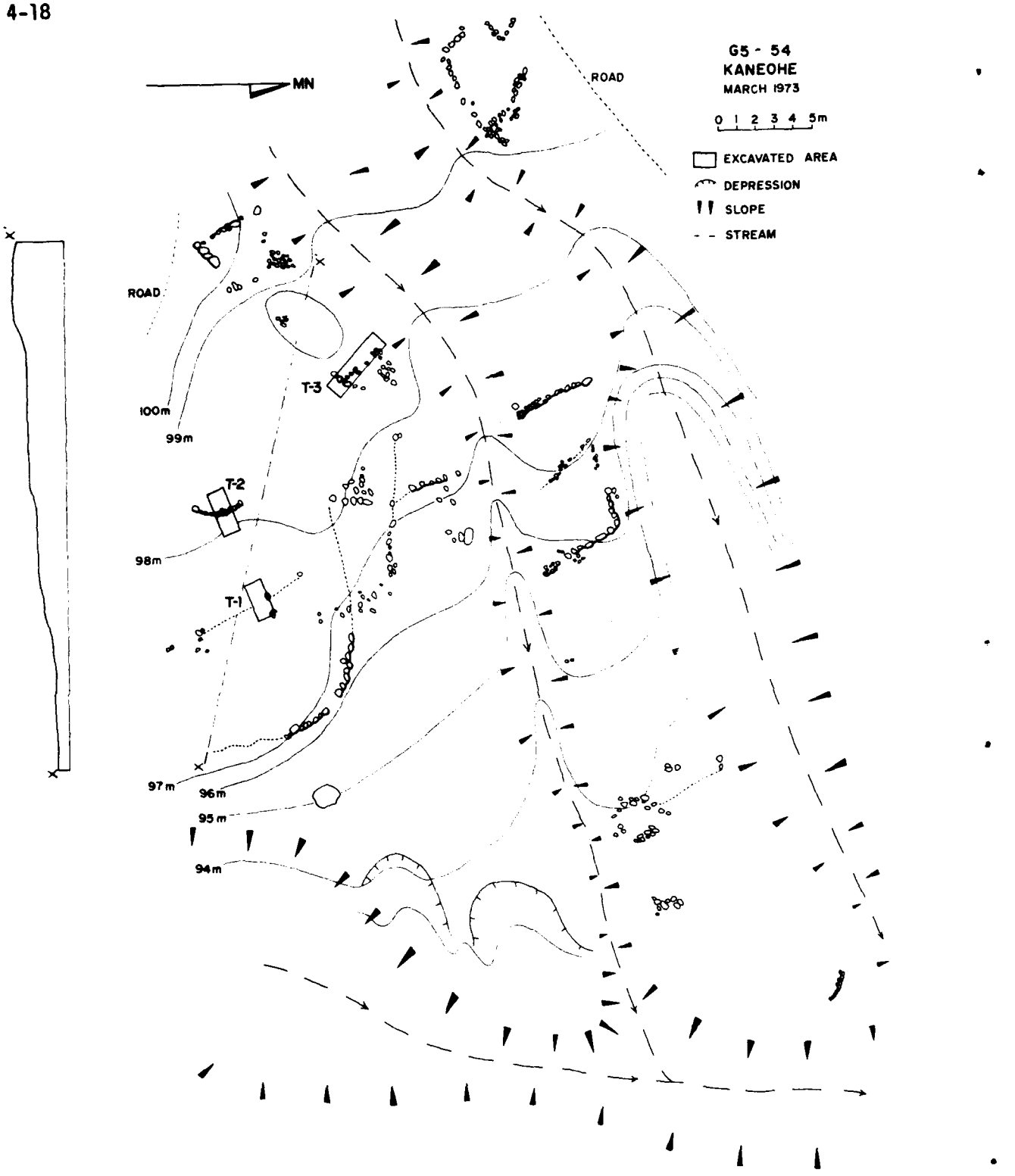


Fig. 4-14. PLAN AND PROFILES OF SITE G5-54.

noted above. Except at its lower end, the gully is shallow compared to the main stream courses, from which it may be inferred that erosion along its secondary course is more recent. It is possible that the gully was originally an irrigation canal (*'auwai*) which, following disuse, fell into disrepair and cut more deeply, eventually removing parts of retaining walls. Several low retaining walls on either side of the gully appear to be aligned. If the terraces were irrigated, water would probably have entered the terrace system at a point upstream of the mound cut by excavation trench T-3 on the S side of a small paved area (Fig. 4-14).

Basically, the site consists of three or more prepared terraces on the first natural bench between the two tributaries of Kamo'oali'i Stream, all of them oriented essentially perpendicular to the high S bank of the most westerly tributary, and three additional artificial terraces on the second natural bench.

PLAN OF EXCAVATION

The better preserved terraces on the upper bench were the focus of attention in the test excavations. Trenches T-1 and T-2 were put through the retaining walls of the two lower terraces and a third (T-3) through the NE end of an artificial mound resting on the gully edge of the upper terrace. The excavations, done with pick and shovel, were dug quickly and aimed primarily at defining terrace stratigraphy and collecting information on retaining-wall construction.

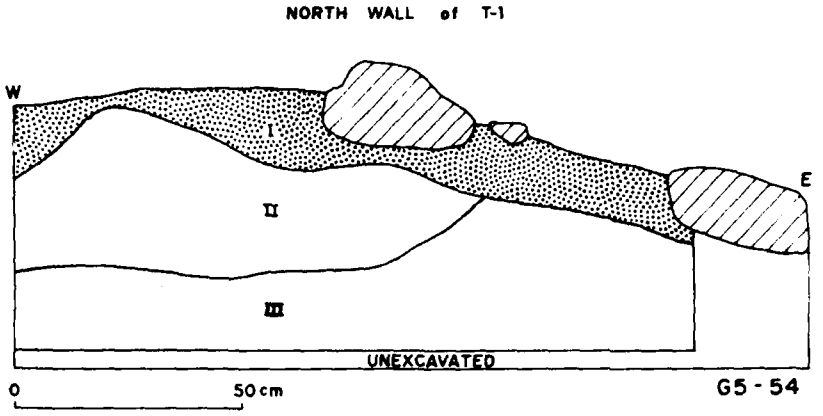
STRATIGRAPHIC DESCRIPTIONS AND INTERPRETATIONS

The T-1 and T-2 excavations exhibit the same stratigraphic profiles except that the agricultural soil (Layer II) in T-1 truncates beneath the topmost stone in the retaining wall (Fig. 4-15). In that lowest terrace there is no indication of a retaining wall in Layer II, and the wall above is obviously a later addition. A small trench appears to have been cut to construct the wall in the second terrace.

The T-3 excavation through the mound on the edge of the third, upper terrace revealed four stratigraphic layers and two lenses of alluvial sediments on the gully bank (Fig. 4-16). Layers III and IV are alluvial deposits of a clayey consistency. Layer II is a mixed soil, also clayey, but more compact than the lower deposits. The mixing is almost certainly a result of the cutting and leveling of the upper terrace, the back dirt from which forms the mound. Layer II is equivalent to the same layer in T-1 and T-2. A single-course wall was laid along the edge of the mound to check slumping onto the terrace (Fig. 4-17).

DATING

Scattered specks of charcoal were present in Layer II of the T-3 excavation, but were of insufficient quantity to submit for radiocarbon dating. Although not totally conclusive, it is significant that no historic artifacts were found on the site. The complex is inferred to be of precontact age.



I humus, dark-brown clay-loam
II dark-brown/brown clay-loam
III yellowish-red, weathered alluvium

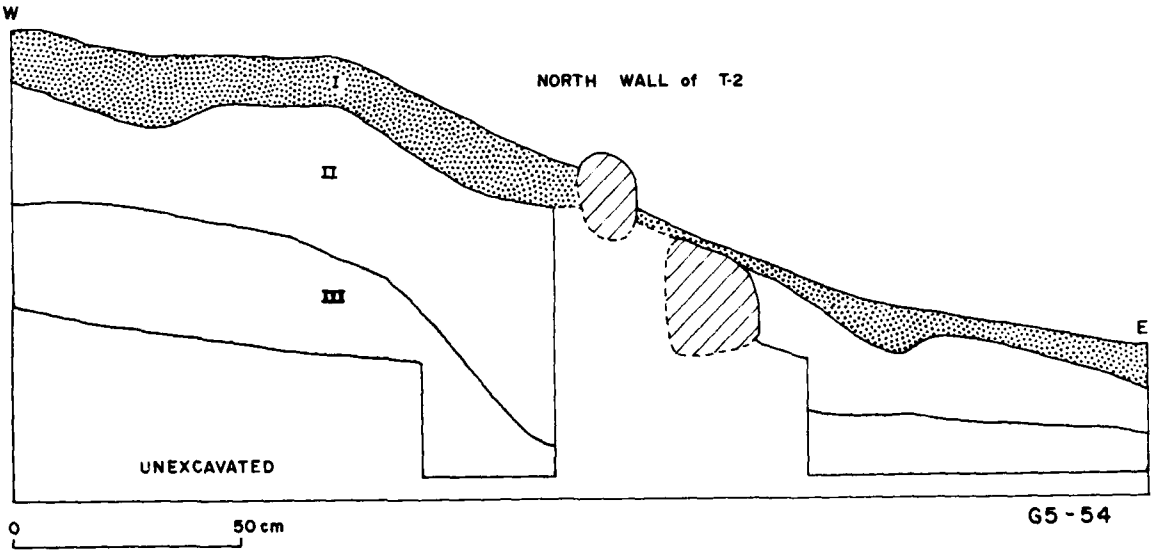
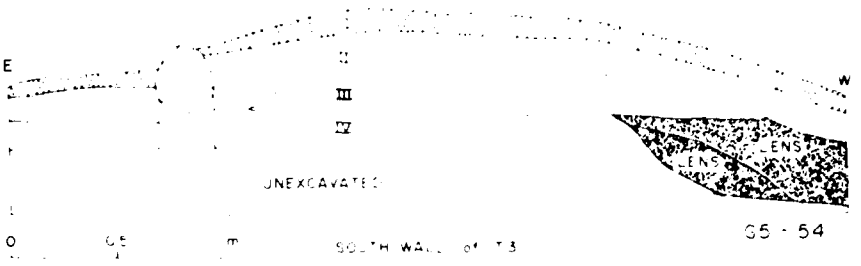


Fig. 4-15. STRATIGRAPHIC PROFILES OF NORTH WALLS, T-1 AND T-2, SITE G5-54.



I humus, very dark-grayish-brown clay-loam
II dark-grayish-brown/grayish-brown clay
III very dark-grayish-brown/dark-grayish-brown clay
IV grayish-brown clay

Fig. 4-16. STRATIGRAPHIC PROFILE ON S WALL OF T-3, SITE G5-54.

Fig. 4-17. T-3 EXCAVATION THROUGH MOUND, SITE G5-54 (BPBM Neg. No. OA(a) 76-4).

SITE G5-55

SITE DESCRIPTION

Site G5-55 is a low, roughly circular, stone outline located on the edge of a high second terrace above upper Kamo'oali'i Stream. There is a small mountain-apple grove immediately on the N surrounded by guava and some [illegible] trees. Stands of *Pandanus* are found on the ridge back of the site. Grasses, ferns, and wild bananas complete the flora of the immediate area.

The stone outline is 8 meters in diameter, with four apparently intentional breaks in the wall (Fig. 4-18). The dimensions of the outline are unusually large. The center is cleared and leveled. The alignments on the NW and SW sides are mostly intact and, where not disturbed by tree roots, are generally 50 cm wide. The NE and SE sides are not as well-defined, with the stones more scattered. The outline is uniformly one course high.

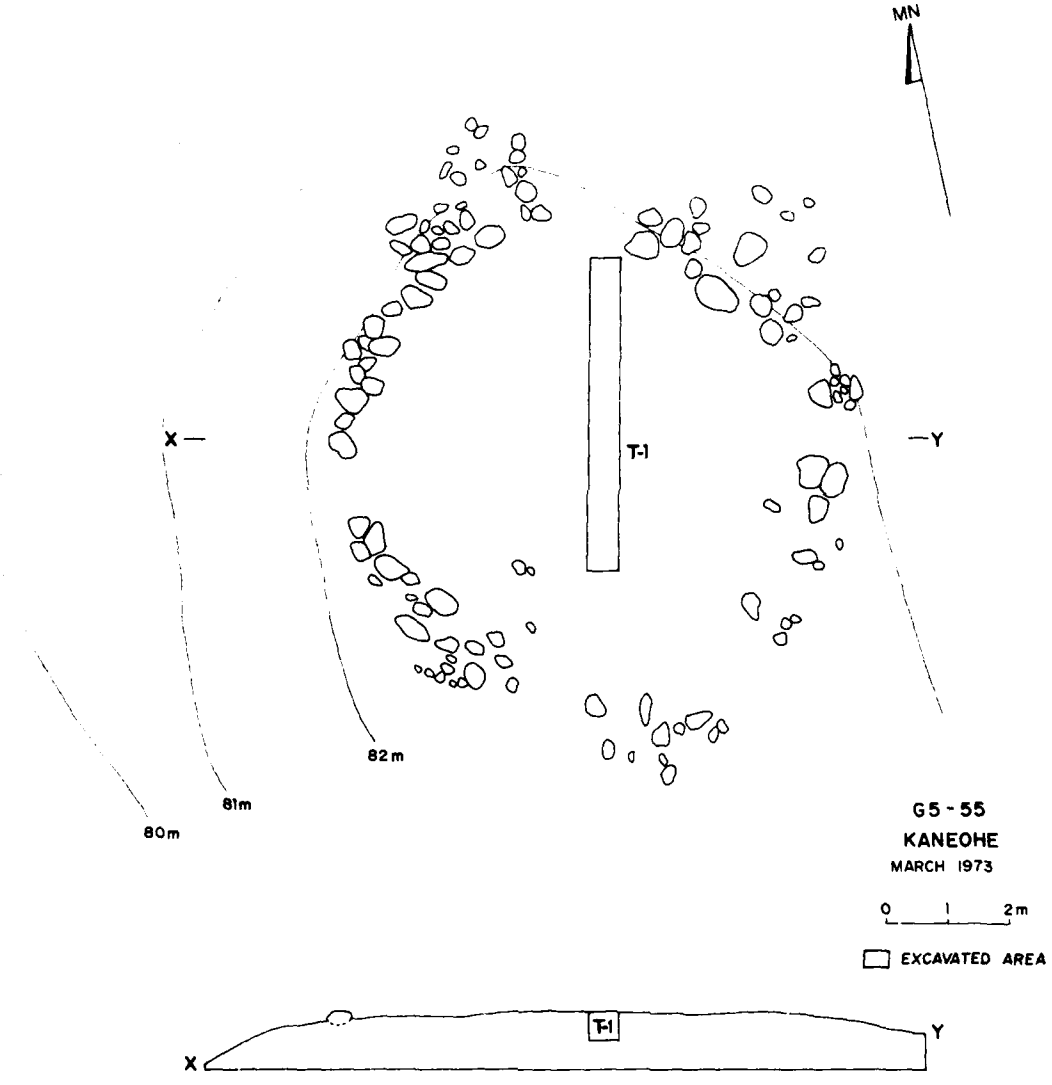


Fig. 4-18. PLAN AND PROFILE OF SITE G5-55.

PLAN OF EXCAVATION

A notable feature of the site is the unusually dark color of the soil (nearly black) in the center of the outline, in contrast to the brown and reddish colors of soils on other sites throughout the region. The unusual soil color and uniqueness of the stone outline were the major criteria for selecting the site for excavation--it appeared to hold some promise of being a midden deposit with some depth.

Initially, a baseline was established through the middle of the outline in an essentially N-S direction. At even-metered intervals, three 50-cm-square test pits were laid out. Sampling of multiple points across the site was intended to provide information on the horizontal extent and content of a midden deposit, if present.

The first two test pits, on the N and center, exhibited such different stratigraphy down to c. 35-cm depth that we decided to dig the short interval between them. It was obvious by this time that the deposits were sterile, except for a heavy concentration of charcoal chunks in the middle test pit, which appeared to be modern. The remainder of the excavation was done quickly with pick and shovel. The trench was extended to the S far enough to pick up the other lip of the large, shallow, artificial basin (see below).

STRATIGRAPHIC DESCRIPTION AND INTERPRETATION

The basal layer (IV) in the site is a loosely consolidated alluvial deposit with medium sorting (Fig. 4-19); the coarse component consists of well-rounded pebbles varying between 1 and 7 cm in diameter. Layer III is a moderately compact, weathered clay containing a few small, oxidized pebbles; Layer III is a relatively thin deposit of clayey loam. The top layer (I) is the A-horizon soil, composed primarily of a dark humus.

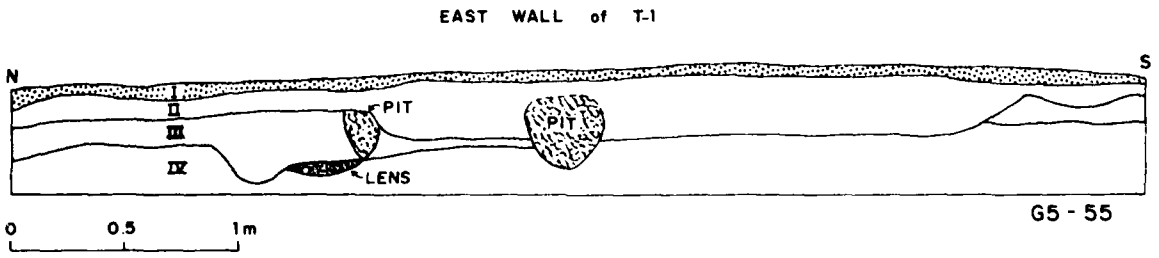


Fig. 4-19. STRATIGRAPHIC PROFILE OF E WALL OF T-1, SITE G5-55.

Dug into Layers II and III is a large, shallow, flat-bottomed basin, 2.9 meters in diameter and 20 to 25 cm deep (Fig. 4-20); it contains a massive quantity of charred branches and stems which seemed to be guava. The largest pieces (10 to 15 cm) are on the bottom. North of the center of this shallow basin is a secondary pit, 30 cm wide and extending another 10 cm deeper. Another, still smaller pit is found on the N edge of the basin.

Fig. 4-20. T-1 EXCAVATION (E WALL) AND ENCLOSING WALL BEHIND SITE G5-55 (BPBM Neg. No. OA(a) 75-3).

FUNCTIONAL INTERPRETATION AND AGE

Based on comparative information (for the Philippines, provided by D.E. Yen, personal communication), the pit is interpreted as having been used for the preparation of guava charcoal. The manufacture of charcoal in this area is documented for the period 30 to 40 years ago (Henry Wong, personal communication); the archaeological evidence is in Sites G5-53 and G5-61--two oval-shaped, domed, stone-and-concrete ovens (McCoy, Sinoto, Cooray, Report 3, p. 18, 20). The shallow pit on Site G5-55 represents a simpler method of preparing charcoal. The secondary pit, extending to a greater depth, is, according to Yen's information on Philippine practices, made by revolving a pole in a circular motion to create a draft in order to facilitate the charring of the wood.

The state of preservation of the charcoal and the fact that some pieces appear to have been cut with a metal blade provide a relative date for the site. That the pit is modern is attested to independently by the stratigraphic evidence -- the accumulation of humus on top of the pit is shallow, compared to depths on other sites with a similar vegetative cover and soil-forming environments.

SITE G5-64

SITE DESCRIPTION

Clearing of Site G5-64 revealed two independent features, c. 4 meters apart (Fig. 4-21). Feature A, on the S, is a low, stone-walled enclosure of roughly

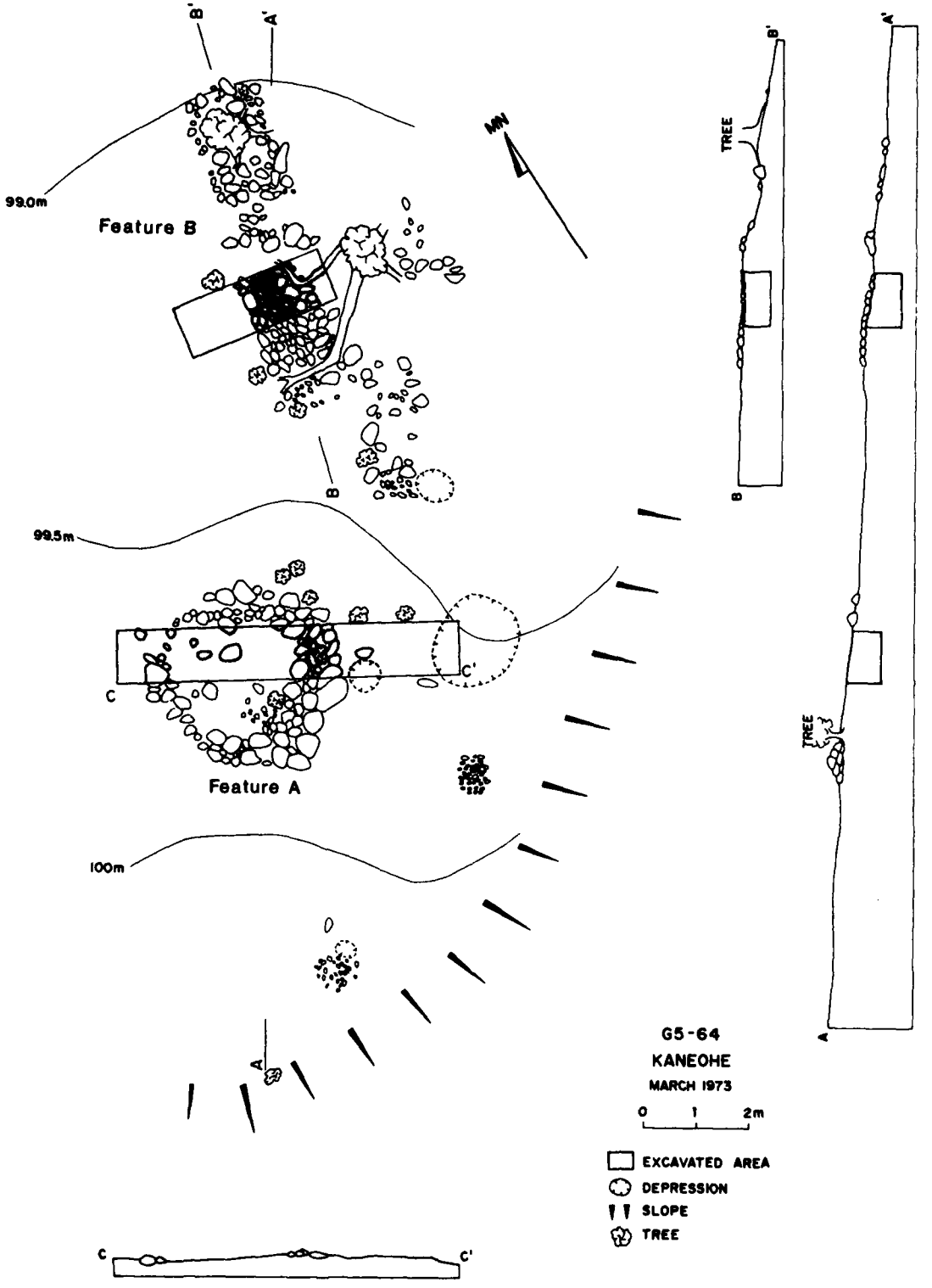


Fig. 4-21. PLAN AND PROFILES OF SITE G5-64.

quadrangular shape. The SE wall is 1 meter wide and constructed of loosely stacked stones reaching a height of c. 50 cm; the other walls are lower and not as wide. Feature B is a low, rectangular platform, 6 meters long, 1.4 meters wide, and about 20 cm high; it has been badly disturbed by tree roots, making it difficult to establish the corners on the S end. Adjacent to the SE corner is a scatter of stones that appear to be the remains of a feature. Other small concentrations of stones were located S and SE of Feature A.

Site G5-64 is located on the edge of a high, second terrace, about 5 meters above the stream bed. The stream meanders and branches considerably in this area. Boulder trains from periods of high water are common to the lower terraces in the area. Floristically, the site is characterized by a large grove of mountain-apple trees, many reaching 15.2 meters in hight. The grove ends abruptly 15 to 20 meters on the W, where a large, open, grassy meadow begins.

PLAN OF EXCAVATION

A trench oriented NW-SE and 6.5 meters long by 1 meter wide was put through Feature A to determine whether or not there was a cultural deposit in the center of the enclosure and in what manner the walls had been built. A smaller trench, 3 meters long by 1 meter wide, oriented E-W and perpendicular to the long axis of the platform, was put through Feature B with the similar goals of determining mode of construction and structure content.

EXCAVATION RESULTS

The excavations revealed no midden deposit and demonstrated that both structures were built directly on a poorly sorted, alluvial-gravel deposit that makes up the terrace. Soil development on the gravel has been minimal, and the base stones of both structures are covered by only a few centimeters of earth. Excavation of Feature B, which consisted of removing stones, revealed a basal layer of large stones (20 to 30 cm diameter) on top of the stony alluvial soil; above this there was a second layer of stones of varied size classes, including some waterworn cobbles 5 to 8 cm in diameter.

FUNCTIONAL INTERPRETATIONS

The negative results of the excavations are of limited use in interpreting site usage. Feature A resembles some makeshift habitations usually found in drier areas and on lava fields, but there is nothing to suggest even temporary occupation. The enclosure is too small and too low either to contain or exclude animals and would have been an unnecessary and limited-use structure for crop propagation. Feature B, likewise, does not exhibit any of the characteristics of known structures for habitation or agricultural use. Both features are among the numerous enigmatic structures located in recent years in salvage operations in Hawaii, which to date have defied functional classification.

CONCLUSIONS

Test excavations on Sites G5-45 and -46 confirm earlier expectations of historic age and strengthen the thesis that those sites were occupied by Chinese rice and taro farmers known to have planted the alluvial flats of Kamo'oali'i Stream in that locality c. 1910. The artifact collections from the two sites are not large enough, and specific items are not distinctive enough, to determine the time span of occupation. There are some suggestive clues, however, in bottles and nails, to lend support to verbal information that the lower flats in the vicinity of the dam site were abandoned as recently as 20 to 25 years ago (Henry Wong, personal communication). The identification of Site G5-38 as a pig pen is provisional; the presence of such a structure adjacent to a house site, however, would be logical.

The only positively prehistoric site investigated, the mound on Site G5-37, is a unique feature with no comparable counterpart in Hawaii or the remainder of Central and Eastern Polynesia. Stratigraphic analysis and absolute dates document two periods of use in the prehistoric period, 300 years apart, and a final period of use for an unknown purpose in the historic or modern period.

The agricultural terrace complex on Site G5-54, in the absence of data to indicate the contrary, is tentatively considered to be precontact. Evidence for irrigation is not clear-cut; the most likely evidence is the erosional gully cutting through the site. Assuming that there was dryland agriculture on the highest bench with three terraces on it, the most likely crop would have been sweet potato.

Site G5-55 is definitely historic or modern, and is one example of several features in the upland area where guava charcoal was made. It is the only known charcoal-manufacturing site in the study area in which an excavated pit was used.

Excavation of Site G5-64 revealed no additional information about the function of the two structures. At most, we are obtaining a catalog of such enigmatic sites and their associations with sites of known function. Using this information and comparing formal attributes from a large sample, we may someday be able to assign a functional label to such structures.

The test excavations, though largely disappointing in terms of the size of artifact assemblages recovered, provide a new corpus of descriptive data on site characteristics and relative age for an area of Oahu that is unsatisfactorily known archaeologically. The most significant findings are, of course, the sequence of prehistoric occupations in the earthen mound. Finally, the excavations strengthen propositions formulated in the first analysis of site-survey data, that the uplands were utilized prehistorically but abandoned until used in modern times for limited activities (such as charcoal-making); around the turn of the century, people, perhaps newcomers, took up residence downstream along the wider alluvial flats, which they planted in rice and taro for commercial purposes.

RECOMMENDATIONS

On the basis of the findings of the test excavations on seven sites, recommendations are made for expanded excavation on only one site--G5-37. Continued

archaeological work on the other sites does not seem warranted in terms of cost, time, or probable recovery of significant new information. While it is certain that more historic items would be found on Sites G5-45 and -46, neither site appears rich enough to merit further work, and recovery of significant new data on structural details also seems doubtful.

The upland sites, G5-54, -55, and -64, which lie in the proposed recreational area, are not endangered by inundation of the pool, although it is true that later use of the park by visitors will threaten to alter the sites. In my view, however, preservation of these three sites is not critical to an understanding of the prehistory of the Kaneohe area. The maximum information for Sites G5-55 and -64 was gained in the test excavations. Should the development plans call for a trail near Site G5-54, it is proposed that the terraces be planted in native Hawaiian plants as a means of enriching the landscape the visitor will see on his walk.

The uniqueness of Site G5-37 and its importance archaeologically can not be overstressed. This is the first reported stratified habitation mound in Central and Eastern Polynesia, and one of the oldest interior habitation sites now known in Hawaii. Since the site will be inundated, it is recommended that complete salvage of the mound be undertaken with the objective of obtaining fuller knowledge of the mound construction, form, and the nature of habitation for the two periods of prehistoric occupancy, and final use of the site in the historic period. Sterile deposits should be stripped to expose fully the Layer III and V occupation surfaces. It is anticipated that a larger artifact assemblage will be obtained that will permit comparison with assemblages from other Hawaiian sites of the same time periods.

In order to comprehend fully the sites and site pattern in the Kaneohe-Kailua Flood-Control Project area, it is necessary to look beyond, at the surrounding undeveloped areas. It is proposed that funds be provided by the National Park Service for survey and test excavations along the upper reaches of Kamo'oali'i Stream to the headwaters, and along the Luluku Stream drainage above its confluence with the former. The overall objectives of this research will be to specify more precisely the broad pattern of settlement and exploitation through time for the windward slope of the Ko'olau Mountains above Kaneohe Bay. The results will add to the body of information to be presented in displays of local culture history and ecology of the planned visitor interpretive center on the edge of the proposed reservoir.

NOTE ON INTENSIVE SURVEY OF ACCESS-ROAD CORRIDORS (1975)

by Paul Rosendahl

One task performed during the 1975 Upland Kaneohe archaeological investigations was the intensive survey of the two project area access-road corridors (see Fig. 3-4, foldout at end of volume), the only remaining portion of the project area not included in the earlier survey work. The total area involved was approximately 8.77 acres (3.54 hectares); Access Road No. 1 comprised 5.37 acres (2.17 hectares), and Access Road No. 2 comprised 3.40 acres (1.37 hectares). The intensive survey of both access-road corridors revealed no new archaeological sites.

REPORT 5. SUPPLEMENTAL EXAMINATION

SUPPLEMENTAL ARCHAEOLOGICAL RESOURCE EXAMINATION OF THE KAMO'OALI'I MOUND SITE (50-OA-G5-3), OAHU ISLAND*

by

Patrick Vinton Kirch

* Originally prepared by the Department of Anthropology, Bernice P. Bishop Museum, for the National Park Service, U.S. Department of the Interior, under Contract No. CX800030028 T. Submitted to the National Park Service in February 1974 as Ms. 083073.

INTRODUCTION

This report presents the results of field investigations conducted at Site 50-OA-G5-37, along Kamo'oali'i Stream, in Kaneohe, Oahu Island. Work was conducted by the staff of the Department of Anthropology, Bernice P. Bishop Museum, under a contract from the National Park Service, U.S. Department of the Interior (Contract No. CX800030028 T).

The fieldwork was conducted in two phases. The initial investigation was supervised by the author and was carried out over a period of six working days, from August 13 to 20, 1973. Field assistants were Jeff Hull, Mikk Kaschko, and David Morgan. Further trench excavation, not directly supervised by the author, was conducted on December 27 and 28, 1973, and January 3 and 4, 1974, by Mike Clark, Paul Cleghorn, Steve Clark, Nick Denning, Erik Komori, and Timothy Lui-Kwan. Stratigraphic sections were recorded by Toni Han and T. Lui-Kwan on January 5, 1974.

Initial investigations at Site OA-G5-37 were carried out by Museum staff, directed by Patrick McCoy, in May 1973 (see Report 4). The oblong, earthen mound (12 meters long, 2.2 meters wide, and 1.5 meters high) had attracted attention as an unusual and unique type of field monument in the Hawaiian Islands. The closest analogs to this site appear to be certain earthen mounds found in Western Polynesia (Samoa, Tonga). In order to determine the possible function, construction technique, and date of this structure, McCoy and his crew cut a trench (T-1), 1 meter wide and 9.3 meters long, across the mound. This excavation revealed that the mound contained six stratigraphic layers; Layers III and V are cultural (Report 4, Fig. 4-5). Layer V, the earlier cultural layer, was dated by C^{14} age assay, with the resulting age determination of 625 ± 105 B.P. (A.D. 1325 ± 105; range at one standard deviation, A.D. 1220 to 1430; laboratory sample number I-7114). Layer III, separated from Layer V by a sterile layer (IV), was dated by means of the hydration-rind method applied to basaltic-glass flakes. These age determinations ranged from A.D. 1591 to 1680 (Report 4, p. 4-7, 4-8).

Because of the unique nature of this site, it was believed that further investigation was warranted. Because only limited funding was available, it was decided to concentrate the present efforts on exploring the nature of the areas surrounding the mound, to determine if any buried stratigraphic or horizontal features could be found adjacent to this structure. Such features, if located, might shed light on the nature of this site. On the other hand, negative results would clearly demonstrate that all future efforts should be directed to the mound itself.

FIELD METHODS

In order to determine the nature of any deposits adjacent to the mound, McCoy's T-1 was extended outward in both directions. To the SW the trench was extended 9.6 meters, at which point the bank of a natural stream terrace was reached. To the NE we extended 10 meters, bringing the trench to within 2 meters

of Kamo'oali'i Stream. Here natural stream deposits were encountered, and the trenching was discontinued. The T-1 extensions were dug to between 50- and 75-cm depth, at which point sterile, basal clay was fully exposed. A smaller, 1-by-2-meter pit (T-9) was dug off the SE corner of the mound (Fig. 5-1); this pit was taken to 75 cm below ground surface.

The T-1 extensions were dug with pick and shovel, and the S faces of both were straightened for stratigraphic inspection. Finer excavation techniques were not required as no cultural deposits or features were encountered.

Following excavation, the soil profiles of the T-1 extensions were recorded using standard pedological techniques and terminology (Soil Survey Staff 1951). Four soil samples were taken from the SW extensions of T-1 (S face) and are available for future laboratory analysis. They will provide control material for comparison with analyses of the cultural deposits in the mound itself.

A second series of six trenches (T-3 to T-8) was dug parallel with T-1, three to the NW and three to the SE (Fig. 5-1). These trenches, which do not penetrate the mound itself, were spaced c. 5 meters apart. The length of each trench is given in Table 5-1. It is apparent in Fig. 5-1 that the entire area surrounding the G5-37 earthen mound--extending 4 meters from the mound's ends and 13 meters from its sides--has been thoroughly tested by means of the T-1 extensions and trenches T-3 through T-8, for a total of 107.2 linear meters excavated.

Table 5-1. TRENCH DATA

Trench No.	Total Length (m)
T-1*	28.9
T-3	8.8
T-4	10.0
T-5	11.0
T-6	6.5
T-7	20.0
T-8	20.0
T-9	2.0
TOTAL	107.2

* Original excavation, 9.3 meters; SW extension, 9.6 meters; NE extension, 10.0 meters.

Following the excavation of trenches T-3 through T-8, stratigraphic profiles were drawn of one face of each trench. The profiles of T-4 and T-6 are reproduced with this report (Fig. 5-2), and are fully representative of the others. All trenches were dug to between 50 and 75 cm below ground surface, well into completely sterile, undisturbed soil.

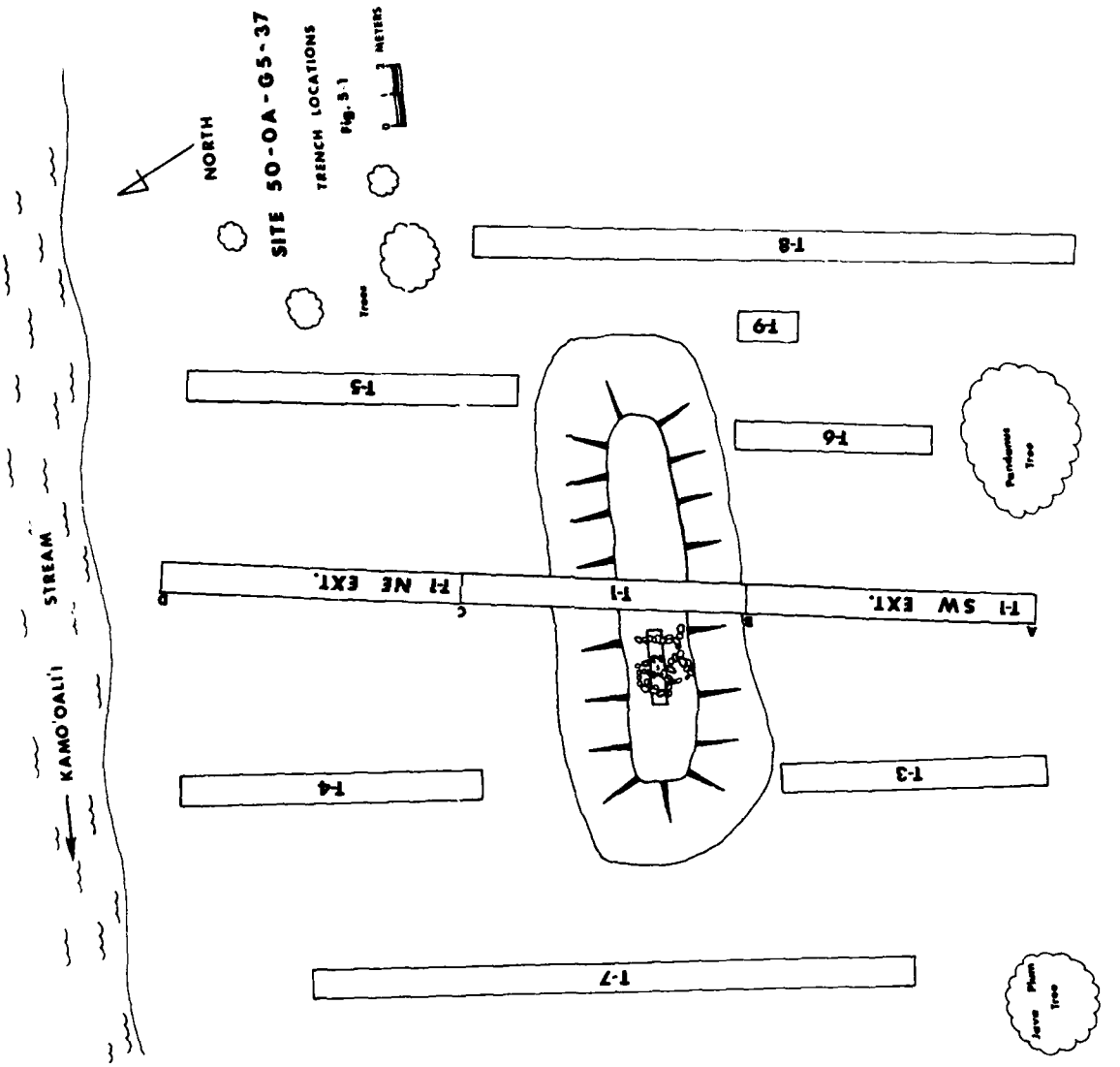
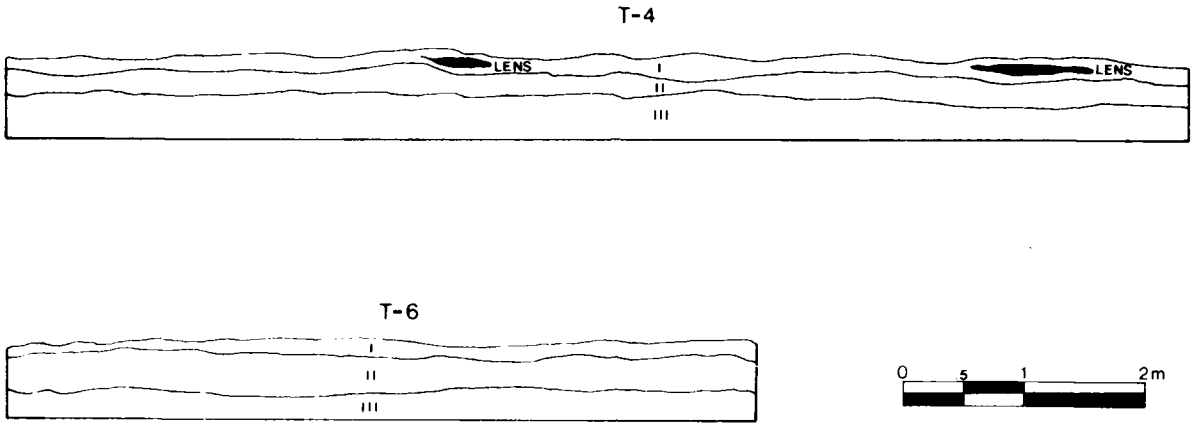


Fig. 5-1 PLAN OF SITE 50-OA-G5-37, SHOWING TRENCH LOCATIONS



I Dark-brown humus
II Dark-brown clay-loam with charcoal flecking
III Sterile, undisturbed clay-loam base

Fig. 5-2 STRATIGRAPHIC SECTIONS OF THE NW FACE OF T-4 AND THE SE FACE OF T-6, SITE OS-G5-37.

RESULTS

In terms of cultural materials, results were negative--no habitation layers or horizontal features were uncovered. Thus it may be stated with some confidence that human occupation of Site 50-OA-G5-37 was confined to the area of the mound itself. It is here that future excavation should be concentrated.

The stratigraphic profile along the W face of T-1, including both the SW and NE extensions, is presented in Fig. 5-3. The soil profile of the T-1 SW trench extension, 50 cm from the end of McCoy's T-1 (S face), is given in Table 5-2.

Table 5-2. SOIL PROFILE OF T-1, SW EXTENSION

Layer	Depth Below Surface (cm)	Description
I	0-15	Humus. Dark brown (7.5 YR 5/2)*. Angular structure. Non-sticky, non-plastic.
II	15-50	Dark brown (7.5 YR 3/2). More compacted than Layer I, slightly sticky. Non-plastic. Subangular blocky. Relatively large amount of charcoal.
III	50-63	Brown (7.5 YR 4/4) with strong brown mottling (7.5 YR 5/6). Slightly sticky, non-plastic. Granular.
IV	63-75 (base)	Dark brown (7.5 YR 3/2). Very slightly more reddish than Layer I. Sticky, slightly plastic. Granular.

Layer II, containing some charcoal throughout the length of the trench, has the appearance of having been disturbed by human activity. Layer III, with heavy mottling (oxidation), is probably an alluvial deposition. Layer IV is basal, undisturbed, alluvial clay.

The soil profile of the NE extension of T-1, about 5 meters from the end of McCoy's cut (S face) is given in Table 5-3.

Table 5-3. SOIL PROFILE OF T-1, NE EXTENSION

Layer	Depth Below Surface (cm)	Description
I	0-13	Recent(?) silt deposit, probably deposited by flooding. Dark reddish-brown (5 YR 3/3).*
II	13-23	Old humus layer. Dark brown (7.5 YR 3/2).
III	23-43	Some charcoal, comparable to Layer II in SW extension of T-1. Dark brown (7.5 YR 3/2).
IV	43-63	Water-laid deposit of silt, rounded pebbles. Yellowish-red (5 YR 4/6). Mottled.
V	63 +	Water-laid silt/sand deposit. Reddish-brown (5 YR 4/4).

* Munsell Color Chart designation.

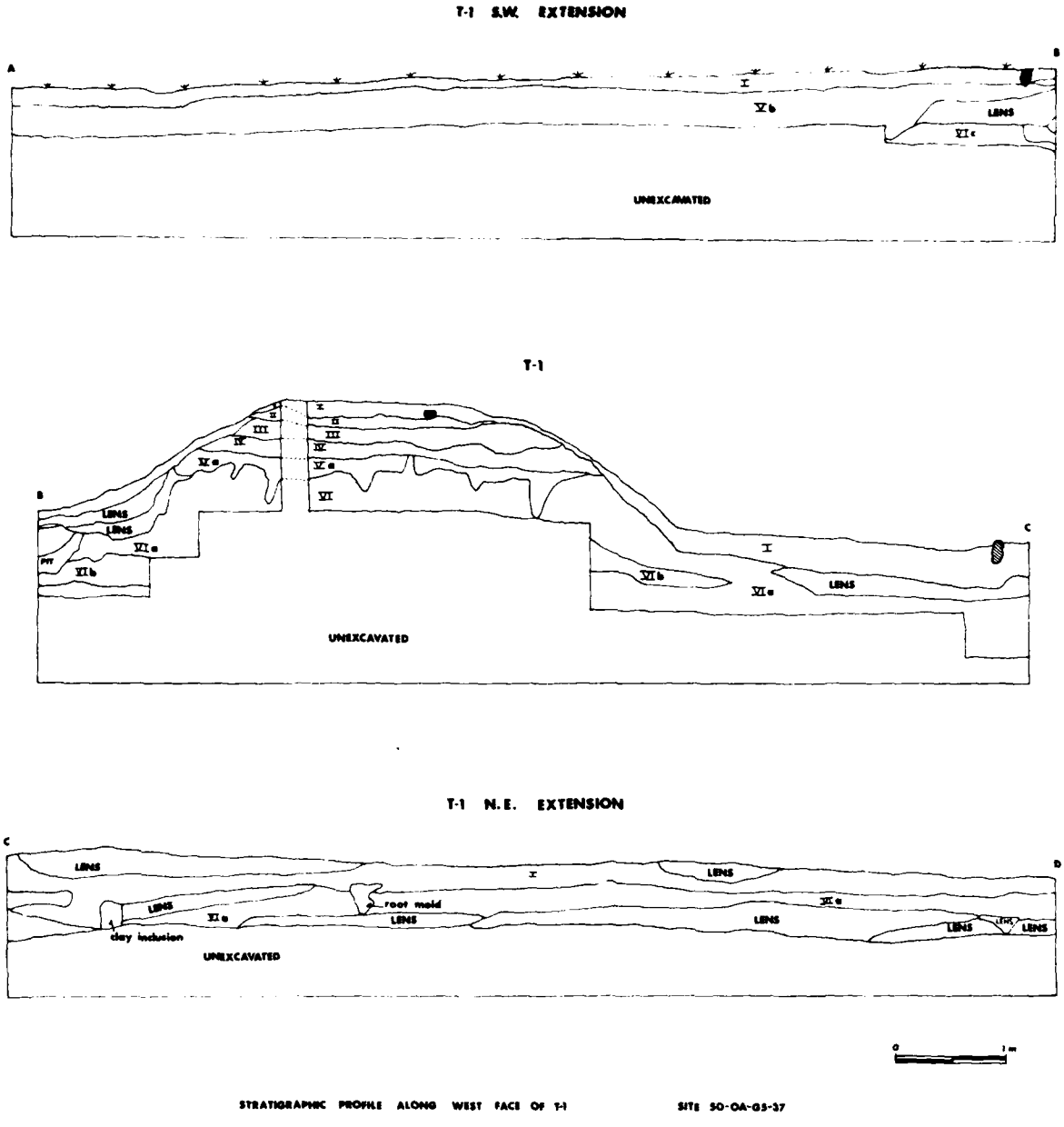


Fig. 5-3. STRATIGRAPHIC PROFILE ALONG W FACE OF T-1, SITE OA-G5-37.

In T-1 and T-1 NE Extension, Layer VIa corresponds with Kirch's Layer III (see p. 5-5). McCoy's Layer V of T-1 (see p. 4-3) is subdivided here, so that McCoy's Layer V is now Va, and Vb appears in the T-1 SW Extension that was excavated later. In the T-1 SW Extension, Layer Vb corresponds to Kirch's Layer II (see p. 5-5).

Stratigraphic profiles of T-1 Extensions recorded by P. Cleghorn and E. Jourdane.

The stratigraphy of the small test pit (T-9) to the SE of the mound was the same as that of the SW extension of T-1 (Table 5-2), except that at c. 40 cm below surface a lens (c. 20 cm thick) of water-laid sand/silt and rounded pebbles was encountered. This lens pinched out toward the SW (away from its souce, Kamo'oali'i Stream).

The two detailed soil profiles described in Tables 5-2 and 5-3 are typical of the areas surrounding the GS-37 mound. Sections were also recorded for trenches T-3 through T-8 but are not reported because they are entirely repetitive. Trenches T-4, T-5, T-7, and T-8 contained small lensitic deposits of water-laid pebbles and sand, similar to that recorded as Layer IV in Table 5-3. These lenses were found at the ends of the trenches near Kamo'oali'i Stream and were clearly deposited during periods of higher water (greater energy transport). Profiles for T-4 and T-6 are shown in Fig. 5-2.

Stratigraphic profiles for the area surrounding the G5-37 habitation mound correlate in exhibiting the following characteristics:

1. An upper humus layer (Fig. 5-2, Layer I)

2. A layer of dark-brown, minimally disturbed, clay-loam with some charcoal flecking, but no other cultural indicators (Fig. 5-2, Layer II)

3. An entirely sterile, undisturbed clay-loam base (Fig. 5-2, Layer III)

4. Limited lensitic deposits of water-laid sand and pebbles, derived from Kamo'oali'i Stream (Fig. 5-2, T-4 Section, lenses).

The only evidence for possible cultural activity represented in the profiles is the limited charcoal flecking in Layer II (T-1, SW extension, Table 5-2); it is correlated in the other trenches (Layer II in Fig. 5-2). Interpretation of the charcoal flecking is difficult without further evidence and complete excavation of the habitation mound itself. We may pose three alternative hypotheses for the origin of this charcoal flecking:

1. The charcoal was derived from the nearby habitation mound, where it was produced as a result of cooking or other domestic, fire-using activity. (Charcoal was a component of the two cultural layers defined by McCoy for the mound itself.)

2. The charcoal was derived as a result of original clearing of the site, prior to construction of the habitation mound. This hypothesis, of course, supposes the use of fire in clearing.

3. The charcoal was derived as a result of prehistoric horticultural activity--specifically, shifting cultivation (gardening)--at this locus. The soil in the general area, i.e. the flats bordering Kamo'oali'i Stream, comprises Hanalei Clay Loam (Cline 1955:608), which is known to be productive for horticulture; hence, prehistoric gardening could have been feasible.

CONCLUSION AND RECOMMENDATION

These results demonstrate that no significant cultural deposits or features of any kind lie buried in the immediate vicinity of the habitation mound at Site 50-OA-G5-37, as determined through a comprehensive trenching program

(107.2 meters total of trenches, 1 meter wide). Layers II (T-1, SW extension) and III (T-1, NW extension), and their correlates in the other trenches (Layer II, Fig. 5-2), exhibit a limited amount of probable cultural disturbance in the form of charcoal flecking, which may indicate either initial clearing, gardening activity, or other cultural activity relating to the mound itself.

On the basis of present evidence, it is not possible to discriminate further among the three alternative hypotheses; such discrimination may be possible following further work on the nature and function of the mound. The excavations also provided control data on the soils adjoining the mound, which may be compared to those in the mound. All further efforts should be directed to the mound itself.

REFERENCES

Cline, M.G. (d.)
1955 *Soil Survey of the Territory of Hawaii*. U.S. Dept. of Agriculture. Soil Survey Series 1939, No. 25. Washington, D.C.

Soil Survey Staff
1951 *Soil Survey Manual*. U.S. Dept. of Agriculture Handbook No. 18, Washington, D.C.

REPORT 6. SALVAGE EXCAVATIONS

SALVAGE EXCAVATION OF THE KAMO'OALI'I MOUND SITE (50-OA-G5-37)

by

Paul H. Rosendahl

PREFACE

Between July 21 and October 17, 1975, archaeologists from the Department of Anthropology, Bernice P. Bishop Museum, conducted salvage excavations at Site 50-OA-G5-37, an earthen mound located in the drainage area of Upper Kamo'oali'i Stream, Kaneohe, Ko'olaupoko, Oahu, Hawaii. This work was done for the U.S. Army Corps of Engineers as part of their Kaneohe-Kailua Flood-Control and Allied Purposes Project, carried out with the cooperation of the City and County of Honolulu. In accordance with (1) the Memorandum of Agreement among the National Advisory Council on Historic Preservation, the U.S. Army Corps of Engineers, and the Hawaii State Historic Preservation Officer (dated August 20, 1974, by the Chairman, Advisory Council on Historic Preservation), and (2) the Contract Scope of Work (revised August 22, 1975) for "Archaeological Investigations of the Dam Site, Upper Kamo'oali'i Stream, Oahu, Hawaii" (Contract No. DACW84-75-C-0020), these salvage excavations accomplished the full recovery of information from Site 50-OA-G5-37. All necessary fieldwork was completed, and resultant data recovery and analysis were deemed sufficient to allow dam construction to proceed.

The Museum field crew consisted of Paul Rosendahl (Project Director), Margaret Luscomb, Aki Sinoto, Toni Maiava, Richard Hughes, Elaine Jourdane, Frank Krau, and Eric Komori. A number of volunteers spent a day or more working with the Museum crew--Steve Clark and Bob Connolly, with their crew from the Kualoa Regional Park Project (City and County of Honolulu), Cindy LePage, Bill Luce, Terry Hunt, Rowland Reeve, Filipo Maiava, and Ngalo Maulupe.

Several staff members of the Department of Anthropology, Bishop Museum, visited the mound site during excavations to join in the work and discussions and to offer advice--Ethnobotanist D.E. Yen, and Archaeologists Patrick Kirch, Yosihiko Sinoto, and Patrick McCoy. Peter Gilpin, Photographer, spent several days in the field making a detailed photographic record of all main excavation sections. Other individuals contributing to useful field discussions were H. David Tuggle (Department of Anthropology, University of Hawaii), geological consultant Maury Morgenstein (Hawaii Marine Research, Inc.), and Oran Bailey (U.S. Soil Conservation Service).

At the Museum, a number of people in the Department of Anthropology assisted in data analyses and preparation of this report--Margaret Luscomb (laboratory work), Aki Sinoto and Eric Komori (drafting), Peter Gilpin (photography), Doug Yen (floral remains identification), Bonnie Clause (report production), and Marilyn Plott (typing).

Throughout the Upland Kaneohe project, assistance and support were given by the staff, particularly Ruby Mizue, of the Environmental Planning Section, U.S. Army Corps of Engineers-Pacific Ocean Division.

To all these individuals who contributed to the successful completion of the salvage project, I want to express my appreciation and thanks.

INTRODUCTION

This archaeological salvage report presents (1) the detailed descriptive account of the complete salvage excavation of the earthen mound, Site 50-OA-G5-37, and the subsequent analyses of the recovered portable remains; and (2) the concluding interpretation of Site 50-OA-G5-37, as derived from the salvage excavation and other relevant data. An earlier report (Rosendahl Ms.) summarizing the preliminary findings at the completion of fieldwork was submitted to the U.S. Army Corps of Engineers on October 31, 1975.

REPORT ORGANIZATION

This report consists of four basic sections. The Introduction describes the location, local environmental setting, and formal characteristics of the mound site; summarizes the results of the previous mound site investigations; and outlines the basic field and lab methods and procedures followed during the salvage excavation project. The second and third sections are essentially descriptive. The second section (Excavations) discusses the excavation plan (the strategy and tactics of the salvage excavations); describes the stratigraphy of the mound, and of the peripheral area surrounding the mound; and describes the structural features revealed by the excavations. The third section (Analyses) presents results of the radiocarbon and hydration-rind age determinations; and gives detailed information on provenience and results of analyses of the recovered portable remains--artifacts, non-artifactual remains, a human burial, and soil samples. The fourth section (Conclusion) argues the structural interpretation of the mound; discusses the occupation sequence and archaeological interpretation of the site; and evaluates the potential significance of the site, as a contribution to Hawaiian prehistory. This section finishes with a summary of the major points of the conclusion.

SITE DESCRIPTION

Site 50-OA-G5-37 consisted of an earthen mound located adjacent to Kamo'oali'i Stream, approximately 500 ft (152 meters) upstream from its confluence with Kuou Stream, and 1.95 miles (3.14 km) inland from Kaneohe Bay (Figs. I-1 and 3-4, foldouts at end of volume). An unnamed, smaller stream joins Kamo'oali'i Stream c. 100 ft (30.5 meters) downstream from the site, defining a small parcel of land, c. 2.65 acres (1.07 hectares) in area, that contains the remains of several low, artificial terraces and historic habitation features (Fig. 6-1). The mound was situated on one such terrace, c. 140 ft (42.7 meters) above sea level, and approximately 52.5 ft (16 meters) W of the bank of Kamo'oali'i Stream.

The immediate area of the mound site was covered with a dense canopy of candlenut (*kukui, Aleurites moluccana* [L.] Willd.), Java plum (*Eugenia cuminii* [L.] Druce.), and guava (*Psidium guajava* L.). Beneath this cover was a thick growth composed principally of *koa haole* (*Leucaena glauca* [L.] Benth.), screwpine (*hala, Pandanus odoratissimus* L.f.), lantana (*Lantana camara* L.), Job's tears (*Coix lachryma-jobi* L.), and several species of grasses and ferns.

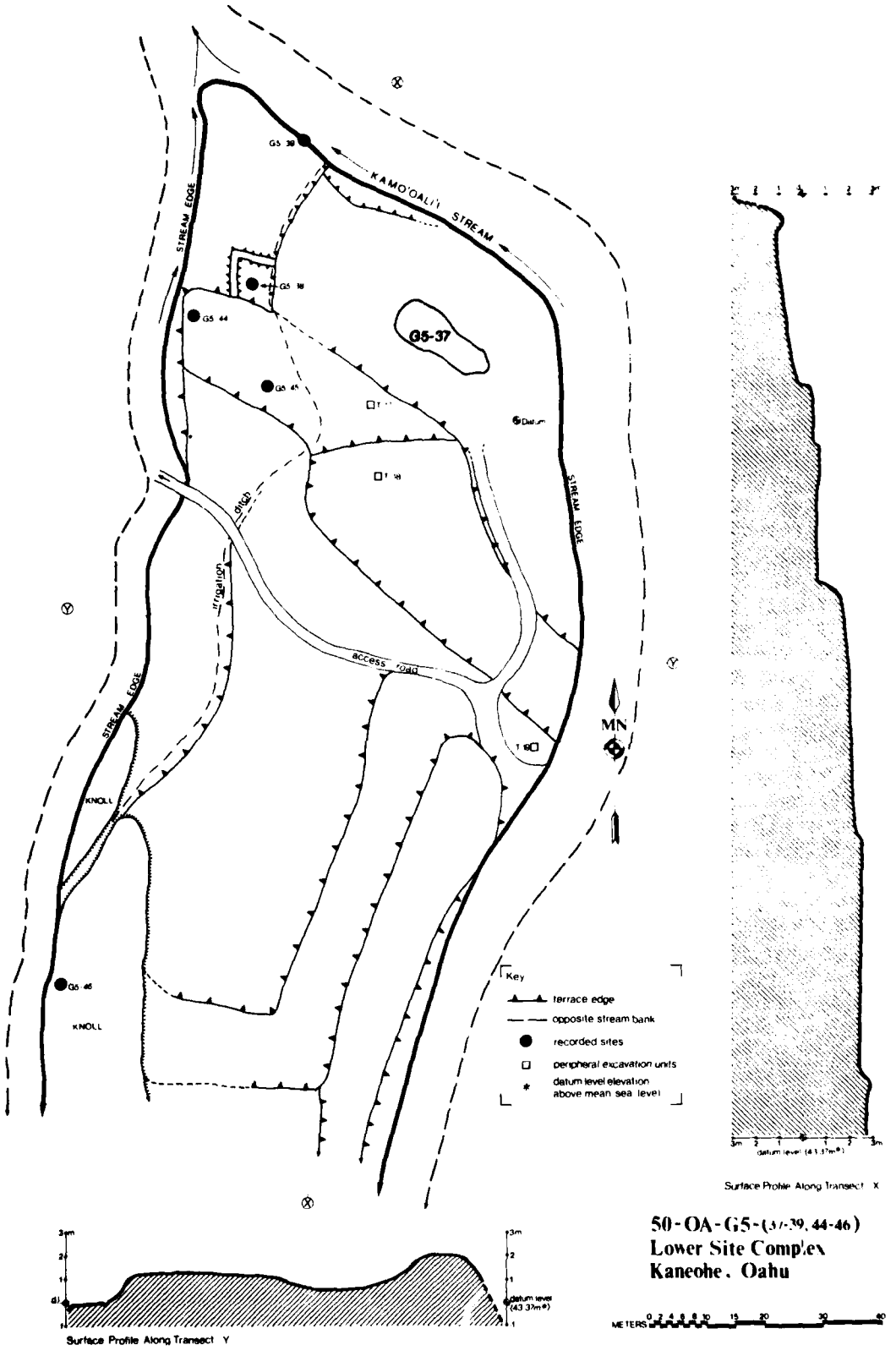


Fig. 6-1. LOWER SITE COMPLEX. Earthen mound (Site 50-OA-G5-37), nearby historic habitation sites, and remains of historic cultivation terraces.

Survivals noted in the immediate area, possibly evidencing earlier cultivation, included banana (*mai'a, Musa* hybrids), taro (*kalo, Colocasia esculenta* [L.] Schott), elephant ear (*'ape, Alocasia macrorrhiza* [L.] Schott), and yam (*uhi, Dioscorea alata* L.)

The mound was an elongated, sub-rectangular earthen structure with sloping sides (Fig. 6-2). The top surface was c. 12.2 meters long and from 1.2 to 3.1 meter wide, while the base expanded out to become 17.5 meters long and from 4.8 to 6.6 meters wide. In height the mound varied from 0.3 to 1.6 meters above immediately adjacent ground surface. The angle of slope varied from 25° to 45° on the N side, from 20° to 45° on the S side, from 20° to 25° on the E end, and from 40° to 50° on the W end. In plan view, the mound was assymetrical, with the eastern half being lower and narrower than the western half. Both ends were somewhat rounded. Situated atop the western half of the mound was a low, roughly square, stone platform. No other obvious structural features were noted in association with the mound.

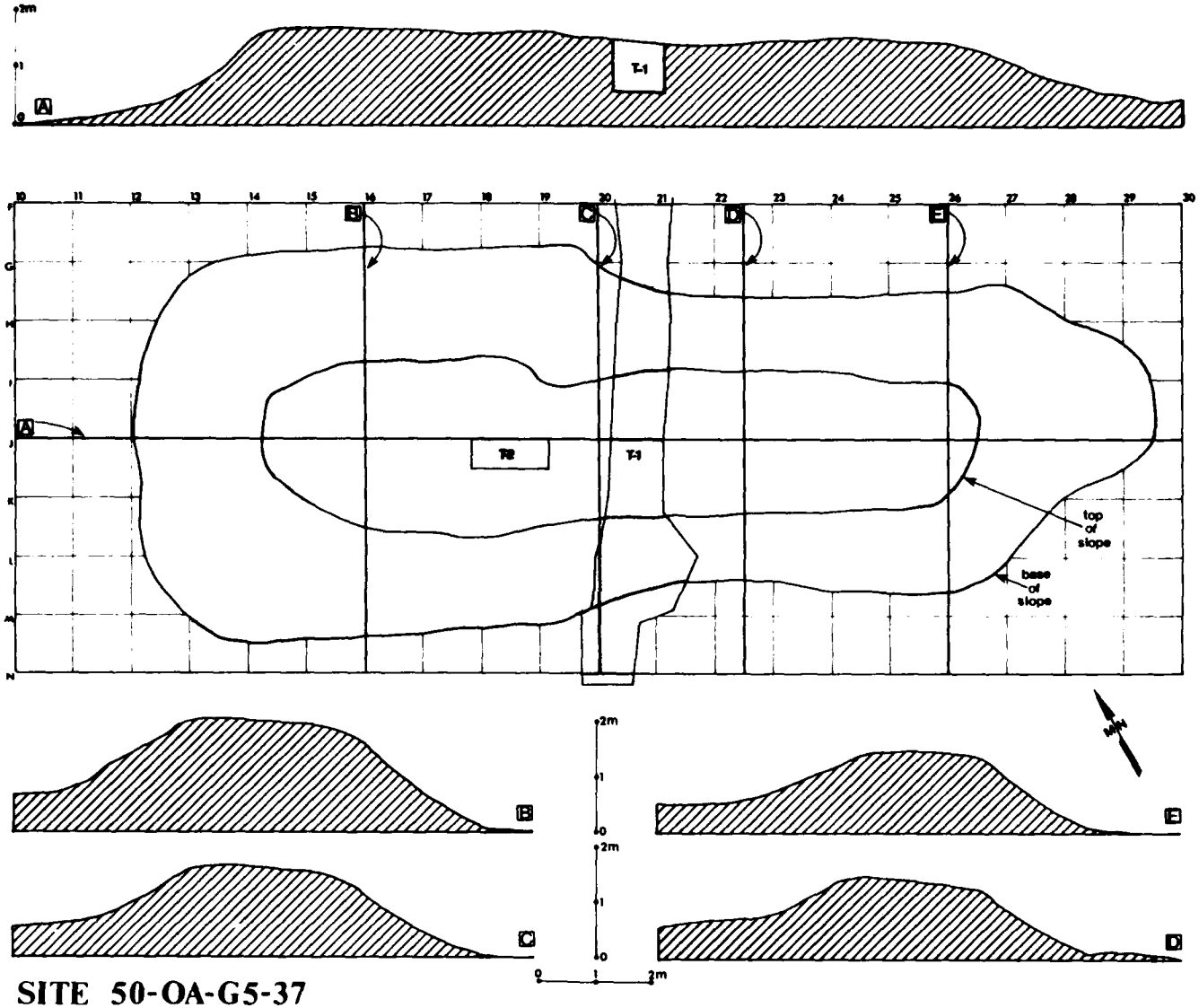
PREVIOUS RESEARCH

Site 50-OA-G5-37 was first recorded in January 1972 during the initial reconnaissance survey of the area (McCoy, Sinoto, and Cooray, Report 3, this volume). In accordance with the evaluation and recommendations derived from that reconnaissance survey, the mound was subsequently recorded in greater detail and limited test excavations (test trenches T-1, T-2) were conducted in March, 1973 (Report 4, this volume; McCoy 1974) (Fig. 6-3). T-1 was 9.3 meters long and 1.0 meter wide, and was situated perpendicular to the length of the mound, sectioning the center of the mound. T-2 (1.25 meters long and 0.5 meter wide) sectioned the low stone platform atop the western half of the mound.

Two cultural layers (Layers III and V) were defined, separated by a sterile deposit (Layer IV) (Fig. 4-5). The upper cultural layer (III) yielded several flakes of basaltic (volcanic) glass, while the lower (Layer V) produced a single non-utilized basalt flake. On the basis of two radiocarbon and five hydration-rind age determinations, the lower cultural layer (V) was assigned a date of c. A.D. 1325, and the upper cultural layer (III) c. A.D. 1650.

Based on these limited test excavations, McCoy interpreted Site 50-OA-G5-37 to be a stratified habitation mound evidencing at least two distinct and temporally separate periods of prehistoric occupation. This was the first such site reported for the Hawaiian Islands, and apparently also for the rest of East and Central Polynesia. Because the mound was situated where it would be destroyed by the planned construction of the dam and reservoir, complete archaeological salvage of this unique site was recommended.

Supplemental fieldwork, aimed at testing the immediate surrounding area of the mound for possibly associated cultural remains, was conducted in August and December, 1973, and January, 1974 (Report 5, this volume). Nine 1-meter-wide test trenches (T-1 extensions and T-3 through T-9), comprising a total of 97.9 square meters of excavation, were dug to sample the entire peripheral area of the mound (Fig. 6-3). As a result of this supplemental examination, it was concluded that no significant subsurface cultural remains (deposits or features) of any kind were present within the immediate surrounding vicinity of the mound, and it was recommended that all subsequent work be directed at the mound structure itself.



SITE 50-OA-G5-37

Kaneohe, Oahu

Fig. 6-2. PLAN AND PROFILES OF EARTHEN MOUND (SITE 50-OA-G5-37) BEFORE SALVAGE EXCAVATIONS. Vertical scale indicates elevation above ground surface.

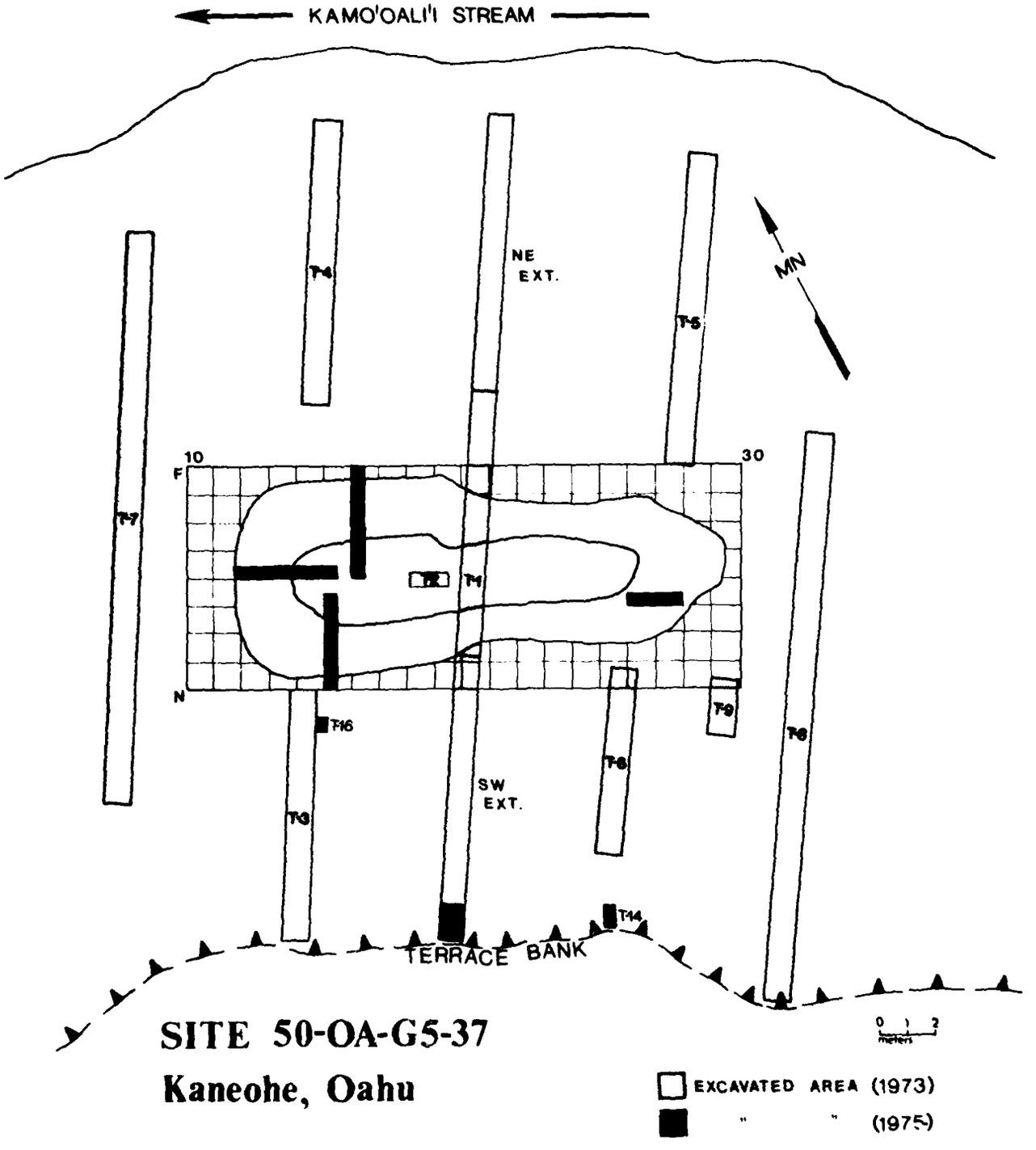


Fig. 6-3. PLAN OF PREVIOUS AND SALVAGE EXCAVATION UNITS. Previous excavation units T-1 to T-9, and salvage excavation units T-10 to T-16. See Fig. 6-1 for location of units T-17, T-18, and T-19.

METHODS AND PROCEDURES

Fieldwork

The field crew, supervised by the Project Director, consisted of five field assistants, experienced excavators who individually supervised various aspects and areas of the mound excavation. Fieldwork was conducted between July 21 and October 17, 1975. The field crew was occasionally augmented by volunteer assistants and by other Museum personnel and outside consultant specialists. Approximately 256 man-days were expended on the salvage project (including 10 volunteer man-days)--about 226 man-days (88%) were involved in actual mound excavation, and 30 man-days (12%) were directed at peripheral excavations and other related activities.

To permit excavation to proceed uninterrupted by bad weather, the entire mound structure was tented with clear polyethylene sheeting, supported by a central rope slung above the long axis of the mound. This tent was lowered at the end of each work day to protect exposed excavation areas from rain damage during nights and weekends. This shelter system worked so well that virtually no field man-hours were lost through bad weather, in spite of frequent, and often heavy, rainfall.

The site was first cleared of all standing vegetation and surface debris (Fig. 6-4). Overburden resulting from recent bulldozer activity by the Army Corps of Engineers was carefully removed from the surface of the eastern half of the mound. A metric control grid of 1-meter squares was established over the site with telescopic level, tape measure, and plumb (Fig. 6-5). The 160-square-meter grid system was laid out coincident with the main axes of the mound. An alpha-numeric system was used to label grid squares, with letters extending from north to south and numbers from west to east. Individual grid squares were designated according to the alpha-numeric intersection at their northwest corners.

A datum point was established c. 10 meters SE of the mound, using the top of a steel casing of a test well bored earlier by the Army Corps of Engineers. This point had a known absolute elevation, 142.3 ft (43.37 meters above mean sea level [msl]), which permitted subsequent conversion of the daily excavation relative elevations to absolute values. A detailed contour map (20-cm-contour intervals) of the mound was constructed. Included on this map were the location of previous excavation units, trees, and the visual make and break (top and base) of the sloping mound sides.

Excavation usually was conducted by 1-meter-square grid units, according to natural stratigraphy, using hand trowels. Wherever justified, short exploratory trenches were dug. These were numbered sequentially, following the same sequence of previous excavations at the site (Fig. 6-3). The actual strategy and tactics of the mound excavation are outlined in the excavation section of this report. All excavated soil was processed through 0.25-in.-mesh screens to facilitate recovery of portable remains. Water screening, using a small portable gasoline-engine pump to draw water from Kamo'oali'i Stream, was initially utilized in an attempt to increase potential recovery of portable cultural remains from the clayey soil. A comparison of the water method with dry screening was made; since there was no appreciable difference in either the nature of materials or rate of recovery, water screening was

Fig. 6-4. VIEW (TO NE) OF EARTHEN MOUND DURING CLEARING BEFORE SALVAGE EXCAVATIONS. North end of supplemental examination trench (T-3) excavated in December 1973 visible in foreground. (BPBM Neg. No. OA(a)111-12.)

Fig. 6-5. VIEW (TO NNW) OF EARTHEN MOUND AFTER CLEARING. Control grid laid out before excavations began. Remains of low stone platform (HF-1) visible atop mound, beyond test trench (T-1) excavated in March 1973. (BPBM Neg. No. OA(a)111-28.)

discontinued in favor of the more efficient dry screening for the rest of the excavation.

Non-artifactual remains were bagged according to grid square and stratigraphic layer or horizontal feature. Non-artifactual remains were extremely limited in the nature, range, distribution, and amount of materials, with the exception of the rather evenly dispersed charcoal pieces and fragments found principally in the cultural deposits. This situation called for an essentially qualitative (non-quantitative) sampling of non-artifactual remains. All unique and rare specimens were collected, but only the larger pieces of charcoal--those with potential for subsequent floral identification--were retained.

All portable artifacts were collected. Excavated artifacts were recorded according to grid square and layer or horizontal-feature provenience. Artifact numbers were assigned according to grid squares and sequence of recovery; the complete artifact number includes site number, grid square, and recovery sequence number--e.g., 50-OA-G5-37-H19-8. Surface finds, recorded somewhat differently, were assigned a sequential number with a GS (General Surface) prefix, rather than a grid-square number--e.g., 50-OA-G5-37-GS-5. Artifact and horizontal-feature proveniences were plotted on individual excavation plans of grid squares.

Charcoal samples with potential for radiocarbon dating were collected from all horizontal features yielding sufficient amounts of charcoal. Soil samples were collected from a wide range of stratigraphic and feature proveniences, for both subsequent sedimentary studies and sampling of possible microfossil floral remains.

The elevations of stratigraphic deposits, horizontal features, and portable artifacts were recorded in terms of both absolute elevation and depth below immediate ground surface.

In addition to excavation of the mound itself, work in peripheral areas of the mound was also conducted. This involved a series of test excavations (T-14 through T-20), extensive surface elevation determinations, and construction of a map of the immediate area between Kamo'oali'i Stream and the small unnamed stream to the W.

A complete photographic record (black and white, and color) was made of the salvage excavations. This record complements the detailed written record provided by the plans, sections, excavation forms, and field notes.

Museum Laboratory

All portable remains were removed to the Museum's Archaeology Laboratory for processing and analyses. This work was done by a lab technician, under the supervision of the Project Director, over a period of 14 weeks. The final report was prepared by the Project Director over a period of five months.

Portable artifacts were cleaned, labelled, catalogued, and tabulated. Non-artifactual remains were sorted, identified, recorded, and tabulated. Specific soil and charcoal samples were selected, on the bases of specific excavation questions and problems, and submitted to outside consultants for

detailed sedimentary analyses and radiocarbon age determinations. After processing as artifacts, all basaltic-glass pieces were submitted to an outside consultant for hydration-rind age determinations.

EXCAVATIONS

EXCAVATION PLAN

The basic objective of the salvage excavations was the complete and full recovery of all relevant and significant archaeological data from the mound site, in order to define the nature and age of the occupations evidenced by the two cultural layers revealed during the earlier test excavations. Specific objectives included:

1. Confirmation or negation of the hypothesis that the structural feature was a prehistoric habitation mound;
2. If confirmed, definition of the mound construction and occupation sequence;
3. Exposure of the full extent of cultural Layers III and V;
4. Definition of the provenience, nature, and patterning of any structural features, such as fire pits, postholes, and ovens;
5. Determination of the specific nature of occupation evidenced by the cultural deposits and features;
6. Establishment of the natures and relationships of the other, non-cultural mound layers to the cultural layers (III and V);
7. Determination of the nature of Layer VI--was it a natural or artificial deposit;
8. Establishment of the relationship, if any, between the low stone platform atop the W portion of the mound and the mound structure itself;
9. Recovery of the full range of portable artifacts and non-artifactual remains present;
10. Recovery of sufficient adequate dating samples, both radiocarbon and basaltic-glass hydration-rind, to secure a precise absolute chronology for the mound; and
11. Determination of the relationship of the mound and its deposits to deposits of the surrounding peripheral area.

Excavation units and their specific, limited objectives are summarized in Table 6-1. The listing of excavation units includes all work done at Site 50-0A-G5-37 as part of the testing and salvage excavations. The table summarizes: (1) the various excavation units in terms of project and total area of excavation; (2) general provenience--mound or periphery; and (3) unit-specific excavation objectives--definition of stratigraphy, soil sampling, exposure of horizontal features, and recovery of portable artifacts, non-artifactual remains, and dating samples.

Initial salvage excavation strategy involved extensive horizontal area excavations--the stripping of individual layers over the entire mound. It soon became obvious that the simple and easily recognized stratigraphy revealed by the earlier test trench (T-1), across the long axis in the center of the mound, was neither as straightforward nor as clear elsewhere within the mound. This

Table 6-1.

EXCAVATION UNITS AND OBJECTIVES

Excavation Unit	Project and Area: Project*	Project and Area: Approx. Area of Excavation (m^2)	General Provenience: Main Mound	General Provenience: Periphery	Excavation Objectives: Stratigraphy	Soil Samples	Horizontal Features	Portable Artifacts	Non-Artifactual Remains	Dating Samples
T-1	K-II(1)	9.3**	+	+	+	?	+	+	?	+
T-1 (NE ext.)	K-II(2)	10.0		+	+		+			
T-1 (SW ext.)	K-II(2)	9.6		+	+	+	+			
T-2	K-II(1)	0.63	+		+		+	+		+
T-3	K-II(2)	8.8		+	+		+			
T-4	K-II(2)	10.0		+	+		+			
T-5	K-II(2)	11.0		+	+		+			
T-6	K-II(2)	6.5		+	+		+			
T-7	K-II(2)	20.0		+	+		+			
T-8	K-II(2)	20.0		+	+		+			
T-9	K-II(2)	2.0		+	+		+			
T-10	UPK II	2.0+	+		+					
T-11	UPK II	1.0+	+		+					
T-12	UPK II	1.75+	+		+					
T-13	UPK II	1.75+	+		+					
T-14	UPK II	0.54		+	+	+				
T-15	UPK II	0.88		+	+	+				
T-16	UPK II	0.25		+	+	+				
T-17	UPK II	1.0		+	+	+				
T-18	UPK II	1.0		+	+	+				
T-19	UPK II	1.0		+	+	+				
T-20	UPK II	0.25		+	+	+				
Main Mound (1975)	UPK II	64.77++	+		+	+	+	+	+	+
TOTAL AREA EXCAVATED		177.52								

*K-II(1) = Kamo'oali'i Phase II, Part 1 (intensive survey & test excavations, 1973).
K-II(2) = Kamo'oali'i Phase II, Part 2 (supplemental archaeological resource examination, 1973-74).
UPK II = Upland Kaneohe, Phase II (salvage excavations, 1975).
**Includes c. 5.00 m^2 within mound and 4.30 m^2 beyond.
+Included in main mound excavation area total.
++Includes 0.82 m^2 of fall and debris from 1973 work, removed in 1975.

situation dictated a shift in tactics to (1) initial excavation of short exploratory trenches into both the E and W ends of the mound, and (2) limited horizontal areal excavations within restricted portions of the mound where identified layers could be recognized. These tactics permitted gradual definition of overall mound stratigraphy, recording of horizontal features, collection of soil and dating samples, and recovery of portable artifacts and non-artifactual materials. The consequences of the initial stratigraphic problems and uncertainties, and of the use of the short exploratory trenches, are reflected in the mixed layer proveniences that are referred to in subsequent sections of this report. The various stratigraphic and provenience problems were also compounded by surface and subsurface disturbances assignable to multiple sources, including tree roots, burrowing of rats, and recent bulldozer activity.

Excavation units were dug in both the mound and the peripheral area of the mound (Figs. 6-1, 6-3). T-1 and T-2 tested the mound and the most immediate adjacent area. The T-1 extensions (NE and SW) and T-3 through T-9 completely sampled the area immediately surrounding the mound. T-10 through T-13 were intra-mound exploratory trenches. T-14 through T-19 tested the less immediate surrounding area. T-14 through T-18 were all located at varying distances (within c. 25 meters radius) to the S of the mound, while T-19 was situated c. 70 meters to the SE, near the W bank of Kamo'oali'i Stream. T-20 was located approximately 180 meters to the SW of the mound, in the middle of a historically cultivated rice pondfield.

Table 6-2 summarizes the area of excavation in square meters. The total area excavated during investigation of the mound site was 177.52 square meters. Excavation of the mound itself comprised approximately 70.40 square meters (Fig. 6-6) and an estimated volume of c. 35.30 cubic meters. Complete excavation of the mound cultural deposits did not necessitate total leveling of the mound structure because the sterile subsoil beneath the cultural deposits and composing the base of the mound was elevated above the immediately adjacent ground surface.

The mound area excavated during the 1975 salvage excavation was 64.77 square meters. Five main reference baulks (50 cm wide, one running E-W on the long axis, and four perpendicular N-S) were left standing during excavation as stratigraphic controls (Figs. 6-6, 6-7). Temporary baulks were utilized as required. Upon completion of the area excavations, stratigraphic cross sections of all faces on the five main reference baulks were drawn (1:10 scale) and photographed (120 black and white, 135 color, 135 infra-red), and four soil monoliths were made for retention as permanent, visual records of representative stratigraphy within various portions of the mound. Finally, the reference baulks were removed to permit completion of recording of horizontal features and the recovery of any additional portable cultural remains.

STRATIGRAPHY

Description

The stratigraphy defined in the center of the mound (T-1, W face) during the 1973 test excavations (Report 4, this volume [Fig. 4-5]), was utilized as

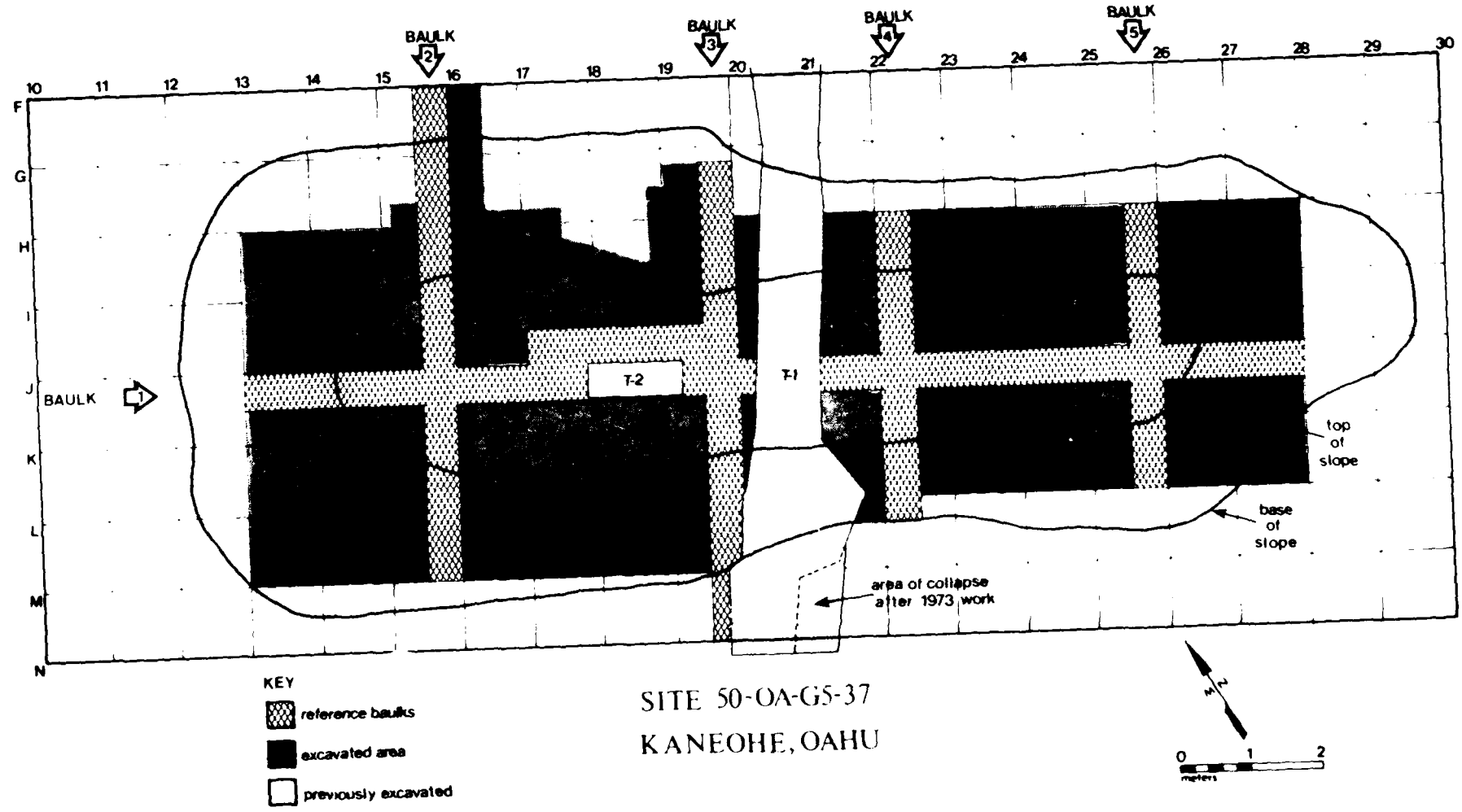


Fig. 6-6. PLAN OF SALVAGE EXCAVATION LIMITS. Area of excavation before removal of reference baulks.

Fig. 6-7. 'EW (TO N) OF EARTHEN MOUND BEFORE REMOVAL OF REFERENCE BAULKS. Salvage excavations completed except for removal of 50-cm wide baulks. Control grid st.ings removed, but flagged grid stakes still in place along baulks. (BPBM Neg. No. OA(a)115-13.)

Table 6-2.

SUMMARY OF EXCAVATED AREAS

General Provenience	Project*	Total Excavated Area (m^2)	Percent of Excavation	Total Excavated Area (m^2)	Percent of Total Site Excavation
Main Mound				70.40	39.66%
T-1	K-II(1) (1973)	5.00**	7.10%		
T-2	K-II(1) (1973)	0.63	0.89		
Remainder of Mound	UPK-II (1975)	64.77†	92.00		
Peripheral Area Units				107.12	60.34%
	K-II(1) (1973)	4.30	4.01%		
	K-II(2) (1973-74)	97.90	91.39		
	UPK-II (1975)	4.92	4.59		
Total Site Area Excavated				177.52	100.00%

*See Key, Table 6-1, for explanation of Project designations.
**Portion of T-1 within main mound.
†Includes approximately 0.82 square meters of fall and debris from 1973 work, removed and processed in 1975.

the main control section (Square J20, W face) for the salvage excavations (Fig. 6-8). Two other sections, one near each end of the mound, were selected as comparable E and W control sections (I23, S face; I14, S face). The basic stratigraphies of the main control and secondary control sections are compared in Table 6-3.

Several soil monoliths were made as permanent records of mound stratigraphy. Monolith No. 1 recorded stratigraphy of the main control section, while Monoliths Nos. 2 and 3 recorded the W and E control sections. The detailed descriptions of the main and secondary control sections are presented in Table 6-4, while Figure 6-9 presents in schematic form the control sections as recorded on the three monoliths. The overall stratigraphy of the mound, as recorded on the five main reference baulks, is presented in Figures 6-10 (foldout at end of volume) and 6-11.

The approximate horizontal extents of mound Layers II, III, IV, and V are indicated in Figure 6-12, and their approximate area in square meters is summarized in Table 6-5. Main control section Layers IV and V were absent from the E portion of the mound; both thinned out and discontinued in the area of Baulk No. 4 (E face). The distribution of Layer II in the W portion of the

Table 6-3.

COMPARISON OF CONTROL SECTION STRATIGRAPHY

General Nature of Layer	Layer Designation	East Control Section	Main Control Section	West Control Section
Humic topsoil	I	+	+	+
Sterile, primary alluvial deposit	II	+	+	+*
Cultural deposit	III	+	+	+
Sterile, primary alluvial deposit	IV	-	+	+**
Cultural deposit	V	-	+	+
Sterile, well-weathered, alluvial subsoil	VI	+	+	+

+ = Present, - = Absent

*Discontinuous distribution, often very thin and/or mixed with lower portion of Layer I.

**Upper portion (IVa) disturbed/mixed, containing some limited cultural material, possibly from Layer III.

Fig. 6-8. VIEW (TO WSW) OF MAIN STRATIGRAPHIC CONTROL SECTION. Section exposed on E face of Baulk No. 3, at approximate center of mound. Remains of E edge of low stone platform (HF-1) visible atop baulk. Survey pins delimit W side of grid square J20. (BPBM Neg. No. 0A(b)11-8.)

Table 6-4.

DETAILED DESCRIPTIONS OF CONTROL SECTION STRATIGRAPHY

Layer	East Control	DESCRIPTION* Main Control	West Control
I	Dark-brown silty clay; 0-15 cm BS; SS-44	10YR 3/3**, dark-brown silty clay; 0-12 cm BS; moderate subangular blocky; hard, friable, very sticky and plastic; abrupt, smooth boundary; fine and medium roots; moderate organic material; SS-50	Dark-brown silty clay; 0-7 cm BS; includes Layer II; SS-56
II	Dark-yellowish-brown silty clay; 15-30 cm BS; SS-45	10YR 4/4, dark-yellowish-brown silty clay; 12-22 cm BS; strong, subangular blocky; hard, friable, very sticky and plastic; abrupt, smooth boundary; includes weathered, waterworn pebbles, 2-3 cm in diameter; SS-51	Very thin, mixed with Layer I; SS-56
III	Very dark-grayish-brown silty clay; 30-48 cm BS; SS-46	10YR 3/2, very dark-grayish-brown silty clay; 22-35 cm BS; strong, subangular blocky; slightly hard, friable, sticky and plastic; clear, smooth boundary; few weathered pebbles; charcoal flecking abundant; SS-52	Very dark-grayish-brown silty clay; 7-24 cm BS; no SS available
IV	Not present	10YR 4/4, dark-yellowish-brown silty clay; 35-46 cm BS; strong, angular blocky; hard, friable, very sticky and plastic; abrupt, smooth boundary; includes weathered, waterworn pebbles; SS-53	IVa†-10YR 3/3; dark-brown silty clay; 24-49 cm BS; charcoal fragments; SS-57 IVb-10YR 4/4; dark-yellowish-brown silty clay; 49-72 cm BS; SS-58
V	Not present	10YR 3/3, dark-brown silty clay; 46-60 cm BS; strong, prismatic/blocky; slightly hard, friable, very sticky plastic; clear, smooth boundary; charcoal flecking; SS-54	10YR 4/3, brown-to-dark-brown silty clay; 72-87 cm BS; no SS available
VI	Dark-reddish-brown silty clay; 48-65+ cm BS (maximum depth not known); SS-47	5YR 3/4, dark-reddish-brown silty clay; 60-91+ cm BS (maximum depth not known); strong, subangular blocky; slightly hard, friable, sticky and plastic; SS-55	Dark-reddish-brown silty silty clay; 87-92+ cm BS (maximum depth not known); SS-60

*Main Control = Square J20, W face; East Control = I23, S face; West Control = I14, S face. Unless described different, West and East Control layers correspond in description to Main Control section layers. Abbreviations: BS = Below Surface; SS = Soil Sample.

**Munsell Color Chart designation.

†IVa designates upper portion of IV, in western portion of mound (see Fig. 6-15), that was culturally disturbed, subsequent to natural deposition. IVb designates the undisturbed lower portion.

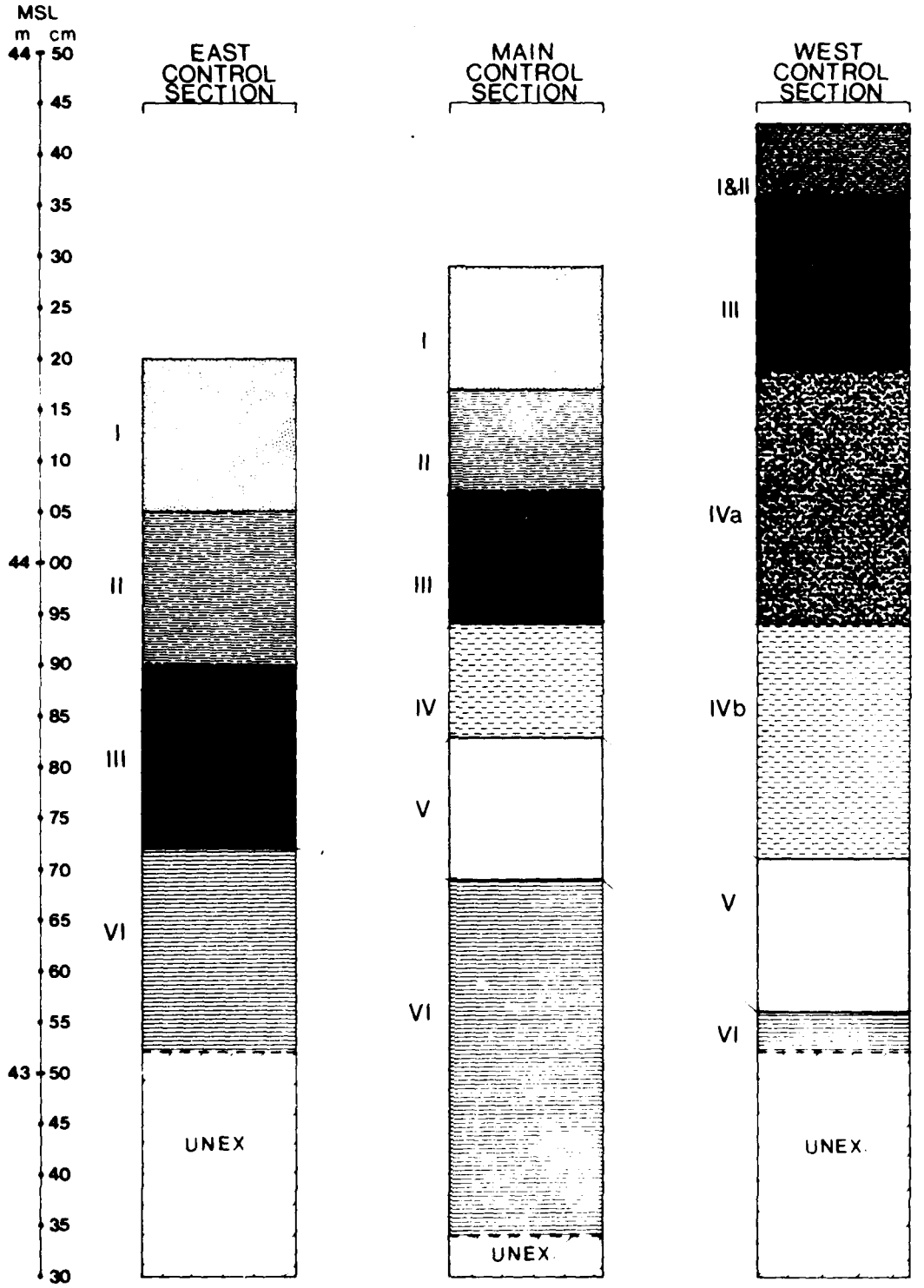
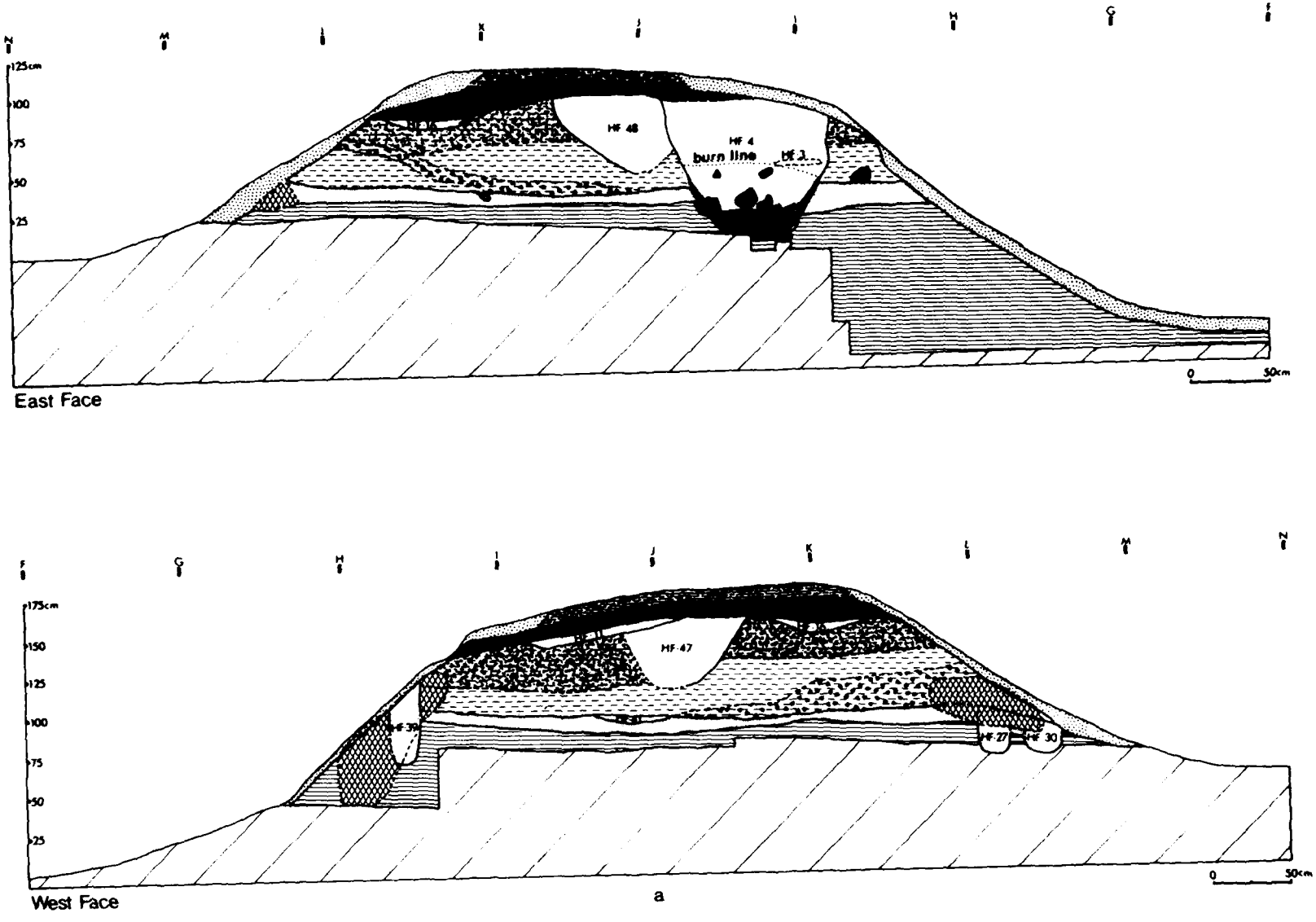
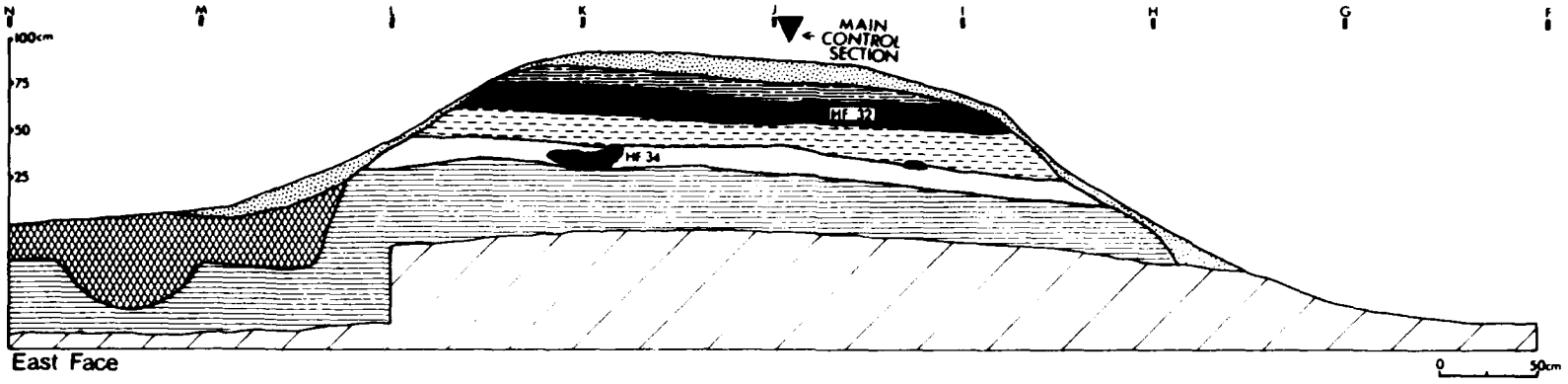


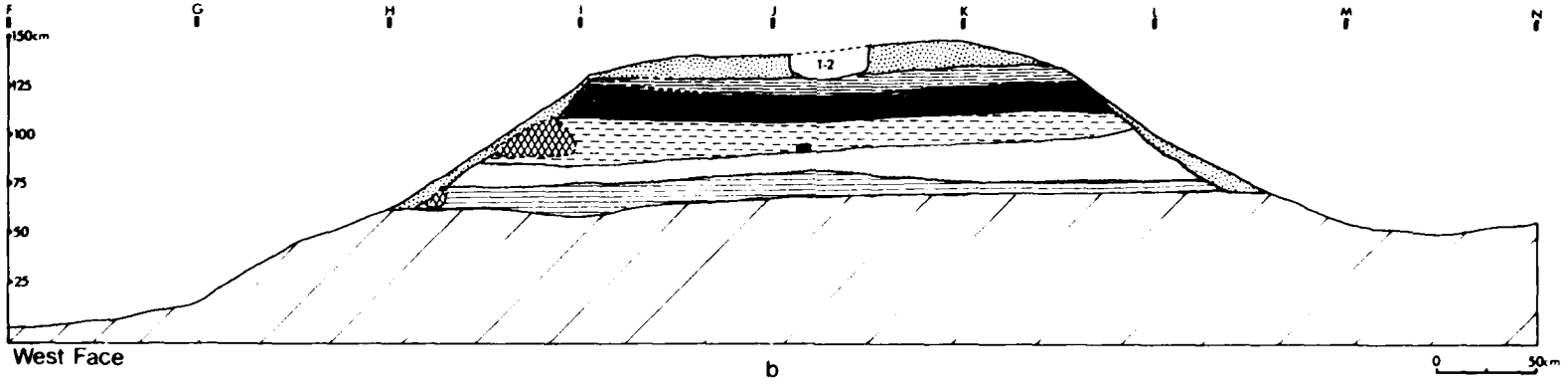
Fig. 6-9. SCHEMATIC VIEW OF MAIN AND SECONDARY CONTROL SECTIONS. Stratigraphy as recorded on control section soil monoliths. (Main Control = Monolith No. 1, East Control = Monolith No. 3, and West Control = Monolith No. 2.)



50-OA-G5-37 baulk 2

Fig. 6-11. MOUND CROSS SECTIONS. View of E and W faces of Baulks No. 2, 3, 4, and 5. Key to symbols located on Fig. 6-10 (fold-out at end). Vertical scale indicates elevation above ground surface.

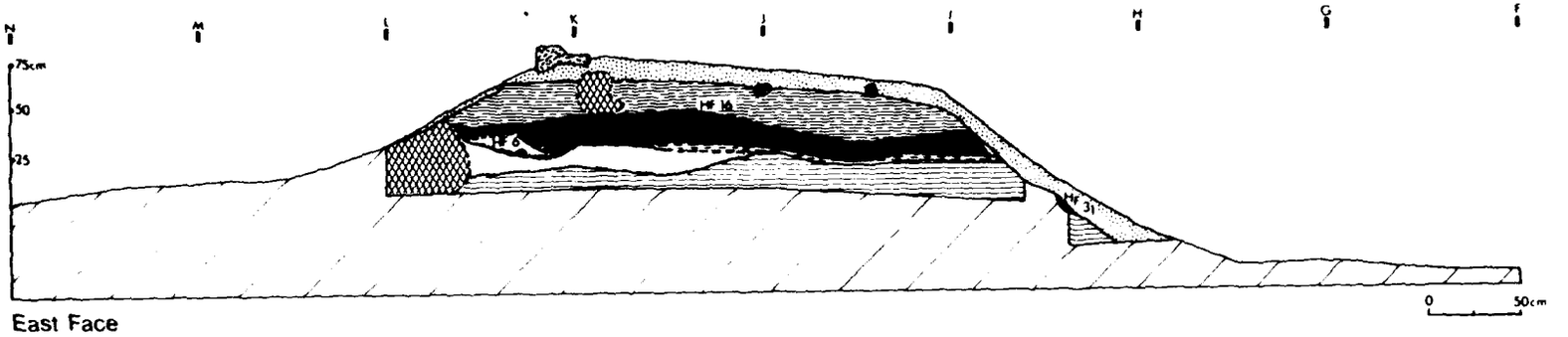




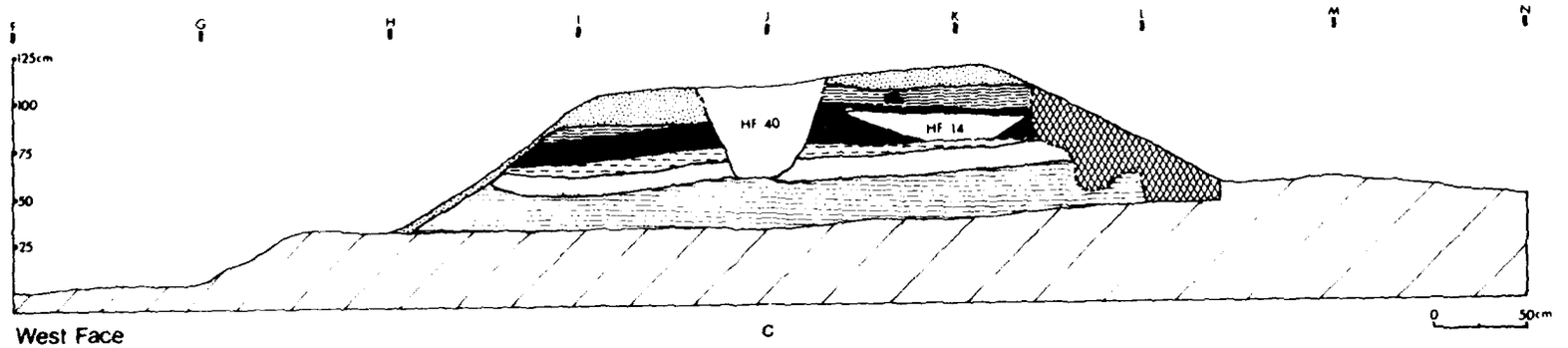
b

50-OA-G5-37 baulk 3

Fig. 6-11b.



East Face

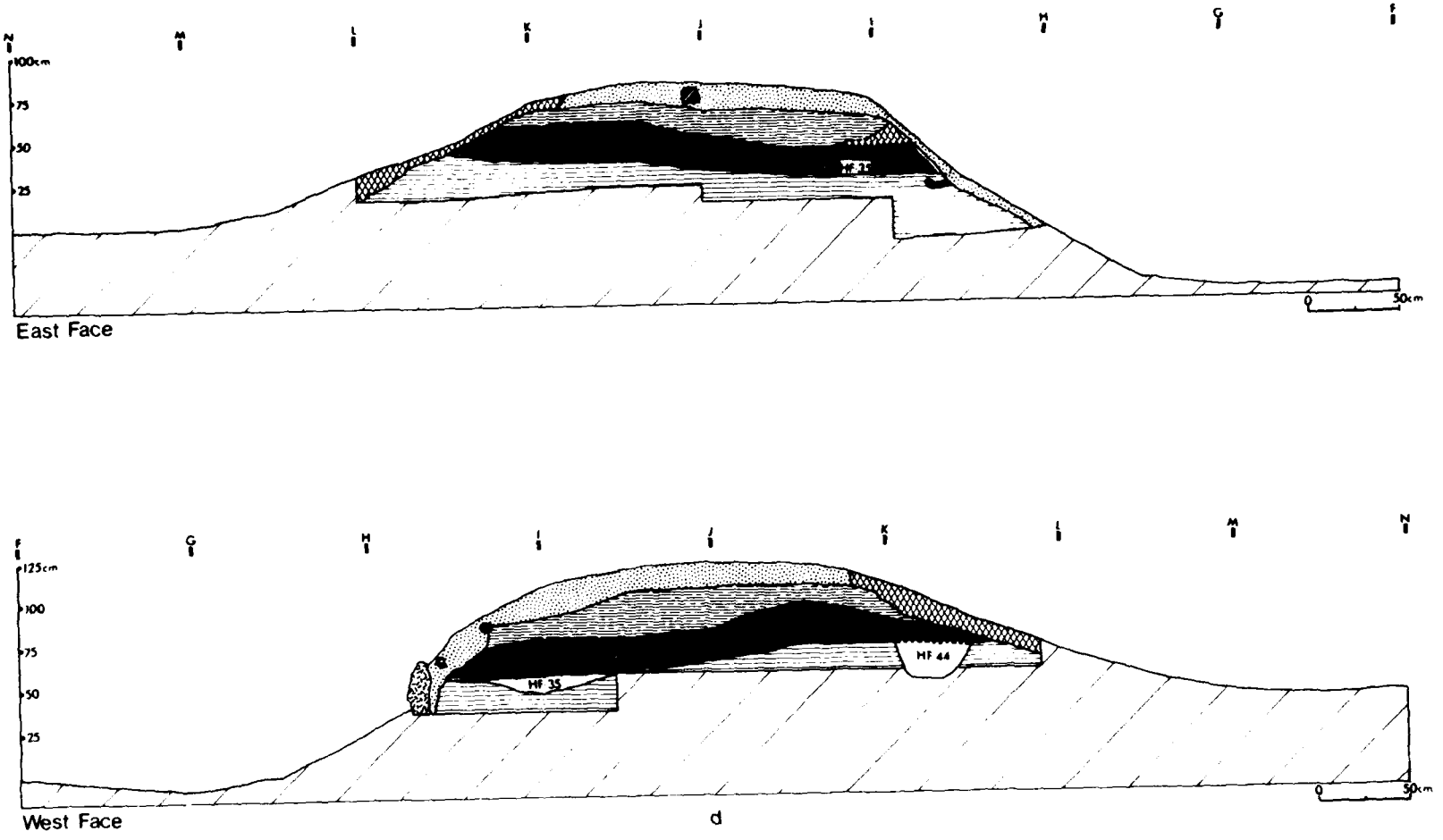


West Face

C

50-OA-G5-37 baulk 4

Fig. 6-11c.



50-OA-G5-37 baulk 5

Fig. 6-11d.

mound was discontinuous, and often very thin and mixed with the lower part of Layer I. In the W portion of the mound, three components of Layer IV could be distinguished: IVa, a disturbed or mixed portion containing limited cultural remains, principally charcoal fragments, and several pit features; IVb, the undisturbed portion of the sterile, primary alluvium designated as Layer IV throughout the rest of the mound; and IVc, a thin lens of somewhat coarser, sterile alluvium, limited in distribution to the western part of the mound.

The basic stratigraphy of selected peripheral excavation units is summarized in Table 6-6. The section of T-4, located about three meters N of the mound, was selected as the peripheral control section representative of the area immediately surrounding the mound. Other peripheral excavation units were selected for comparison on a basis of varying immediacy to the mound. Detailed data from sedimentary analyses of mound and peripheral-unit soil samples are given in a subsequent section of this report.

Elevations

To determine the relative elevations of various layers, absolute elevations were taken with telescopic level at several excavation loci. Elevations were all taken from the established datum and recorded according to mean sea level (msl) elevation. Table 6-7 presents data from selected loci. It should be noted that in instances of spatially discrete excavation loci, the stratigraphic layer designations are excavation-unit specific, and do not necessarily correlate with similar designations in other units. Figure 6-13 shows the selected elevation data plotted as two transections, both bisecting the mound, with Transection A extending from S to N, and Transection B from E to W.

Transections A and B both indicate two significant points. They demonstrate the relative elevation of the mound (mound deposits) above the surrounding area ground surface; they also show that the sterile subsoil (Layer VI) beneath the mound deposits, while elevated above the surrounding ground area, was at the same time level immediately beneath the mound deposits, with only a very slight slope toward the stream. Neither Transection A nor B demonstrates any definite correlations of mound stratigraphy levels to more distant excavation units, except for the similar sterile subsoil, though mound layers might have correlated with certain layers in T-18.

Discussion

Several points can be made regarding the stratigraphy of the mound and its immediate peripheral area. Mound Layer VI, a well-weathered, alluvial subsoil, most likely represented a natural alluvial stream terrace. Beneath the mound, the surface of the layer was relatively level, sloping only gently toward Kamo'oali'i Stream (to NE, N, and NW). Once beyond the base of the mound, Layer VI cut sharply downward, as is clearly shown on the E face of Baulk No. 2 (Fig. 6-11a), as well as in several of the other main baulk faces. Both the main baulk cross sections and the elevation data transections suggest that either (1) the mound was constructed atop a natural mound or knob of the same horizontal area, or (2) the mound resulted from downcutting (into Layer VI) and removal of more substantial and extensive deposits. The latter possibility was supported by the sharp downward inclination of Layer VI in all directions immediately outside the base of the mound deposits.

Table 6-5.

HORIZONTAL AREA OF MOUND LAYERS II, III, IV AND V

Layer	Area (m^2)			
	T-1 (1973)	T-2* (1973)	Main Mound* (1975)	OVERALL TOTAL AREA
II	2.68	0.63	28.24	31.55
III	3.02	0.63	35.15	38.80
IV	3.36	0.63	28.49	32.48
a	--	--	11.00	11.00
b	3.36	0.63	28.49	32.48
c	--	0.10	6.40	6.50
V	3.68	0.63	31.80	36.11

*Area calculations based on probable area of specific layers prior to intrusion of burial pit (HF-2). Intrusion disturbed approximately 1.75 square meters of Layers II through V.

This interpretation is further supported by the cross sections and elevation transections which demonstrate the conspicuous level orientation of mound Layers II through V (Figs. 6-10, -11, -13). These strata were further distinguished by their obvious sharp truncation at their horizontal extents. This truncation was most clearly exemplified in the S part of the W face of Baulk No. 3 (Fig. 6-10b). Soil Monolith No. 4 was taken to preserve this excellent example. Similar evidence of the truncation of Layers II through V was clearly displayed by virtually every one of the main baulk cross sections, and was also supported by the partial and almost complete truncation of several horizontal features (see Table 6-8).

In no instances was it possible to definitely correlate any of the strata in any of the peripheral excavation units to mound Layers II, III, IV, or V. The probable cultural deposits revealed in the peripheral units were generally interpreted as the remains of agricultural activities, most likely historic, that were subsequent and unrelated to the occupations represented by the mound cultural layers. In conclusion, the stratigraphic evidence, both horizontal and vertical, strongly suggests that the earthen mound was simply a still-standing remnant of earlier, more extensive deposits no longer present in the immediate surrounding area.

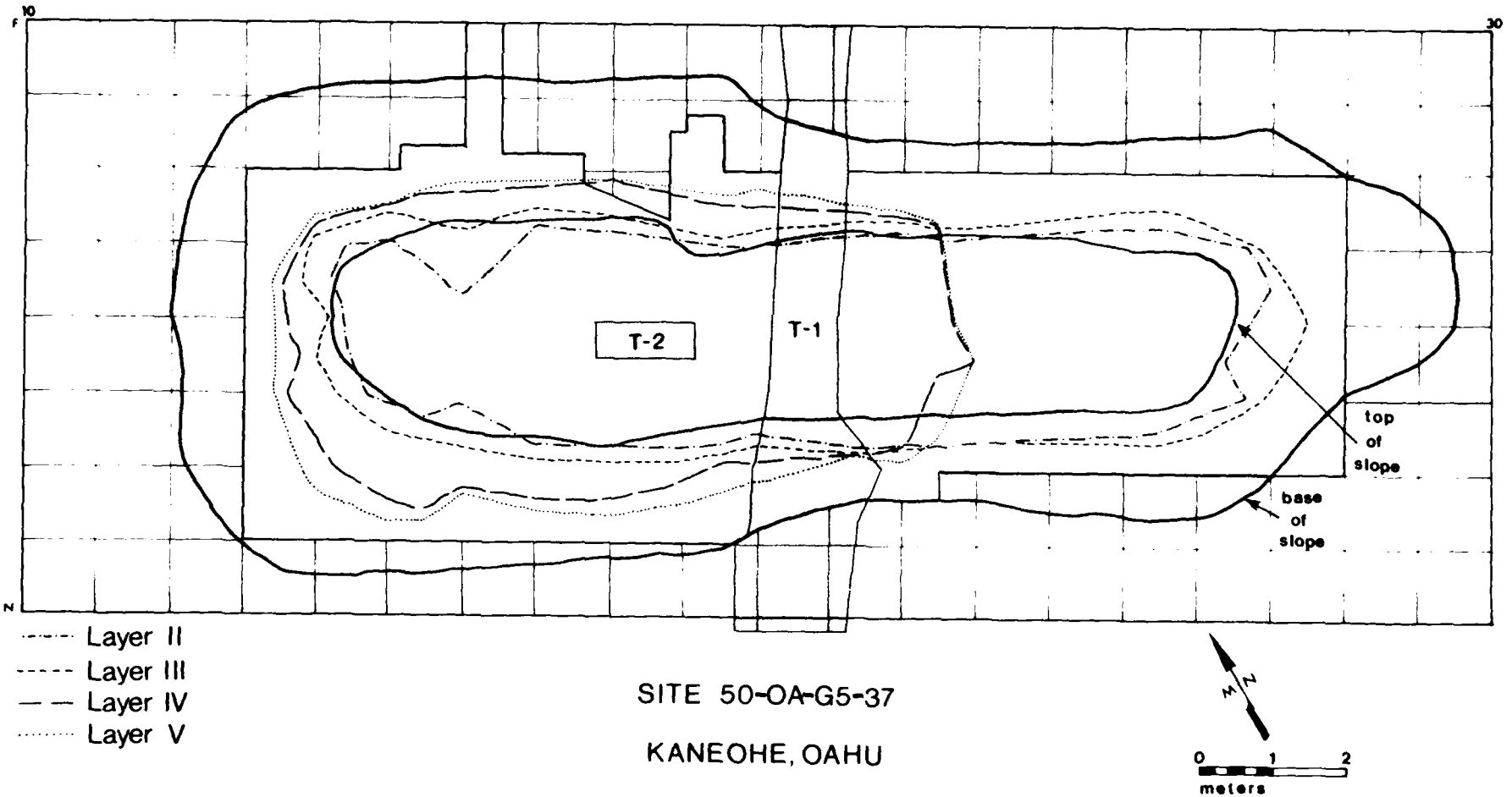


Fig. 6-12. PLAN OF HORIZONTAL EXTENT OF MOUND LAYERS II, III, IV AND V.

Table 6-6.

SUMMARY OF SELECTED PERIPHERAL EXCAVATION UNIT STRATIGRAPHY

Layer*	T-4	T-1, NE Extension	T-1, SW Extension	T-15	T-17	T-20
I	Humic topsoil, SS-7**	Recent(?), sterile, primary alluvial deposit	Humic topsoil	Humic topsoil, SS-39	Humic topsoil, SS-20	Humic topsoil SS-10
II	Possible cultural deposit, charcoal flecking present, cultivation layer(?), SS-8	Humic layer, probable former topsoil	Cultural deposit, charcoal flecking present, probable cultivation layer	Possible cultural deposit, cultivation layer(?) SS-40	Cultural deposit, probable cultivation layer, SS-21	Cultural deposit, probable irrigated cultivation layer, SS-11
III	Sterile, well-weathered, alluvial subsoil with lenses of coarser alluvium, SS-9	Cultural deposit, charcoal flecking present, probable cultivation layer	Sterile, primary alluvial deposit, probably lens	Sterile, well-weathered, alluvial deposit, SS-41	Sterile, well-weathered, alluvial subsoil, SS-22	Sterile, well-weathered, alluvial deposit, SS-12
IV	--	Sterile, coarse, primary alluvial deposit	Sterile, well-weathered, alluvial subsoil	Sterile, well-weathered, alluvial subsoil, SS-42	--	Sterile, well-weathered, alluvial subsoil, SS-13
V	--	Sterile, well-weathered, alluvial subsoil	--	--	--	--
Pit fill	--	--	--	Ditch or channel fill, uncertain if natural or cultural feature, SS-43	--	--

*Layers do not necessarily correlate simply because of same designation, since layers were labeled sequentially within units.

**SS = Soil Sample

NOTE: For more detailed description of T-1 NE and SW Extension stratigraphy, see Report 5, Tables 5-2 and 5-3.

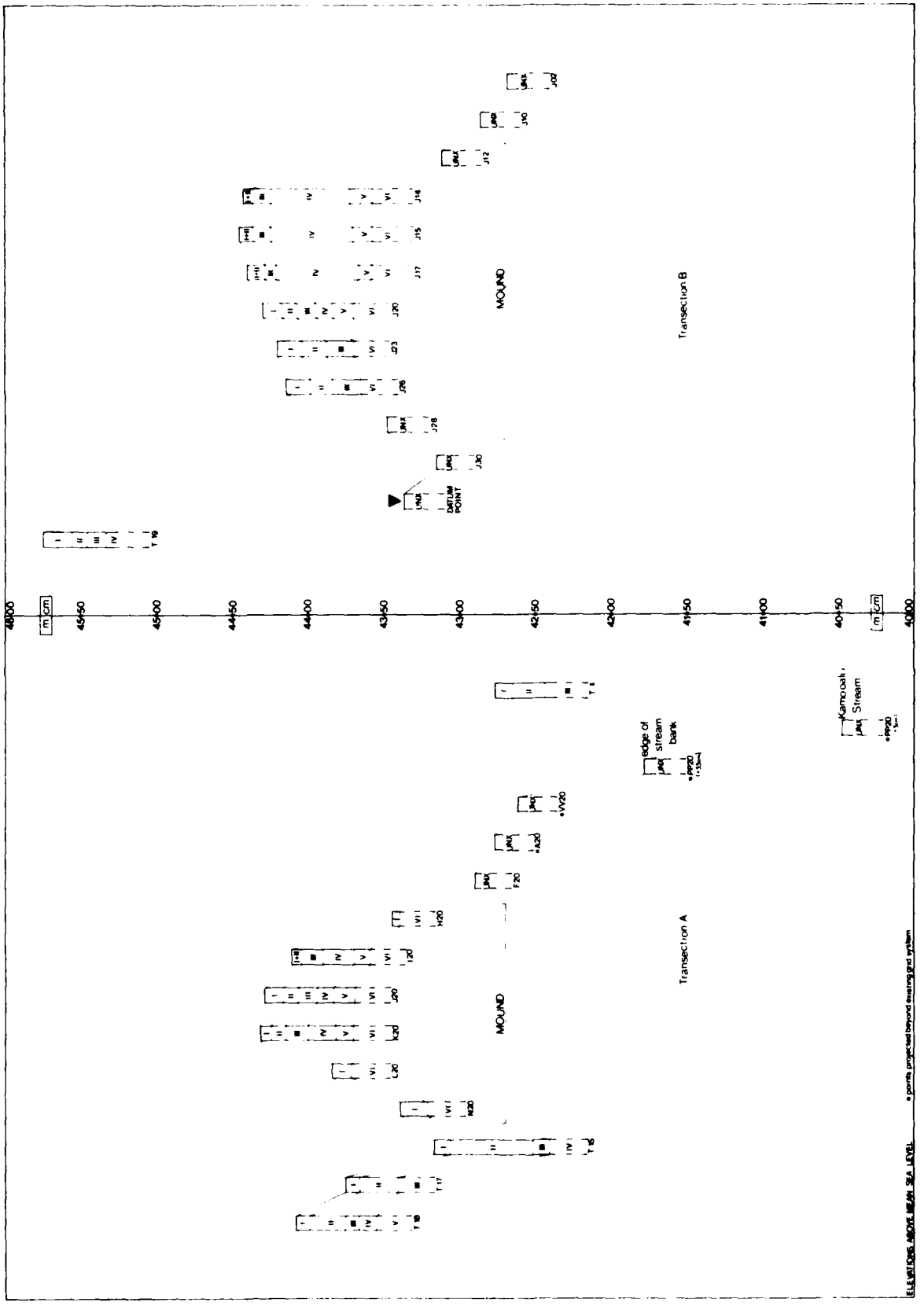


Fig. 6-13. MOUND TRANSECTIONS A AND B. Comparison of stratigraphic elevations.

Table 6-7.

ELEVATION DATA

Transection	Elevation locus*	Elevation for Top Surface of Layer**					
		I†	II	III	IV	V	VI
A	T-18	44.08	43.98	43.75	43.66	43.54	--
	T-17	43.75	43.66	43.40	--	--	--
	T-15	43.16	43.06	42.51	42.51	--	--
	N20	43.39	--	--	--	--	43.21
	L20	43.84	--	--	--	--	43.72
	K20	44.32	44.25	44.15	44.00	43.82	43.70
	J20	44.29	44.17	44.07	43.94	43.83	43.69
	I20	44.10	44.05	44.05	43.90	43.69	43.58
	H20	43.43	--	--	--	--	43.39
	F20	42.89	--	--	--	--	--
	A20	42.77	--	--	--	--	--
	VV20	42.61	--	--	--	--	--
	PP20(+55)	41.78	--	--	--	--	--
	PP20 (+5)	40.48	--	--	--	--	--
B	T-19	45.75	45.56	45.46	45.34	--	--
	Datum	43.37	--	--	--	--	--
	J30	43.16	--	--	--	--	--
	J28	43.48	--	--	--	--	--
	J26	44.14	43.98	43.83	--	--	43.64
	J23	44.20	44.04	43.87	--	--	43.69
	J20	44.29	44.17	44.07	43.94	43.83	43.69
	J17	44.39	44.28	44.28	44.21	43.65	43.56
	J15(+50)	44.45	44.36	44.36	44.24	43.69	43.56
	J14	44.43	44.36	44.36	44.24	43.71	43.56
	J12	43.11	--	--	--	--	--
	J10	42.86	--	--	--	--	--
	J02	42.68	--	--	--	--	--

*See Figures 6-1 and 6-3 for locations.

**Elevation in meters above mean sea level. Layer designations for mound stratigraphy and peripheral excavation unit stratigraphy do not necessarily correlate simply because of same designation, since layers are labeled sequentially within units.

†Ground surface.

HORIZONTAL FEATURES

Description

Forty-nine horizontal features (HF) were revealed during excavation of the mound, including complete and partial or disturbed features located during the salvage excavations (46 features) and the earlier test excavations in 1973 (3 features; HF-1, -2, -49). The 49 horizontal features are summarized in Tables 6-8 and 6-9, and the detailed descriptions of individual features are presented in

Table 6-10. The horizontal distribution of features according to layer provenience is plotted in Figures 6-14, 6-15, 6-17, and 6-22. Ten different feature types were recorded: postholes (16), firepits (9), charcoal concentrations (9), pits (7), earth ovens (3), concentrations of firepit debris (1) and oven debris (1), a low, raised, stone platform (1) and a burial pit (1), and a concentration of pig bone (1). Three features (HF-1, -2, -40) were dated to the historic period on the bases of stratigraphy and associated historic portable remains; the remainder (46) were apparently prehistoric.

Table 6-8.

SUMMARY OF HORIZONTAL FEATURES*

Layer and Feature (HF)	Feature Type	Truncated**	Dating†	Layer and Feature (HF)	Feature Type	Truncated**	Dating†
I- 1	Platform		HD	III-31	Firepit (or oven)	Yes	
I- 2	Burial Pit		HD				
I-40	Pit?			III-32	Charcoal concentration		HD
III- 3	Charcoal concentration			III-33	Posthole		
III- 4	Oven	Yes		III-35	Firepit		
III- 5	Firepit			III-36	Posthole		
III- 6	Oven	Prob		III-38	Posthole		
III- 7	Posthole?			III-44	Pit	Prob	
III- 8	Firepit			III-45	Firepit		
III- 9	Charcoal concentration	Yes		III-46	Charcoal concentration		
III-11	Oven debris		HD	III-49	Charcoal concentration		RC
III-12	Firepit	Yes					
III-13	Charcoal concentration			IVa-10	Pit		
				IVa-22††	Posthole		
III-14	Oven		HD	IVa-24	Posthole		
III-15	Charcoal concentration		HD	IVa-39††	Posthole	Yes	
				IVa-42	Pit		
III-16	Firepit (or oven)	Prob		IVa-43	Pit		
				IVa-47	Pit		
III-17	Firepit debris			IVa-48	Pit		
				V-27	Posthole	Prob	
III-18	Posthole			V-28	Posthole		
III-19	Posthole		HD	V-30	Posthole	Prob	
III-20	Pig bone concentration		HD	V-34	Charcoal concentration		RC
III-21	Firepit			V-37	Posthole?		
III-23	Firepit	Yes		V-41	Charcoal and ash concentration		RC
III-25	Posthole						
III-26	Posthole						
III-29	Posthole	Yes					

*See Table 6-10 for detailed data on horizontal features.

**Truncated - Features that were definitely (Yes) or probable (Prob) disturbed, partially removed, or otherwise affected by shaping of terminal mound structure.

†Dating: RC = Radiocarbon age determination available for this feature.
HD = Hydration-rind age determination available for this feature.

††HF-22, HF-39 possibly from Layer III.

Table 6-9.

COMPOSITION AND STRATIGRAPHIC DISTRIBUTION OF HORIZONTAL FEATURES

Feature Type	Layer				Totals	Percent of Total
	I	III	IVa	V		
Posthole		9	3	4	16	32.7%
Firepit		9			9	18.4
Charcoal concentration		7		2	9	18.4
Pit	1	1	5		7	14.3
Oven		3			3	6.1
Firepit debris		1			1	2.0
Oven debris		1			1	2.0
Platform	1				1	2.0
Burial pit	1				1	2.0
Pig-bone concentration		1			1	2.0
TOTALS	3	32	8	6	49	
Percent of Total	6.1%	65.3%	16.3%	12.2%		99.9%

Discussion

Six features were assigned to Layer V -- four postholes and two charcoal concentrations (Fig. 6-14). Of the six features, only the two charcoal concentrations (HF-34, -41) were unequivocal in provenience. HF-34 was a relatively large, dense concentration of charcoal consisting of good-sized chunks and fragments, possibly of trunk wood. Sealed within Layer V, it was uncertain whether the feature was the result of *in situ* burning or secondary deposition (Fig. 6-11b, E face). Feature 41 was a thick lens of fine charcoal fragments and ash situated at the top of Layer V (Fig. 6-11a, W face), and was obviously an *in situ* burn feature. The nature of the remains (small charcoal fragments; most appeared to be from small branches, stalks, and leaves of bushes and grasses) and their appearance (extensive burnt soil, thick fine ash, thin charcoal component) suggested the remnants from a burning of piled organic debris such as shrubs, bush,and grasses, rather than a firepit.

None of the four postholes were secure in their Layer V associations. All four were recognized only when complete removal of Layer V revealed that they were cut into Layer VI. HF-34 quite possibly was not really a posthole; its appearance and angle suggested it was likely to have been a root mold. HF-27 and -30 both were situated in an area that was extremely disturbed by the roots of a modern guava tree (Fig. 6-11a, W face), making it uncertain if

Table 6-10

DETAILED DESCRIPTIONS OF HORIZONTAL FEATURES

Feature No.	Feature Type	Provenience		Size* (cm)	Description	Comments
		Layer	Square			
HF- 1	Platform	Surface (I)	I-J-K 17-18-19	c.180x180, c.20-30 high	Low, raised, stone platform, roughly square	Probably platform monument-type burial marker (for HF-2); historic period; SS-28* from platform fill; fill same as Layer I; SS-28 probably mixed I and II; HHD-397*, 428, 430
HF- 2	Burial pit	I	I-J-K 17-18	max.155-160(de) below mound surf. c.95E-Wx220N-S	Rectangular, straight-sided pit	Historic burial, pit intrusive through Layers II-VI; SS-29; fill probably mixed I, II, III, IV, V, and VI; HHD-366,373,382,387,406,439
HF- 3	Charcoal concentration	III	H-I 15-16	c.30-40(dia), c. 3-4(th)	Small chunks of charcoal	Concentration in fill of earth oven HF-4
HF- 4	Earth oven	III	H-I 15-16	max.105 below surface of Layer III, including 25cm into Layer VI; c.110(dia), top	Roughly circular, deep oven; upper portion of fill composed of soil, burnt stone fragments, pebbles, charcoal; lower portion includes same, plus c.65 oven stones (large cobbles to small boulders)	Feature partially truncated on N side, cuts through N portion of HF-48; fill similar to IVa, with more charcoal
HF- 5	Firepit	III	J26	c.40(dia), c.10 (de)	Roughly circular with few small cobbles on periphery	Feature partially overlies HF-7; fill same as Layer III, with charcoal
HF- 6	Earth oven	III	J-K 22-23	max.15(de), c. 75x100	Shallow, roughly oval-shaped oven containing charcoal and c.75 cobbles	Fill same as Layer III
HF- 7	Posthole(?)	III(?)	J26	c.10-12(dia), c. 45(de)	Circular	Probably a root mold or rodent tunnel, not posthole; fill similar to Layers III and IV with charcoal or organic material
HF- 8	Firepit	III	I18	c.30-35(dia), c. 7(th)	Roughly circular with charcoal and small cobbles	Feature overlies pit HF-10; fill same as Layer III
HF- 9	Charcoal concentration	III	H18-19	c.25x60	Roughly oval	Possibly debris from HF-8; partially truncated

*dia = diameter, de = depth, th = thickness; SS = Soil Sample; HHD = Hawaii Hydration-Rind Dating Sample.

Table 6-10 (cont'd)

Feature No.	Feature Type	Provenience		Size* (cm)	Description	Comments
		Layer	Square			
HF-10	Pit	IVa	I19	c.35-40(dia), 30-35(de)	Shallow, oval pit	Fill similar to IVa with more charcoal;.beneath firepit HF-8
HF-11	Oven debris	III	I-J 14-15-16	max.70x140, max. 10(th)	Irregularly shaped concentration of oven debris consisting of charcoal, reddish soil, and burnt rock fragments	Associated with earth oven HF-4; HHD-444,446
HF-12	Firepit	III	K23	c.25x30, c.5(th)	Small, roughly oval firepit containing charcoal and burnt cobbles	Feature apparently truncated on S side; fill same as Layer III
HF-13	Charcoal concentration	III	K21			Concentration within HF-14
HF-14	Earth oven	III	J-K 21-22	max.20-22(de), c.100x140	Roughly oval, shallow oven; few small burnt rocks on surface; contained much charcoal	Fill same as Layer III; HHD-408
HF-15	Charcoal concentration	III	I-J 22-23	max.4(th), c.70x 140	Roughly oval, thin deposit	Possibly debris from earth ovens HF-6 and/or HF-14; HHD-353
HF-16	Firepit	III	K15-16	max.10(th), c. 70x80	Roughly circular, containing charcoal and few small burnt stones	Overlies HF-24, possibly truncated on S edge; fill same as Layer III
HF-17	Firepit debris	III	J-K 15	max.area c.55-60, max.7(th)	Charcoal, burnt soil, and fragments of burnt stone	Debris from HF-16
HF-18	Posthole	III	J16	max.(dia)20, 25 (de)	Roughly circular	Fill same as Layer III
HF-19	Posthole	III	J16	30(dia), 39(de)	Circular, stone-lined	Several small cobbles inside; fill same as Layer III; HHD-359,362,443
HF-20	Pig-bone concentration	III	J-K 17	max.c.25x50	Pig bones, upper and lower mandible, several vertebrae and misc. other bones	HHD-395,429
HF-21	Firepit	III	K 16-17	35-40(dia)	Shallow, circular firepit containing charcoal and burnt soil	Fill same as Layer III
HF-22	Posthole	IVa	J-K 17	c.20(dia), 30(de)	Circular	Fill similar to Layer IVa
HF-23	Firepit	III	K18	max.40-50(dia), 3(th)	Shallow, circular firepit containing charcoal and burnt soil	Fill same as Layer III; appears to be partially truncated on S

*dia = diameter, de = depth, th = thickness; SS = Soil Sample; HHD = Hawaii Hydration-Rind Dating Sample.

Table 6-10 (cont'd)

Feature No.	Feature Type	Provenience Layer	Provenience Square	Size* (cm)	Description	Comments
HF-24	Posthole	IVa	K16	15(dia), 34(de)		Beneath HF-16, possibly truncated by it; fill similar to Layer IVa
HF-25	Posthole	III	J14	15(dia), 15(de)		Probably stone-lined(?); fill same as Layer III, including several small cobbles at top of feature
HF-26	Posthole	III	J15	25(dia), 30(de)		Fill Layer III
HF-27	Posthole	V	L15	20(dia), c.20(de)		Possibly truncated on S side; fill same as Layer V
HF-28	Posthole	V	J14	15(dia), 12(de)		Fill same as Layer V
HF-29	Posthole	III	J14	13(dia), 50(de)		Partially truncated on W side; fill same as Layer III
HF-30	Posthole	V	L15	19(dia), 10+(de)		Possibly truncated on S side; fill same as Layer V
HF-31	Firepit or earth oven	III	H22	remnant	Few burnt cobbles and charcoal	Truncated on N, only small portion of S edge remaining; fill similar to to Layer III
HF-32	Charcoal concentration	III	I 19-20	c.25(dia), 3(th)	Roughly circular	
HF-33	Posthole	III	J16	15(dia), 25(de)	Circular	Adjacent to HF19; fill same as Layer Layer III; HHD-358
HF-34	Charcoal concentration	V	J-K 19-20	max.12(th), 25x45	Roughly oval	HRC-282*
HF-35	Firepit	III	H-I 25	max.12(th), 75(dia)	Large, circular, shallow firepit, with charcoal and burnt rock fragments	Fill similar to Layer III
HF-36	Posthole	III	I14	15(dia), 12(de)	Circular	Fill same as Layer III
HF-37	Posthole(?)	V	K18	12(dia), 14(de)		Possibly root mold; fill same as Layer III
HF-38	Posthole	III	I14	20(dia), 12(de)	Circular	Possible single stone brace; fill same as Layer III
HF-39	Posthole	IVa	H15	20(dia), 53+(de)	Circular	Possibly Layer III feature, truncated completely; fill apparently III/IV mixed, possibly IVa
HF-40	Pit	I	I-J 21-22	max.70x110, 45+ (de)	Roughly oval, irregular pit or disturbance	Historic feature containing glass bottle and other historic material; fill similar to Layer I (probably mixture of I, II, III, IV, V)

*dia = diameter, de = depth, th = thickness; SS = Soil Sample; HHD = Hawaii Hydration-Rind Dating Sample; HRC = Hawaii Radiocarbon Dating Sample.

Table 6-10 (cont'd)

Feature No.	Feature Type	Provenience		Size* (cm)	Description	Comments
		Layer	Square			
HF-41	Charcoal and ash concentration	V	I-J 15	50(dia), 4(th)	Roughly circular, top surface of Layer V	Charcoal, ash, burnt soil; HRC-283 possible agricultural burning feature; SS-59
HF-42	Pit	IVa	I-J 17	est.50(dia), est. 45+(de)	Apparently circular pit	HF-1 overlies HF-42, HF-42 cuts into HF-43; definition uncertain; fill similar to IVa, including some burnt stone fragments
HF-43	Pit	IVa	I-J 17-18	est.75(dia), est. 40+(de)	Apparently circular pit	HF-1 overlies HF-43; HF-2 and HF-42 cut into HF-43; excavation of burial pit (HF-2) partially destroyed HF-43; definition undertain; fill similar to Layer IVa, but darker; also appears similar to fill of HF-2
HF-44	Pit	III	K25	c.50(dia), 22(de)	Roughly circular, shallow pit	Fill same as Layer III
HF-45	Firepit	III	J19	max.5(de), est. 35(dia)	Apparently circular, containing charcoal, burnt soil, small stone fragments	Mostly truncated by HF-2; definition uncertain; fill same as Layer III
HF-46	Charcoal concentration	III	I22-23	c.3(th)		Portion of HF-15
HF-47	Pit	IVa	I-J15	est.max.35x80, 45(de)	Apparently roughly oval pit	HF-11 overlies HF-47; definition uncertain; fill same as IVa
HF-48	Pit	IVa	I-J 15-16	est.max.40x85, 40+(de)	Apparently roughly oval pit	HF-11 overlies HF-48; definition uncertain; fill same as IVa
HF-49	Charcoal concentration	III	T-1 K-20	est.max.80(dia) 1-2(th)	Very thin concentration of unknown dimensions (partially excavated by McCoy in 1973)	HRC-239

*dia - diameter, de = depth, th = thickness; SS = Soil Sample; HHD = Hawaii Hydration-Rind Dating Sample; HRC = Hawaii Radiocarbon Dating Sample

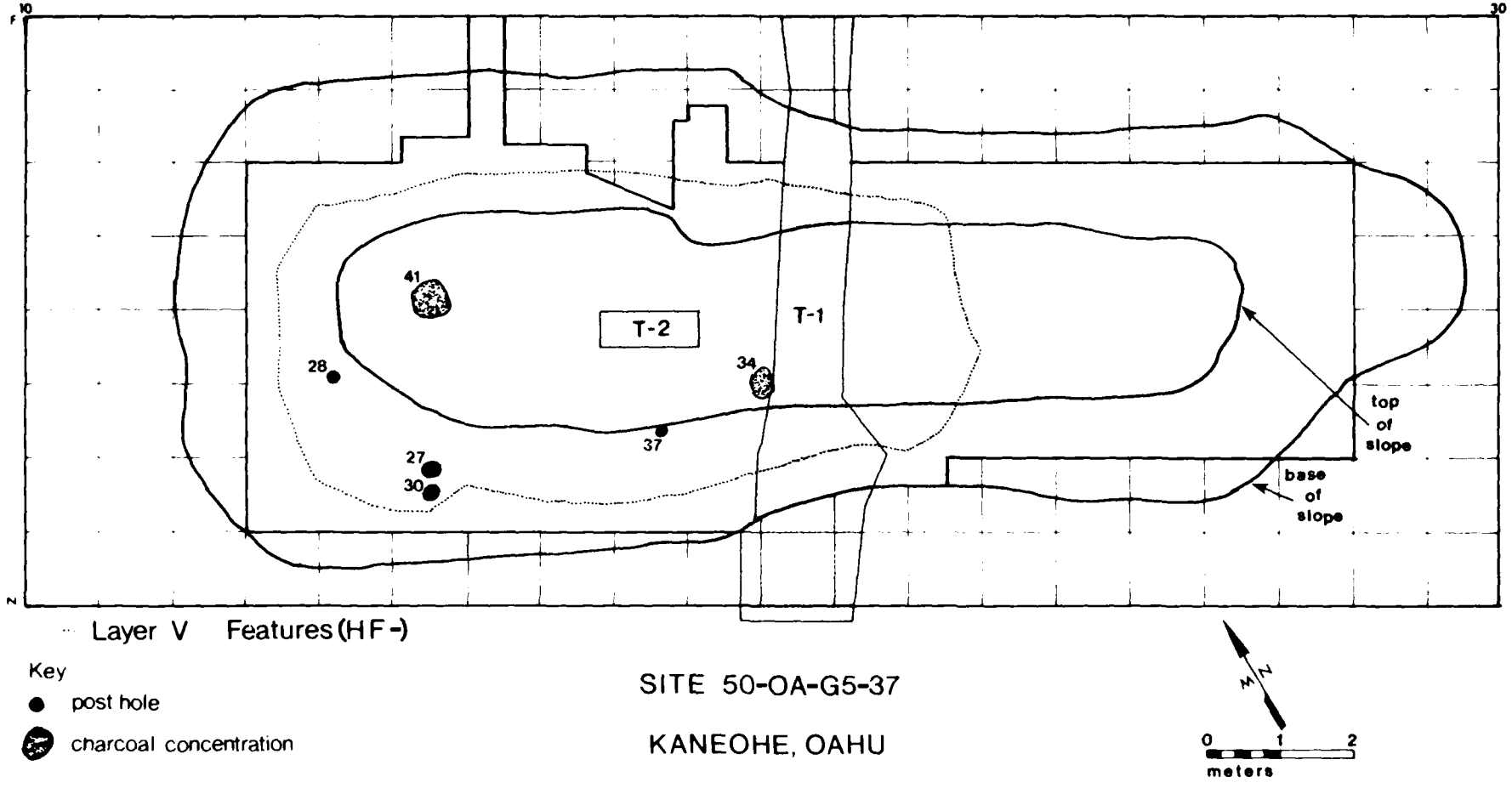


Fig. 6-14. PLAN OF LAYER V HORIZONTAL FEATURES.

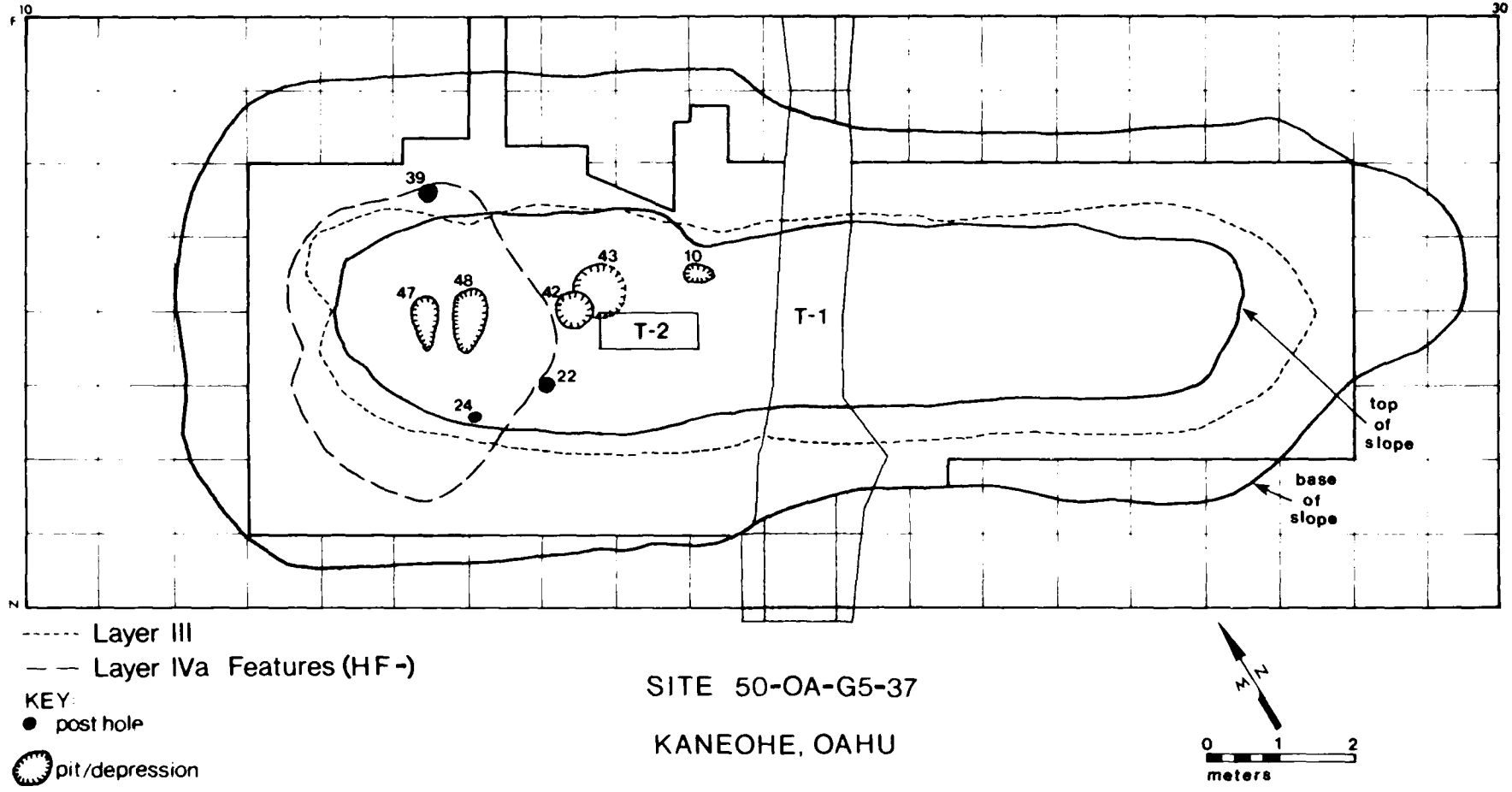


Fig. 6-15. PLAN OF LAYERS III AND IVa, WITH EARLIEST LAYER III HORIZONTAL FEATURES.

they were cut from Layer V, or possibly Layer III. HF-27 and -30 both appeared to have been partially truncated by the S side of the mound. HF-28 was the posthole most securely associated with Layer V, but it also was not recognized until the removal of Layer V revealed it as cut into Layer VI.

Eight features (five pits and three postholes) were associated with Layer IVa, the culturally disturbed upper portion of sterile Layer IV in the western portion of the mound (Fig. 6-15). These features, grouped on the basis of their characteristic fill (similar to IVa) and being sealed in by Layer III deposit and features, probably evidenced the initial portion of the occupation represented by Layer III. The disturbed upper portion of Layer IV, designated IVa on the cross sections, was the only stratigraphic unit that could be associated with these features. Of the eight features, six were clearly sealed in by Layer III (deposit and/or associated features) (HF-10, -24, -42, -43, -47, -48) (Fig. 6-16), while two of the postholes (HF-22, -39) were both somewhat equivocal in provenience, and could both quite possibly have been cut from Layer III. The third posthole (HF-21) also could possibly be assigned to Layer III, if it were interpreted as resulting from an early part of the occupation phase represented by Layer III, while the firepit above (HF-16) resulted from a somewhat later part of the same overall phase. Clear definition of the pits was difficult because the fill of all five was very similar in appearance and composition to the Layer IVa deposit, making it hard to distinguish clearly the edges of the pits. In one instance a pit (HF-42) cut partially through another (HF-43) (Fig. 6-10a). At least one of the Layer IVa features, a posthole (HF-39) was clearly truncated by the N side of the mound (Fig. 6-11a, W face).

Fig. 6-16. VIEW (TO NW) OF LAYER IVa POSTHOLE BENEATH LAYER III FIREPIT. Posthole sealed over by firepit (HF-16). Base of posthole visible in temporary extension of baulk, but not in baulk face. (BPBM Neg. No. OA(a)113-34.)

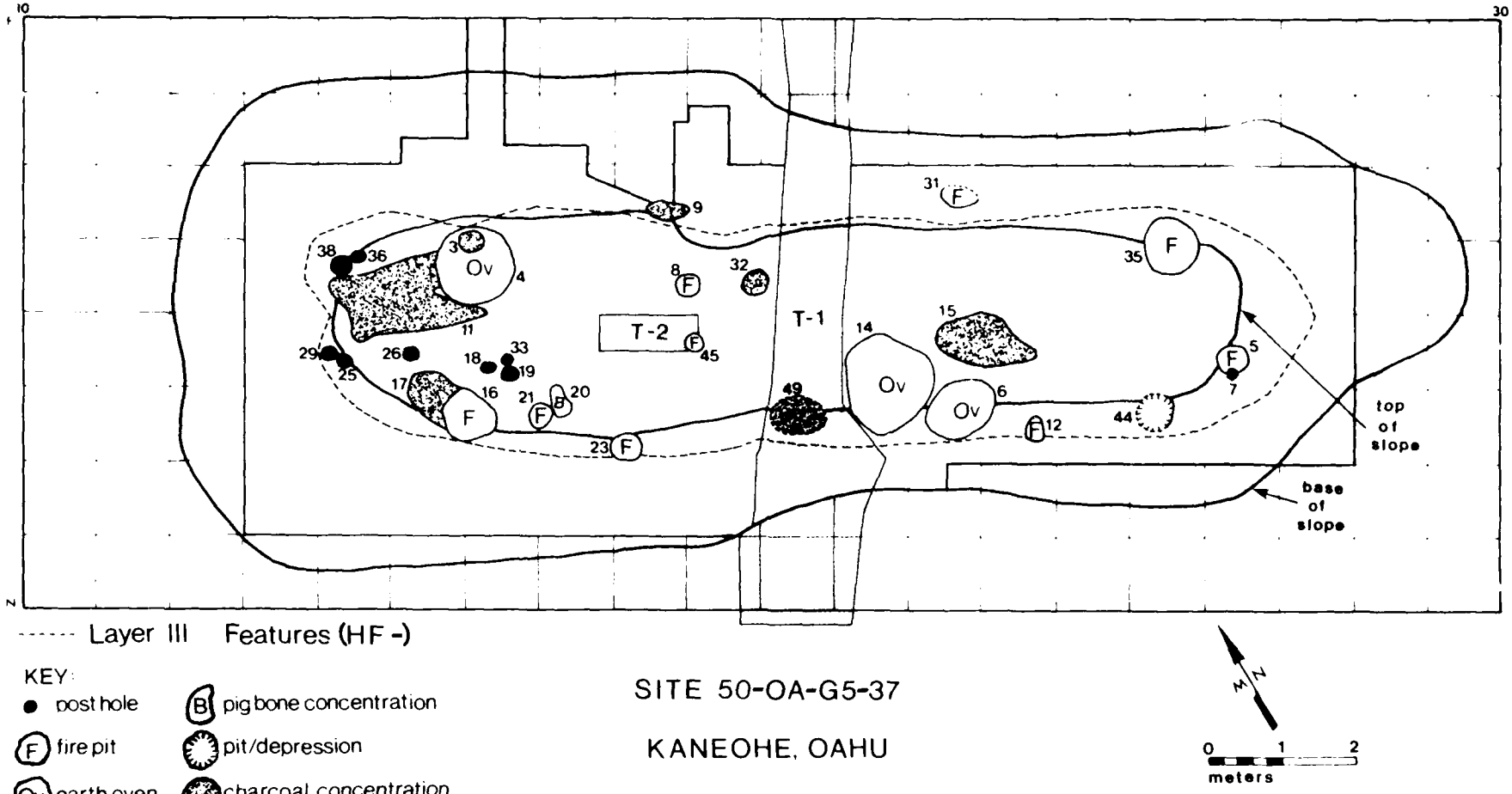


Fig. 6-17. PLAN OF LAYER III HORIZONTAL FEATURES.

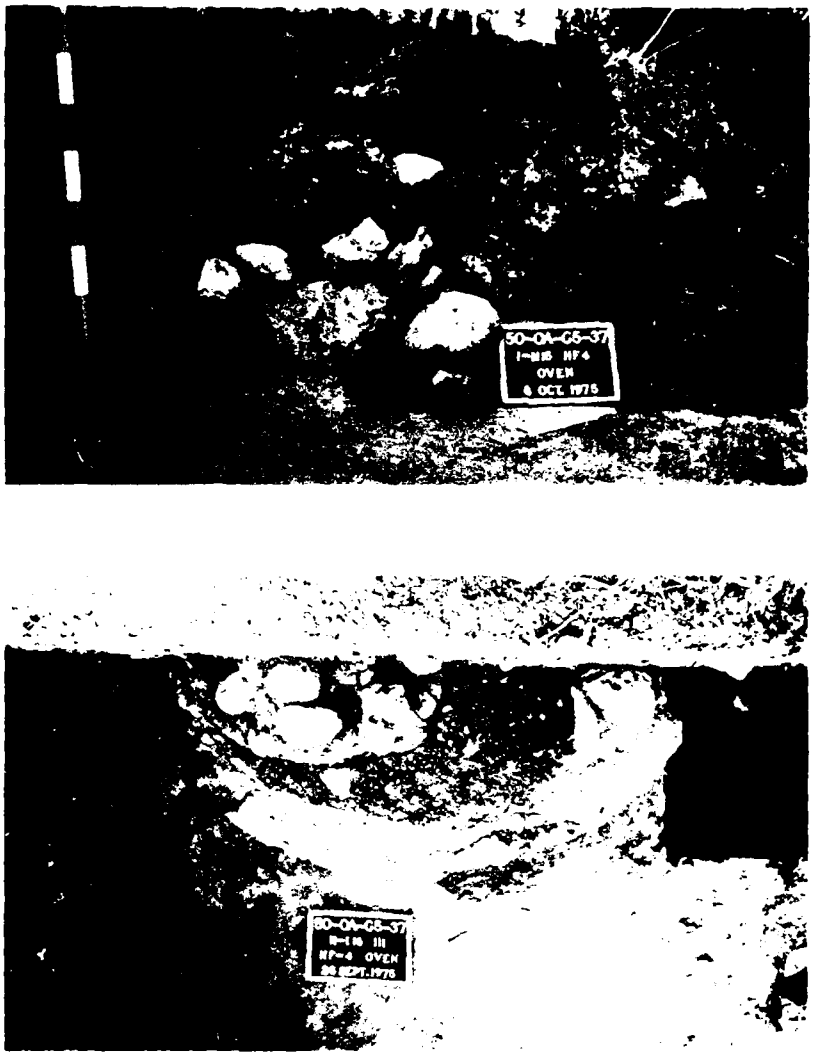


Fig. 6-18. VIEWS OF LAYER III EARTH OVEN. Top, section view (to NW); bottom, plan view of large, deep earth oven (HF-4) during excavation. (BPBM Neg. No. OA(a)115-33a, OA(a)114-36a.)

Thirty-two features were assigned to Layer III (Fig. 6-17). They constituted more than 65% of the features encountered during excavation of the mound. Both the total number and variety of types contrasted sharply to the other layers. Included in Layer III were postholes (9), firepits (9), charcoal concentrations (7), a pit (1), earth ovens (5), concentrations of firepit debris (1) and oven debris (1), and a concentration of pig bone (Figs. 6-18, 6-19, 6-20). Of the nine postholes, eight were situated in the W portion of the mound deposit, while a single one (HF-7) was in the E portion. HF-7 also appeared more likely to have been a root mold than a posthole, on the basis of its appearance and stratigraphic position partially beneath a firepit (HF-5).

Fig. 6-19. VIEW (TO N) OF LAYER III EARTH OVEN. Large, shallow earth oven (HF-6) with numerous small and medium-sized stones. (BPBM Neg. No. OA(a)113-31.)

Of potential significance is the observation that most of the postholes were situated in and associated with a range of features in the W portion of the mound. Though the eight postholes to the W are not in a definite pattern, their distribution (Fig. 6-17) did suggest alignments or a pattern for some kind of structure or shelter, possibly enclosing the largest earth oven (HF-4) (Fig. 6-18). This pattern becomes even more plausible if two postholes (HF-28, -39) of Layer IVa association are included. The same pattern of postholes could also represent a shelter for the nearby large firepit (or possible second, smaller oven, HF-16).

Firepits and ovens were found in both the W and E portions of the deposit. Associated with both types of features were concentrations of burning debris and charcoal, both possibly representing rake-out debris from the cleaning and re-use of firepits and ovens. Of the 32 features within Layer III, six clearly appeared to have been truncated by the sides of the mound (HF-4, -9, -12, -23, -29, -31), while another three probably had been truncated (HF-6, -16, -44) (Fig. 6-21).

Only three features were associated with Layer I (Fig. 6-22)--a low, raised stone platform (HF-1), a rectangular burial pit (HF-2), and a roughly oval pit (HF-40). The first two features were clearly associated with one another, with the platform serving as a marker or monument for the underlying pit, which contained a historic-period burial (Fig. 6-10). The third feature appeared to be an irregular pit, an unintentional disturbance, which yielded historic portable remains (Fig. 6-10a). The late prehistoric age hydration-rind age determination associated with the fills of both the platform and burial pit are from basaltic-glass flakes in secondary deposition, most likely from Layer III, and result from the intrusive excavation of the burial pit through Layers II, III, IV, and V, and into VI. None of the Layer I features were truncated by the side of the mound; all three were situated on t'e central long axis (W-E) of the mound.

Fig. 6-20. VIEW (TO NW) OF LAYER III POSTHOLES. Possible alignment of postholes (HF-22,-19,-33,-18) and associated shallow firepit (HF-16). (BPBM Neg. No. OA(a)113-29.)

Fig. 6-21. VIEW (TO W) OF REMAINS OF TRUNCATED LAYER III FIREPIT OR OVEN. Fired stones and charcoal only remnants of firepit or oven (HF-31) probably associated with Layer III (see Fig. 6-11c). Feature almost completely truncated by N side of mound. (BPBM Neg. No. OA(a)114-15a.)

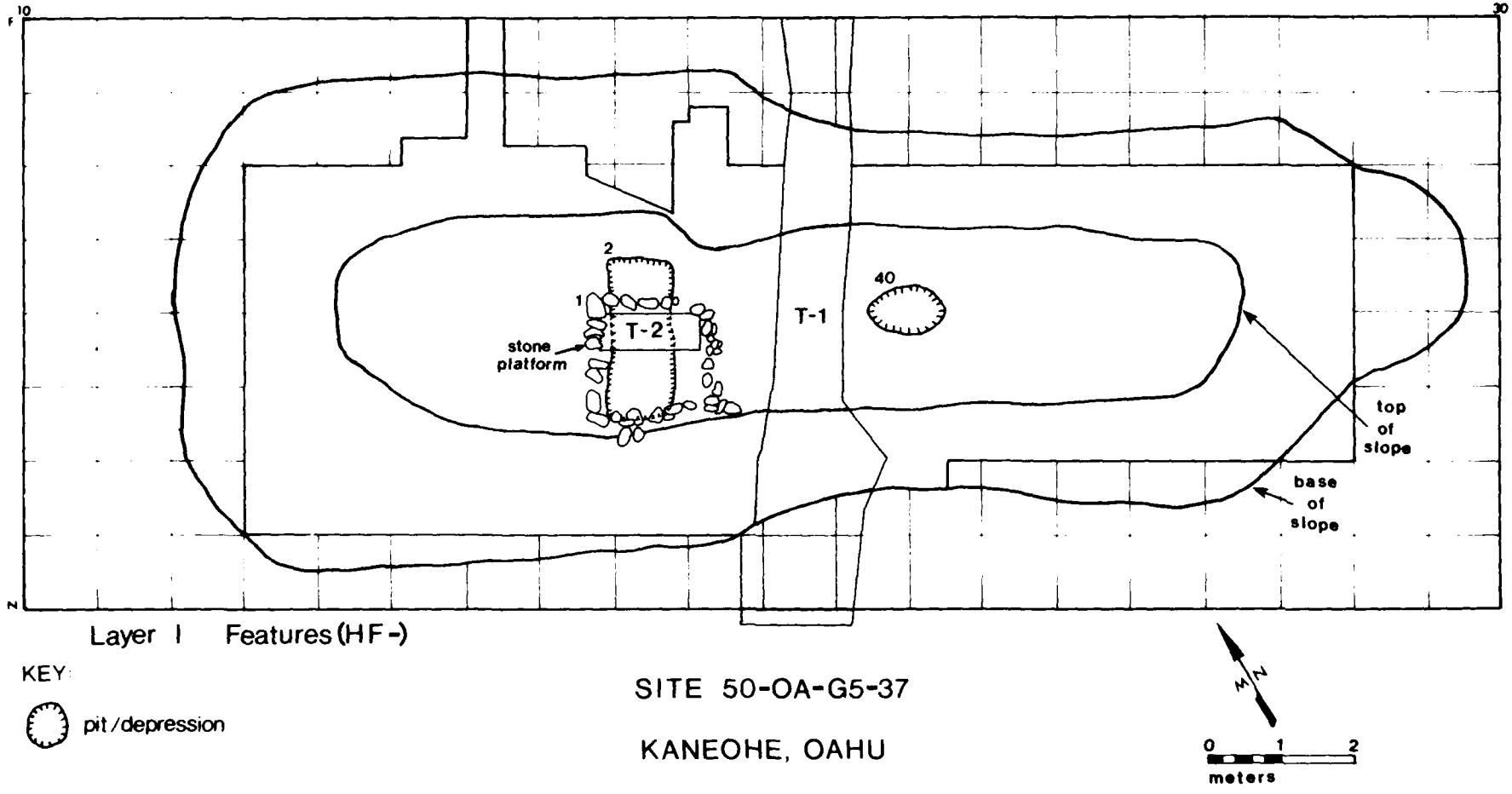


Fig. 6-22. PLAN OF LAYER I HORIZONTAL FEATURES.

ANALYSES

AGE DETERMINATIONS

A total of 139 specimens (four charcoal and 135 basaltic glass) were submitted for age-determination analyses. Of these samples, 111 yielded results--four radiocarbon (C^{14}) and 107 hydration-rind dates. Table 6-11 summarizes the age determination samples according to general provenience and sample type. Of the 135 basaltic-glass samples submitted, 27 were not datable (HHD-461 to HHD-487), and one (HHD-460) was accidentally destroyed in the laboratory during preparation. An additional 15 carbon samples (one from 1973 test excavations, 14 from 1975 salvage excavations) were collected but not submitted for dating; these samples have been filed at Bishop Museum for any possible future analysis.

Table 6-11.

SUMMARY OF AGE DETERMINATION SAMPLE PROVENIENCES

PROVENIENCE	Number of Determinations		TOTALS
	Radiocarbon	Hydration-Rind	
Layer I	-	15	15
Deposit	-	(6)	
Features	-	(9)	
I & II	-	12	12
I & II or III	-	4	4
II	-	2	2
II or III	-	1	1
III	1	58	59
Deposit	-	(48)	
Features	(1)	(10)	
III or IVa	-	5	5
IVa	-	6	6
IVb	-	2	2
V	3	2	5
Deposit	(1)	(2)	
Features	(2)	-	
TOTALS	4	107	111

The radiocarbon samples were all analyzed by the commercial laboratory of Teledyne Isotopes, Westwood Laboratories, Westwood, N.J. Five basaltic-glass samples (HHD-455 to -459) were recovered in 1973 and analyzed by Mark Childs, University of Hawaii, Hawaii Institute of Geophysics (HIG). The remaining 102 samples (HHD-353 to -454) were recovered and analyzed in 1975 by Maury Morgenstein of Hawaii Marine Research, Inc., Honolulu.

Aims

Age-determination analyses of the various charcoal and basaltic-glass samples were undertaken with several objectives in mind:

1. To obtain an estimate for overall time span and depth of occupation evidenced by cultural deposits of the site;
2. To obtain an estimate for time span and depth for non-occupation intervals evidenced by intervening sterile deposits (Layers IV and II);
3. To determine a date for initial occupation of the site;
4. To determine whether occupation(s) evidenced by various cultural deposits represented (a) essentially independent occupations separated by several hundred years (as suggested by results from 1973 test excavation samples), or (b) successive occupations and reoccupations that were temporally so close as to be considered possibly as aspects of a single major occupation;
5. To obtain absolute age estimates for documenting prehistoric presence and age of certain artifacts and floral remains; and
6. To continue the test of the correlation between radiocarbon and hydration-rind dating methods.

Methods and Results

The results of the radiocarbon analyses are presented in Table 6-12. Of the four samples submitted, three were from Layer V and one from Layer III. Table 6-12 requires comment on the various manipulations of initial results. The table identifies samples by both Bishop Museum number (HRC-) and Teledyne Isotopes sample number (I-), summarizes sample provenience, reports initial results as received from the laboratory, and presents adjusted results based on Clark's (1975) discussion of radiocarbon dates and procedures for handling radiocarbon results. The adjustments, which permit more realistic evaluation of C^{14} results, involve the conversion of sample C^{14} ages to true ages according to the most recent calibration curve for C^{14} dates (Clark 1975). Conversion of C^{14} ages is necessitated by recognition of fluctuations in atmospheric C^{14} that result in sample C^{14} ages that may have one or more possible true ages (see Olsson 1970; Ralph et al. 1973; Stuiver and Suess 1966; Suess 1965, 1970).

Adjustment of individual C^{14}-sample estimates involves these steps:

1. Compute the effective standard error (S) of the C^{14} age by taking the square root of the sum of the squares of the standard error of the uncorrected age (S_1), and the appropriate standard error of the calibration curve (S_2);
2. Add and then subtract twice the effective standard error (S) to the original C^{14} age; and

Table 6-12.

RADIOCARBON AGE DETERMINATIONS

Sample Number*	PROVENIENCE			Initial Estimate of Sample C^{14} Age**		Adjusted Estimate of Sample True Age at Two Standard Deviations (S)†	
	Layer	Feature	Excavation Unit	Years B.P.	A.D. Date	Years B.P.	A.D. Date
HRC-239 (I-7446)	III	Charcoal concentration (HF-49)	T-1 (c.K20)	380±80	1570	560-294	1390-1656
HRC-241 (I-7114)	V	Dispersed charcoal pieces	T-1 (c.J20)	625±105	1325	780-455	1154-1474
HRC-282 (I-9141)	V	Charcoal concentration (HF-34)	K20	<175	1775	<283	1667-Modern
HRC-283 (I-9142)	V	Charcoal and ash concentration (HF-41)	I15	<180	1770	<286	1664-Modern

*HRC--Bishop Museum Sample No. (Hawaii Radiocarbon). I--Isotopes Sample No. (Teledyne Isotopes, Westwood Laboratories, Westwood, N.J.).

**Radiocarbon half-life = 5,568 years; B.P. (Before Present) = before A.D. 1950.

†True age estimates calculated according to calibration curve and procedures presented in Clark (1975).

3. Using the calibration curve (Clark 1975: fig. 1 and table 8), read off the true age limits for the corresponding upper and lower C^{14} ages.

The use of twice the effective standard error in Step 2 permits a 95% level of confidence that the sample age is between the upper and lower true-age limits.

The results of the hydration-rind dating analyses are presented in Table 6-13. Table 6-13 identifies samples by Bishop Museum sample number (HHD-), summarizes provenience and surface quality of the sample, reports the determined sample age before A.D. 1975, and presents the age as an A.D. date range. The ± factor for each sample is based on measured rind-thickness range and on instrument error (microscope resolution); therefore, the ± factor represents the true age-determination total range, not a statistical standard deviation.

The hydration-rind method of absolute dating was used extensively (107 dated samples) in preference to the radiocarbon method in the investigation of Site 50-OA-G5-37. In recent years, the hydration-rind method has largely superseded C^{14} dating in Hawaiian archaeology. The method was first used in Hawaii in the fall of 1970 on samples from Halawa Valley, Molokai, and Lapakahi, Hawaii Island. Since then, the theory and techniques involved in the method

have been thoroughly described (Barrera and Kirch 1973; Morgenstein and Riley 1974; Morgenstein and Rosendahl, in press).

Hydration-rind dating is based on a chemical process whereby basaltic glass is gradually altered into palagonite by the absorption of atmospheric moisture. An alteration rind of palagonite is produced as this process progresses from a fresh glass surface toward the center of any piece. The thickness of this rind is related to the length of time a glass piece has been undergoing hydration. The dating method utilized is based on the theory of palagonite formation (Morgenstein 1969) and on a least-squares analysis of hydration-rind thicknesses for samples collected from known-age historic lava flows on Hawaii Island (Morgenstein and Riley 1974:151-152).

The hydration-rate formula was determined to be: $Rp = (N-2)Q/T$, where Rp equals the rate of palagonization, N equals the number of palagonite bands, Q equals the thickness of each band, and T equals age in years. The rate of palagonization is linear, rather than quadratic, and therefore rind thickness is directly related to the time period a sample has been undergoing hydration.

The palagonization rate (Rp) established for Hawaii on the basis of the known-age lava flows was 11.77 microns/10^3 years. The validity of this experimental rate was supported by the calculated theoretical rate (Morgenstein and Riley 1974:152). Two assumptions were made: (1) an effective temperature of 24° C in the Hawaiian Islands for the last 1,000 years; and (2) the composition of Hawaiian basaltic glass was similar to, but slightly more acidic than, that of deep-sea basalts. The theoretical rate was calculated to be 11.10 ± 0.9 microns/10^3 years, strongly supporting the experimentally established rate of 11.77 microns, which fits well within the theoretical range of 10.20 to 12.00 microns/10^3 years.

The advantages offered in Hawaii by the use of basaltic glass* hydration-rind dating over the C^{14} method have been discussed in several recent papers (Barrera and Kirch 1973; Morgenstein and Riley 1974; Morgenstein and Rosendahl, in press). These advantages can be summarized as the following: (1) prevalence of basaltic-glass flakes in archaeological sites; (2) relative ease of sample collection; (3) virtual absence of contamination problems; (4) low cost, relative to the C^{14} method; (5) simplicity of the dating method; (6) refinement in absolute chronological control--including wide age range of method, accuracy of method, minimal age range for individual samples, consistency of results, agreement with accepted C^{14} results, and evaluation of earlier C^{14} results; (7) refinement in stratigraphic interpretation--including correlation of strata, rates of accumulation, recognition of mixing or disturbance, and evaluation of artifact-analyses-based correlations; and (8) recognition of artifact re-use patterns (Morgenstein and Rosendahl, in press).

Little can be said regarding the possible geological sources of the basaltic-glass flakes from Site 50-OA-G5-37. While eventual chemical, petrologic, and petrographic analyses may hold potential for characterization and identification of specific source proveniences, and thus open possibilities for archaeological studies involving cultural patterns for the distribution of such material,

---

* Also referred to in various sources as volcanic glass, obsidian, or trachyte.

Table 6-13

HYDRATION-RIND AGE DETERMINATIONS

Sample No.*	Provenience: Layer & Square or Feature	Surface Quality**	Sample Age Before A.D. 1975	A.D. Range	Sample No.*	Provenience: Layer & Square or Feature	Surface Quality	Sample Age Before A.D. 1975	A.D. Range
HHD-353	III HF-15	G	535 ± 17	1423-1457	HHD-383	IIIorIVa J16	E	382 ± 26	1567-1619
-354	I&II K16	G	484 ± 9	1482-1500	-384	III I15	G	382 ± 17	1576-1610
-355	III I16	G	467 ± 26	1482-1534	-385	I K17	P	382 ± 17	1576-1610
-356	III J16	G	450 ± 60	1465-1585	-386	I K17	VP	382 ± 17	1576-1610
-357	III J15	G	450 ± 17	1508-1542	-387	I HF-2	G	382 ± 9	1584-1602
-358	III HF-33	G	442 ± 43	1490-1576	-388	I K16	P	374 ± 60	1541-1661
-359	III HF-19	G	434 ± 9	1532-1550	-389	I&IIorIII I14	G	374 ± 51	1550-1652
-360	I&II K16	G	425 ± 34	1516-1584	-390	III I17	G	374 ± 51	1550-1652
-361	III I16	G	425 ± 26	1524-1576	-391	III I15	E	374 ± 17	1584-1618
-362	III HF-19	G	416 ± 34	1525-1593	-392	III I16	G	374 ± 17	1584-1618
-363	III I15	G	413 ± 5	1557-1567	-393	I K15	P	374 ± 17	1584-1618
-364	III K17	G	413 ± 5	1557-1567	-394	I K17	P	374 ± 17	1584-1618
-365	III I16	G	408 ± 9	1558-1576	-395	III HF-20	G	374 ± 17	1584-1618
-366	I HF-2	G	400 ± 26	1549-1601	-396	III I15	G	374 ± 9	1592-1610
-367	III K17	G	400 ± 26	1549-1601	-397	I HF-1	G	374 ± 9	1592-1610
-368	IVa I16	G	400 ± 17	1558-1592	-398	I&II J14	G	365 ± 26	1584-1636
-369	I&IIorIII I14	G	400 ± 9	1566-1584	-399	I&II J15	G	365 ± 26	1584-1636
-370	III I15	G	400 ± 9	1566-1584	-400	III J15	P	365 ± 26	1584-1636
-371	IIIorIVa I16	G	400 ± 9	1566-1584	-401	III I16	VP	365 ± 17	1593-1627
-372	III J15	G	400 ± 9	1566-1584	-402	I&II J14	G	365 ± 17	1593-1627
-373	I HF-2	P	400 ± 9	1566-1584	-403	I&II K16	P	365 ± 17	1593-1627
-374	III K16	G	400 ± 9	1566-1584	-404	III I15	P	365 ± 9	1601-1619
-375	III K17	G	400 ± 9	1566-1584	-405	III I21	G	365 ± 9	1601-1619
-376	III I15	G	395 ± 5	1575-1585	-406	I HF-2	P	365 ± 9	1601-1619
-377	III J16	P	390 ± 60	1525-1645	-407	III K19	G	365 ± 9	1601-1619
-378	IV(b?) I17	G	390 ± 34	1551-1619	-408	III HF-14	E	357 ± 51	1567-1669
-379	III K19	G	390 ± 17	1568-1602	-409	I&II J15	VP	357 ± 34	1584-1652
-380	IIIorIVa K16	P	390 ± 9	1576-1594	-410	III I15	G	357 ± 26	1592-1644
-381	II I25	G	382 ± 60	1535-1653	-411	III I19	P	357 ± 26	1592-1644
-382	I HF-2	G	382 ± 34	1559-1627	-412	III J15	P	357 ± 26	1592-1644

*HHD = Bishop Museum Sample No. (Hawaii Hydration)

**E = Excellent, G = Good, P = Poor, VP = Very Poor.

Table 6-13 (cont'd)

Sample No.*	Provenience: Layer & Square or Feature	Surface Quality**	Sample Age Before A.D. 1975	A.D. Range	Sample No.*	Provenience: Layer & Square or Feature	Surface Quality	Sample Age Before A.D. 1975	A.D. Range
HHD-413	III H18	G	357 ± 17	1601-1635	-438	III I16	G	327 ± 5	1643-1653
-414	IV(b?) I17	G	357 ± 9	1609-1627	-439	I HF-2	P	327 ± 5	1643-1653
-415	III I15	G	349 ± 34	1592-1660	-440	I&IIorIII H16	G	323 ± 17	1635-1669
-416	IIIorIVa I16	G	349 ± 26	1600-1652	-441	III I17	G	314 ± 34	1627-1695
-417	IVa I16	G	349 ± 26	1600-1652	-442	III K19	P	314 ± 26	1635-1687
-418	I&II K16	P	349 ± 26	1600-1652	-443	III HF-19	P	314 ± 17	1644-1678
-419	IIorIII K18	G	349 ± 26	1600-1652	-444	III HF-11	G	314 ± 9	1652-1670
-420	III I21	P	349 ± 17	1609-1643	-445	IVa H17	G	306 ± 26	1643-1695
-421	IVa I16	P	340 ± 34	1601-1669	-446	III HF-11	G	306 ± 17	1652-1686
-422	I&II K16	G	340 ± 34	1601-1669	-447	III K23	P	306 ± 17	1652-1686
-423	III J16	G	340 ± 26	1609-1661	-448	V H19†	G	306 ± 9	1660-1678
-424	IVa I16	G	340 ± 17	1618-1652	-449	III I17	G	306 ± 9	1660-1678
-425	I I24	G	340 ± 17	1618-1652	-450	I&II K16	G	297 ± 26	1652-1704
-426	I&II J14	P	340 ± 17	1618-1652	-451	III I15	G	297 ± 17	1661-1695
-427	III J15	P	340 ± 17	1618-1652	-452	IVa I16	G	297 ± 9	1669-1687
-428	I HF-1	P	340 ± 17	1618-1652	-453	V H19†	G	289 ± 9	1677-1695
-429	III HF-20	P	340 ± 17	1618-1652	-454	III K23	G	280 ± 17	1678-1712
-430	I HF-1	G	340 ± 17	1618-1652	-455	III T-1	?	384 ± 25	1566-1616
-431	III I16	P	340 ± 9	1626-1644	-456	III T-1	?	343 ± 18	1614-1650
-432	I&IIorIII I17	G	340 ± 9	1626-1644	-457	III T-1	?	328 ± 48	1599-1695
-433	III I18	G	340 ± 9	1626-1644	-458	III T-1	?	301 ± 27	1647-1701
-434	III J16	G	340 ± 9	1626-1644	-459	III T-1	?	295 ± 65	1615-1745
-435	IIIorIVa I16	G	330 ± 26	1619-1671	-460				
-436	II I21	G	330 ± 17	1628-1662	through	NOT DATABLE			
-437	I&II I15	G	330 ± 9	1636-1654	-487				

*HHD = Bishop Museum Sample No. (Hawaii Hydration).
**E = Excellent, G = Good, P = Poor, VP = Very Poor.
†Disturbed provenience; most likely from Layer III.
NOTE: Samples HHD-455, -456, -457, -458, and -459 were analyzed by Marcus Childs, University of Hawaii (H.I.G.); all others were analyzed by Maury Morgenstein, Hawaii Marine Research Corp. (HMR).

the basic geological studies have not yet been done. At present, apparently the only known occurrence of basaltic glass on Oahu is at Mauna Kuwale, between Lualualei and Waianae Valleys, on the W side of the Waianae Mountains (Stearns and Vaksvik 1935:181; Macdonald and Abbott 1970:112,413).

Discussion of Results

The apparent contradictions presented by the C^{14} results in Table 6-12 necessitate further comment. HRC-239 (Layer III) is reasonable when compared to the maximum overall range of the hydration-rind results (A.D. 1423-1745). As well, HRC-241, -282, and -283 (all Layer V) are also possible when compared to the maximum range of the hydration-rind ages. There were no obvious sources of possible contamination which could account for the apparent disparity between HRC-241 and HRC-282, -283; however, sample HRC-241 was derived from small, dispersed pieces of charcoal, while the other three samples came from well-defined, discrete, horizontal features with clear stratigraphic-layer associations. Possibly the HRC-241 sample material was not related to the Layer V occupation evidenced by the various Layer V horizontal features, but rather to some earlier natural or cultural event or activity, such as a forest fire, dryland slash and burn cultivation, or intentional clearing of the area.

When HRC-239 and HRC-241 are compared using the simple test* suggested by Polach and Golson (1968:233-236) for evaluating the probability of two radiocarbon ages representing real or only chance differences, the comparison indicates that the difference between the two is probably not significant, and is best regarded as due to chance alone. This interpretation appears quite acceptable when the results of analyses of HRC-282, -283, and the hydration-rind samples are also considered, and it seems most reasonable to consider all four radiocarbon results as representative of the same age range, regarding the apparent differences as the result of chance. Because of the apparent relatively recent, late prehistoric age of the site and the difficulties of the radiocarbon dating method when dealing with recent age samples, and because of the relatively long C^{14} age ranges that derive from the large statistical uncertainties (standard deviations), it is perhaps best to regard all of the C^{14} results as simply representing a late prehistoric age, and to turn attention to the 107 hydration-rind age determinations, the overall maximum range of which overlaps the C^{14} results (at two standard deviations).

The hydration-rind sample ages from Layer III samples and from all samples are plotted by 20-year intervals as histograms in Figure 6-23. Layer III was the only layer provenience yielding a reasonably sized sample of age-determination results. The Layer III and total sample assemblages both display very similar distribution, both indicating normal distributions of sample ages. Table 6-14 presents the basic statistics for the distributions of the Layer III and the total-sample age results.

The statistics support the similarity of distribution graphically expressed in Figure 6-23. Comparison of the derived A.D. date ranges presented in Table 6-14 and the individual sample age ranges from Table 6-13 indicates that of the Layer III assemblage sample (n = 58) only five individual sample ranges (four younger, one older), and of the total all-layers assemblage sample (n = 107) only eleven (five younger, six older) lie completely outside of the

* Comparison of arithmetic difference of pairs of age determinations to the square root of the sum of the squares of each standard deviation.

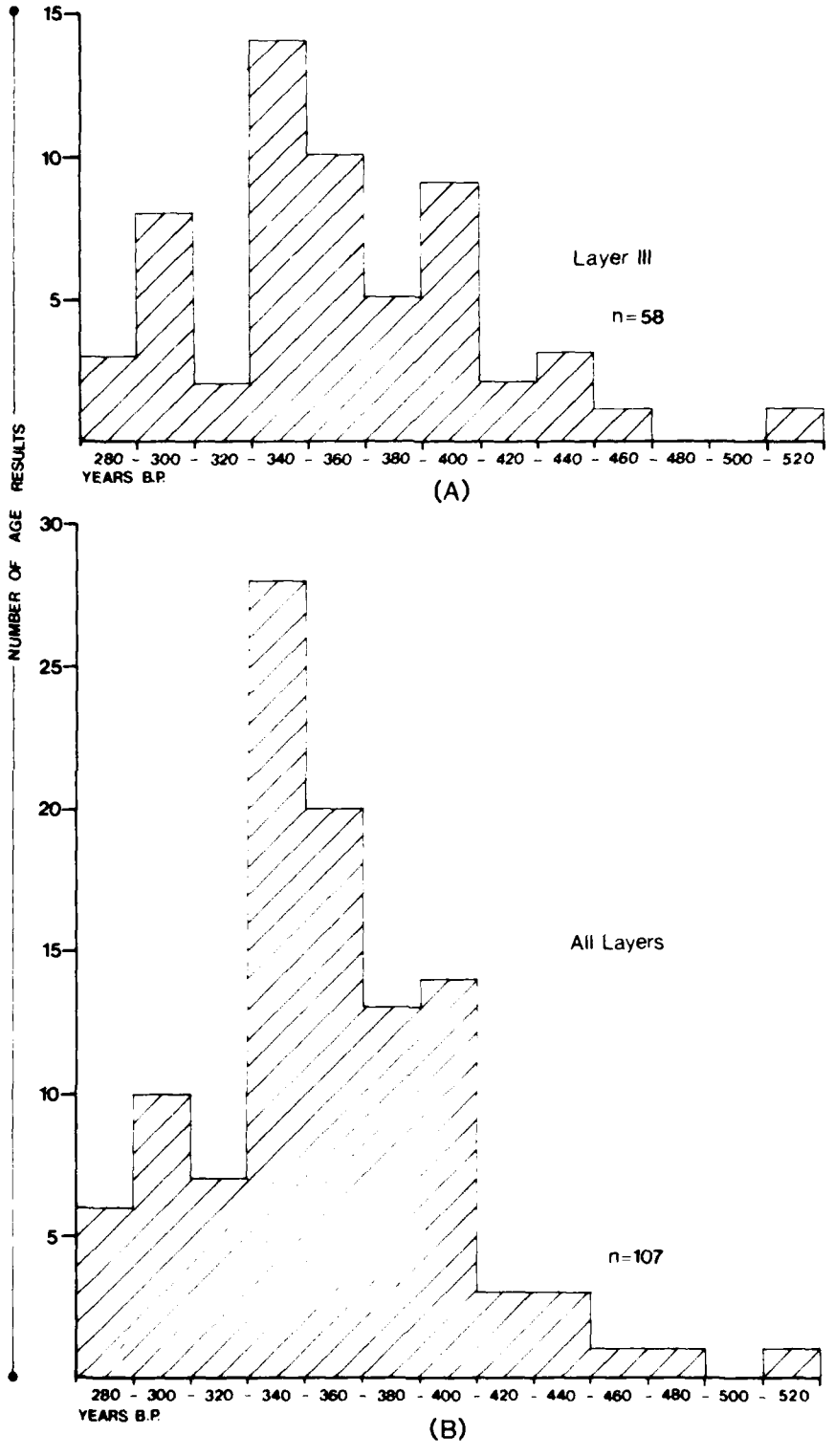


Fig. 6-23. HYDRATION-RIND SAMPLE AGES. Sample age assemblages from (a) Layer III and (b) all layers plotted by 20-year intervals.

Table 6-14.

STATISTICAL ANALYSIS OF HYDRATION-RIND SAMPLE AGES
FROM LAYER III AND ALL LAYERS

Assemblage Provenience	n	Years before 1975	S* (years)	Mean Date A.D.	A.D. Date 1 S*	Ranges 2 S*
Layer III	58	368.22	48.32	1607	1558-1655	1510-1703
All Layers	107	364.47	43.05	1611	1567-1654	1524-1697

*S = Standard Deviation

respective A.D. date ranges at one standard deviation. At two standard deviations, only a single sample age-range (HHD-353, A.D. 1423-1457) falls completely outside of the respective A.D. date ranges presented in Table 6-14. In conclusion, it seems justifiable to regard the hydration-rind age-determination results as composing a relatively homogeneous, normally distributed sample assemblage.

The results of the age determination analyses can now be summarized in terms of the aims outlined earlier. A very conservative estimate for the overall time depth of human occupation evidenced at Site 50-0A-G5-37 would be A.D. 1565-1655, with A.D. 1525-1695 representing a maximum. Thus the period of overall occupation probably ranged from 90 to 170 years. Even though no hydration-rind age determinations are available for samples with secure Layer V provenience, it seems acceptable to include Layer V within this time span because the time period separating Layers V and III, as evidenced by Layer IV, was apparently quite short. This estimate excludes historic activity at the site, which apparently was not related to the prehistoric site occupation. It is impossible to assign individual spans of occupation to the individual cultural layers, due principally to the overlapping ranges for the various dating-sample layer proveniences (Fig. 6-23b), and to the difficulties met in assigning any definite age span to Layer V.

There is no direct basis for estimating more exactly the span or time depth of the non-occupation intervals evidenced by the intervening sterile (non-cultural) deposits (Layers II and IV). The spans and ages of the various dated samples for other layers, and the stratigraphic nature of the deposits themselves, do suggest that the time intervals were quite short, and perhaps insignificant where considered against the overall span of site occupation.

The most reasonable estimate for the initial occupation of Site 50-0A-G5-37 is probably A.D. 1565. There is the possibility of earlier occupation, based on the range of a single C^{14} estimate (HRC-241), but this is considered unlikely when all other age estimates are taken into consideration. As to the nature of occupation, the multiple age estimates and the extensive overlap of sample-estimate ranges suggest that the overall span of occupation would best be considered as successive reoccupations of close temporal relationship.

The age determination analyses were successful in documenting the late prehistoric presence of various culturally important floral species. This is of interest not because their prehistoric presence was previously questioned, but simply that their absolute prehistoric age associations are thereby established.

The results are not particularly significant as a test of the correlation between the C^{14} and hydration-rind dating methods, due both the apparent short span of occupation and recent age, and to the limitations of the C^{14} method--especially the relatively wide statistical ranges of sample ages and the questionable reliability of very recent-period sample ages. However, it can be stated that there are no reasons to suggest that the C^{14} results and the hydration-rind results are not entirely consistent.

In summary then, the age determination analyses indicate a late prehistoric site characterized by recurrent temporary occupation. This evaluation is supported by the stratigraphic evidence, and by the analyses of the various horizontal features and portable remains.

PORTABLE ARTIFACTS

A total of 238 portable artifacts was recovered during the test and salvage excavations at Site 50-OA-G5-37: 237 from the mound deposits and one (a piece of metal) from a peripheral excavation unit (T-14). Of the 238 portable artifacts, 174 (73.1%) are prehistoric types, and 64 (26.9%) are historic items. These artifact totals incorporate items recovered during the 1973 test excavations (20 prehistoric, 18 historic) (see Report 4) and the 1975 salvage excavations (154 prehistoric, 46 historic). Overall artifact density for the mound area excavation was 3.815 artifacts/square meter. The field and laboratory methods and procedures involved in the recovery, recording, and processing of the portable artifacts have already been summarized.

The types, numbers, and layer proveniences of portable artifacts are summarized in Table 6-15, and the detailed distribution of artifacts according to horizontal and vertical provenience is presented in Table 6-16. The reasons for the apparent mixing and uncertainty of layer proveniences utilized in both tables have been mentioned (p. 6-11). Analysis of the age determination results indicates that the overall time span of prehistoric site occupation was at most c. 170 years; this suggests that the apparent problems expressed by the varied layer proveniences are less significant than was supposed at first, and that for all practical purposes the prehistoric and historic assemblages can be considered minimally as two separate assemblages.

Prehistoric Artifacts

Of the total portable artifact assemblage, 174 (73.1%) are prehistoric-type artifacts. Basaltic-glass flakes comprise 149 pieces (85.6%) of the prehistoric assemblage, while the remaining 25 items (13.8%) consist of 15 basalt flakes (8.6%), four adz flakes or fragments (1.7%), four polished stone fragments (2.3%), a crude basalt chopper (0.6%), nd a fragment of a stone pounder (0.6%).

Adz Flakes. Four items were identified as small basalt flakes or fragments from stone adzes, probably struck accidentally during use. All four are of close-grained, homogeneous basalt. Three of the four have two well-ground surfaces (Fig. 6-24a, c, d), and appear to be fragments from the sides of adz blades, while the fourth (Fig. 6-24b) has only a single ground surface.

Chopper. This large, heavy flake of coarse basalt displays edge damage indicating that it probably had been utilized as a crude chopping tool (Fig. 6-24e).

Polished Stone Fragments. Four stone fragments with polished or ground surfaces were recovered. Three are of relatively soft, coarse basalt, not an appropriate material for manufacture of adzes. The fourth piece is a small fragment of unidentified stone, possibly kaolinite or a similar chemical weathering decomposition product, recovered from the interior of HF-4.

Pounder Fragment. A hemispherical piece of coarse basalt with a completely pecked convex surface was identified as a fragment of a stone pounder, possibly the distal end of a large pestle or, more likely, the proximal end of a typical Hawaiian knobbed food pounder (Fig. 6-24f).

Basalt flakes. Fifteen undifferentiated basalt flakes were recovered. None have any obvious edge damage or polish evidencing utilization, though a few of the smaller might have come from the interior of damaged adzes (Fig. 6-24g-j).

Basaltic Glass Assemblage. The mound site excavations yielded 149 flakes and cores of basaltic glass, 19 from the 1973 test excavation and 130 from the 1975 salvage excavations. In general nature and composition the basaltic glass assemblage is similar to those described from upland Lapakahi, Hawaii Island (Rosendahl 1972a:367-373), Wailea, Maui (Cleghorn Ms.), Halawa Valley, Molokai (Barrera and Kirch 1973; Kirch and Kelly [eds.] 1975), and Kalahuipua'a, Hawaii Island (Kirch Ms.).

Of the 149 pieces, 129 (86.6%) are flakes and 20 (13.4%) are cores. Figure 6-25 displays the distribution of 129 flakes and cores by size, plotted as a function of length and width. No comparable measurements were available for the 19 flakes recovered during the 1973 test excavations. Utilized flakes have been indicated with triangles. Most of the small cores appear to be remnants from the production of small flakes by simple bashing or smashing of cores, rather than any pre-flake-striking core preparation. Several cores displayed portions of their original non-glassy basalt cortex.

Table 6-17 presents the mean and standard deviation statistics of length (L), width (W), and thickness (Th) for the basaltic-glass assemblage recovered during the 1975 salvage excavations. For purposes of comparison, the assemblage was sub-divided into utilized flakes, non-utilized flakes, and core samples. These statistical manipulations support two qualitative observations. First, utilized flakes tend to be larger in overall size than non-utilized flakes. Second, the larger size of the utilized flakes tends to be proportionally the same (33 to 36%), in terms of length, width, and thickness.

The 129 flakes were microscopically examined for evidence of edge damage. Ten flakes (7.8%) show some degree of damage, indicating utilization, while the remainder are apparently all waste flakes or debris resulting from flake production. Observed edge damage suggests use of flakes principally for scraping and for cutting or sawing operations. A single piece (I14-3) suggests possible use as a reamer or boring tool. No intentional retouching of flakes was noted.

Overall density of basaltic glass for the mound excavation area is 2.12 pieces/square meter. Consideration of the maximum number of pieces possibly recovered from Layer III (91 pieces) yields a maximum density of 2.35/square meter for Layer III. Viewed in either fashion, the greatest density of horizontal distribution of basaltic glass was in the W portion of the mound.

Table 6-15.

SUMMARY OF PORTABLE ARTIFACTS*

PROVENIENCE	Type and Number of Artifacts																					
	PREHISTORIC									HISTORIC												
						Basaltic Glass																
	Adz flake	Chopper	Polished basalt fragment	Pounder fragment	Basalt flake (non-utilized)	Utilized flake	Non-utilized flake	Core	TOTAL - Prehistoric	Button	Comb	Glass bottle (complete)	Glass fragments	Air bellows casing	Iron pipe section	Nail (complete & fragments)	Coin (penny)	Metal fragments	Metal & wood fragments	TOTAL - Historic	TOTAL ARTIFACTS
Surface	1		1						2					1	1					2	4
Layer I	1	1	1		4	2	23	2	34	1	1	2	13			12	1	26	4	60	94
I&II							14	3	17												17
I&II∿III						3	2	1	6												6
II							2		2				1								3
II∿III							1		1												1
III	2		2	1	6	2	65	10	88												88
III∿IVa						1	6		7												7
IVa						2	5	1	8												8
IV(b?)								2	2												2
IV/V interface					3				3												3
V					2		1**	1**	4												4
T-14 Layer II																		1		1	1
TOTALS	4	1	4	1	15	10	119	20	174	1	1	2	14	1	1	12	1	27	4	64	238

*See Table 6-16 for detailed provenience data.

**Disturbed provenience; most likely from Layer III

Table 6-16.

DETAILED DISTRIBUTION OF PORTABLE ARTIFACTS

Provenience		Type and Number of Artifacts																								
		PREHISTORIC									HISTORIC															
							Basaltic Glass																			
Layer	Grid/HF/T (trench)	Adz flake	Chopper	Polished stone fragment	Pounder fragment	Basalt flake (non-utilized)	Utilized flake	Non-utilized flake	Core		Button	Comb	Glass bottle (complete)	Glass fragments	Air bellows casing	Iron pipe section	Nail (complete & fragments)	Coin (penny)	Metal fragments	Metal & wood fragments						TOTAL ARTIFACTS PER UNIT
Surface	General			1											1	1										3
	H14	1																								1
I	F16																	1								1
	H24													1												1
	I19																1									1
	I24							1						1					1							3
	I26													1												1
	J24													1												1
	J25																		1							1
	K15						1										1									2
	K16							1																		1
	K17							4									2									6
	K25																		1							1
	T-1							3						3			1		14							21
	HF- 1	1				3	1	7						6			5		4							27
	HF- 2				1	1		7	2		1	1	1				2		5	4						25
	HF-40		1										1													2
I&II	I14							1																		1
	I15							2																		2
	J14							3	1																	4
	J15							1	1																	2
	J16							7	1																	8
I&II~III	K18							1																		1
III	H18					1	1																			2
	H22					1																				1
	I15							10	1																	11
	I16							7	2																	9
	I17							4	1																	5
	I18					1		2																		3
	I19							1	1																	2
	I21							2																		2
	I25				1																					1
	J15							4	1																	5

Table 6-16. (continued)

DETAILED DISTRIBUTION OF PORTABLE ARTIFACTS

Provenience		Type and Number of Artifacts																				
		PREHISTORIC								HISTORIC												
							Basaltic Glass															
Layer	Grid/HF/T (trench)	Adz flake	Chopper	Polished stone fragment	Pounder fragment	Basalt flake (non-utilized)	Utilized flake	Non-utilized flake	Core	Button	Comb	Glass bottle (complete)	Glass fragments	Air bellows casing	Iron pipe section	Nail (complete & fragments	Coin (penny)	Metal fragments	Metal & wood fragments	TOTAL ARTIFACTS PER UNIT
III	J16							3	1											4
	J18			1																1
	J23					1														1
	K16							1												1
	K17							4												4
	K18	1				1														2
	K19							3												3
	K23							2												2
	T-1							13												13
	HF- 4			1		1														2
	HF-11						1	2	1											4
	HF-14							1												1
	HF-15							1												1
	HF-19	1						3												4
	HF-20							2	1											3
	HF-33								1											1
III∿ IVa	I14							1												1
	I16							3												3
	J16						1													1
	K16							2												2
IVa	H17							1												1
	I16						2	4	1											7
IV (b?)	I17								2											2
IV/V interface	I18					3														3
V	H17					1														1
	H19							1	1											2
	T-1					1														1
II	T-14																	1		1
TOTAL ARTIFACTS PER CATEGORY		4	1	4	1	15	10	119	20	1	1	2	14	1	1	12	1	27	4	238

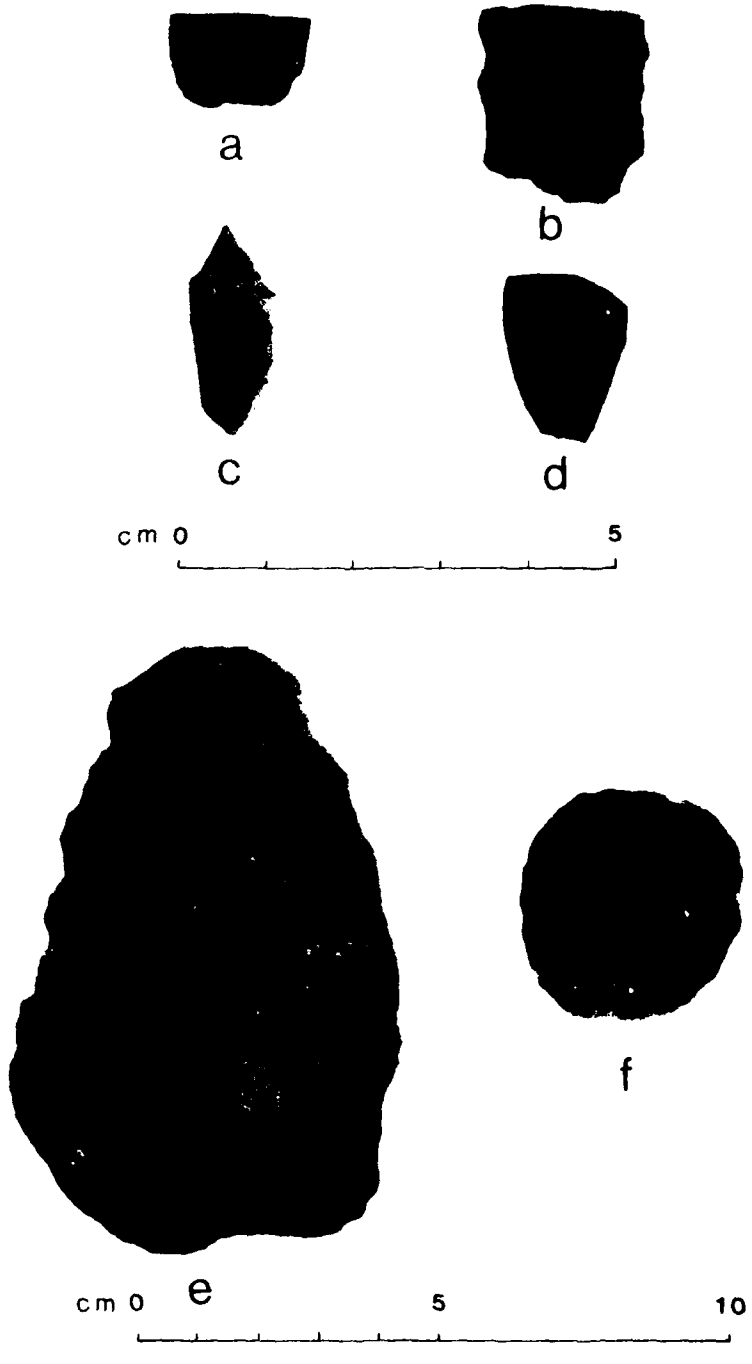


Fig. 6-24. PORTABLE ARTIFACTS. The artifact types and specimen numbers (50-0A-G5-37-) are as follows: (a) adz flake, J16-8; (b) adz flake, H14-1; (c) adz flake, K18-3; (d) adz flake, J17-2; (e) chopper, I21-4; (f) pounder fragment, I25-3.

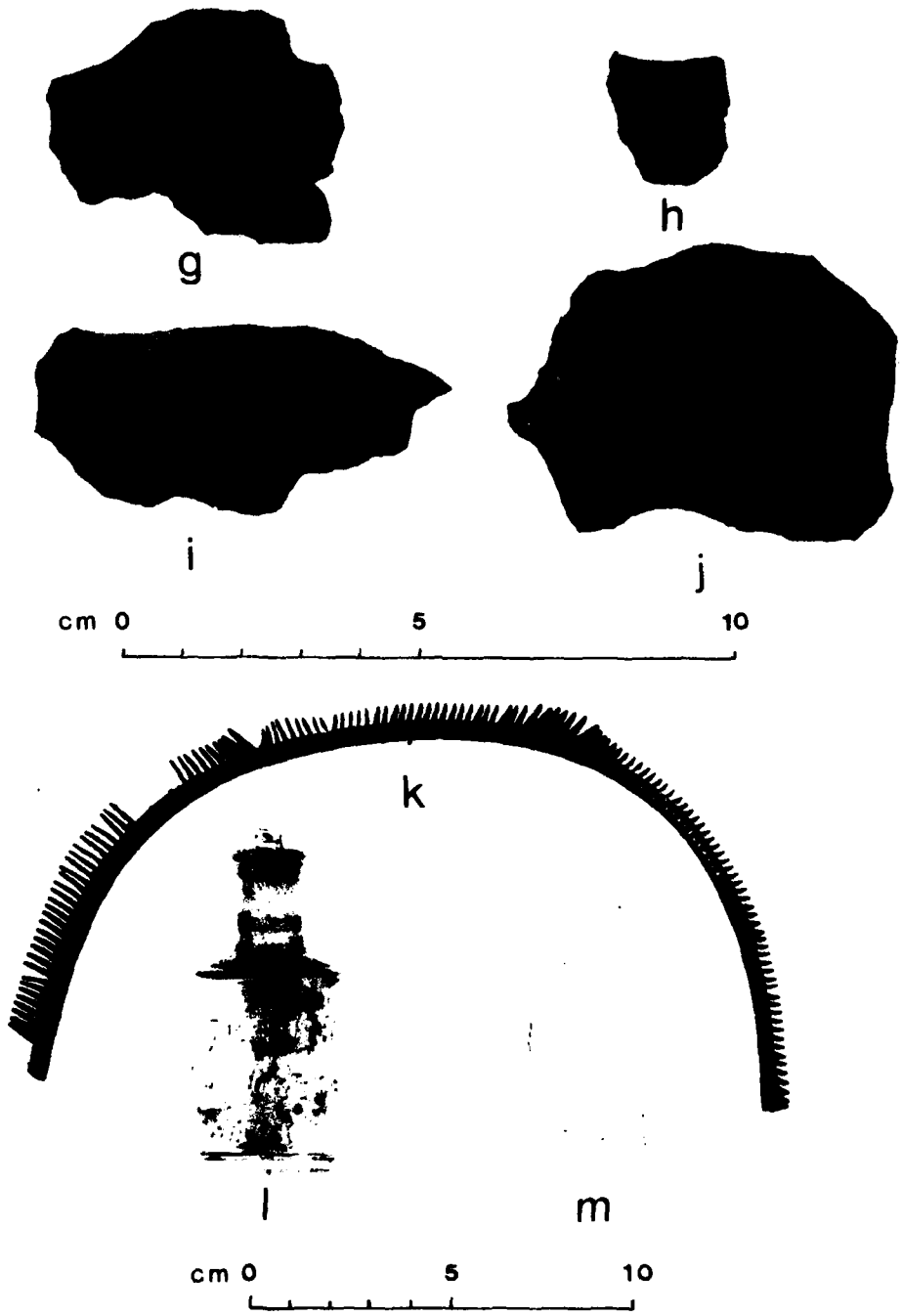


Fig. 6-24 (cont'd). (g) basalt flake, H17-1; (h) basalt flake, J23-1; (i) basalt flake, H18-7; (j) basalt flake, J18-1; (k) comb, K18-8, (l) bottle, K18-19; (m) bottle, I21-5.

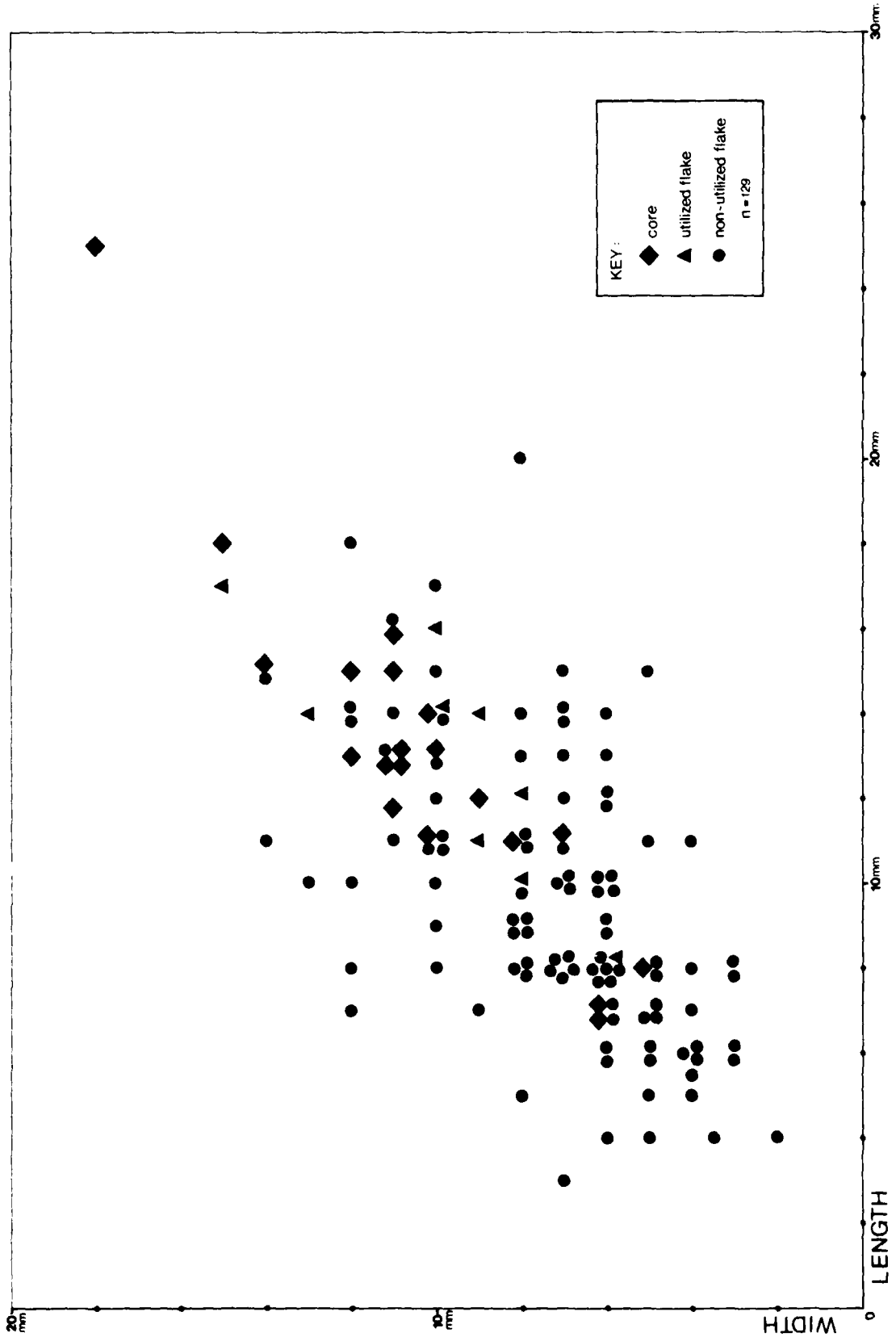


Fig. 6-25. BASALTIC-GLASS ASSEMBLAGE. Flakes and cores plotted as a function of length and width.

Table 6-17.

STATISTICAL ANALYSIS OF BASALTIC-GLASS ASSEMBLAGE*

Sample	Number (n)	MEAN			Standard Deviation (S)		
		L	W	Th	L	W	Th
Utilized flakes**	9	12.9 mm	9.8 mm	4.0 mm	2.9 mm	2.7 mm	2.1 mm
Non-utilized flakes	100	9.5	7.3	3.0	3.5	2.6	1.5
Cores	20	13.3	10.6	8.1	3.6	3.3	2.8
Total Assemblage	129	10.3 mm	8.0 mm	3.8 mm	3.8 mm	3.0 mm	2.1 mm

*Assemblage composed of pieces recovered from 1975 salvage excavations. Comparable metric data are not available for 19 pieces recovered during 1973 test excavations.

**One piece (Artifact No. K18-4) was omitted. On the basis of natural weathered appearance and size (L = 48 mm, W = 29 mm, Th = 10 mm), the piece was regarded as a large natural flake or nodule, modified through use or utilized as a scraping implement. When compared to mean values for utilized flakes, K18-4 is 3.7 times larger, 3.0 times wider, and 2.5 times thicker.

Historic Artifacts

Of the total portable artifact assemblage, 64 (26.9%) are historic items or pieces of historically introduced material. Glass, both complete bottles and fragments, comprises 16 pieces (25.0%) of the historic assemblage, while metal of all kinds comprises 46 pieces (71.9%); the remaining two items (3.1%) are a button and a comb. With the single exception of a glass fragment from a disturbed area of Layer II, all historical material was recovered from the present ground surface, Layer I, or Layer I associated features.

Button. One small, flat, plain, black glass button was removed from the fill of the burial pit (HF-2).

Comb. Associated with the skeletal remains at the bottom of HF-2 was a black celluloid comb. It is curved, probably to be worn as a woman's head-band (Fig. 6-24k).

Bottles. Two complete glass bottles were recovered. Found in association with the skeletal remains at the bottom of the burial pit (HF-2) was a small, clear glass, stoppered perfume bottle with the following words embossed on it: "Lubin," "Parfumeur," and "Paris" (Fig. 6-24l). The other bottle, removed from a pit

(HF-40), appears to be a small medicine bottle bearing several embossed inscriptions: on one side, "Made in Japan," and on one face, in both English and Japanese, "Ishii Drugstore" (Fig. 6-24m).

Glass Fragments. A number of glass fragments, apparently from broken bottles, were recovered. It is interesting to note that several of the fragments appear to have edge damage similar to that on basaltic glass flakes, and may well have been utilized in similar fashion.

Air-Bellows Casing and Iron Pipe Section. On the mound surface, adjacent to the low stone platform (HF-1), two cast-iron items were found. These probably were parts of a portable air bellows used by early-20th century itinerant blacksmiths.

Nails. Rusted iron nails, complete and fragmented, were removed. All appeared to be square nails.

Coin. One 1964-D Lincoln copper penny was recovered from Layer I.

Metal Fragments and Metal and Wood Fragments. Numerous fragments of rusted metal--otherwise indistinguishable as artifacts--were removed from Layer I and from the fill of HF-1 and HF-2. A single artifact lot (incorporating more than 70 pieces) of metal and adhering wood fragments from near the bottom of the burial pit (HF-2) suggests the remains of some type of coffin or burial container.

Discussion

Little can be said regarding the historic artifact assemblage. With the exception of a single piece of glass (possibly from a disturbed provenience), all the historical material was recovered from either the surface or from Layer I (deposit or associated features). The assemblage contains nothing of particular significance. Both the nature and variety of materials encountered can be considered typical of assemblages from historic sites in Hawaii.

Similarly, the prehistoric assemblage contains nothing in either nature or variety that can be considered unusual in terms of known prehistoric Hawaiian artifact types and assemblages. Taking layer proveniences into account, it is possible to look at the site distribution of prehistoric artifacts by considering distribution in terms of minimum and maximum numbers assignable to each layer (Table 6-18). By far the greatest proportion of the prehistoric material was from Layer III--between 50 and 60%.

The composition of the prehistoric assemblage is extremely limited in the range of categories represented. All items are of stone, principally basalt and basaltic glass. Virtually all items could be classified in the general categories of tools or domestic implements. Within these general categories the range of types is quite restricted, with flaked stone (basalt and basaltic glass) comprising 94.2% of the assemblage, and basaltic glass alone comprising 85.6%. Barrera and Kirch (1973), in their discussion of basaltic-glass artifacts from Halawa Valley, have suggested a variety of probable prehistoric uses for basaltic-glass flakes:

> Basaltic glass holds a fine, sharp edge and the tools make excellent cutting and scraping implements. They may have been used in food

Table 6-18.

DISTRIBUTION OF PREHISTORIC
PORTABLE ARTIFACTS ACCORDING TO MINIMUM AND MAXIMUM NUMBERS PER LAYER*

Layer Provenience	Minimum No. of Artifacts	Percent of Total Prehistoric	Maximum No. of Artifacts	Percent of Total Prehistoric
Surface	2	1.2%	2	1.2%
I	34	19.5	57	32.8
II	2	1.2	26	14.9
III	88	50.6	102	58.6
IV	10	5.8	20	11.5
V	4	2.3	7	4.0
VI	-	-	-	-

*Total prehistoric artifacts = 174 items.

> preparation, for cutting and scraping plant materials, for delicate woodworking. ...these tools are extremely common, being found in virtually every type of [Hawaiian] site. The suggestion, then, is that the ubiquitous basaltic-glass flakes functioned as a prehistoric 'pocketknife,' to use a modern analogy [1973:185-186].

These comments are quite appropriate for the basaltic glass assemblage from Site 50-OA-G5-37.

The complete absence of other artifact categories and types (such as worked bone and shell, scoria, coral and echinoid spine abraders, fishhooks and fishhook manufacturing debris, bone awls, and octopus lures) contradicts sharply a recent interpretation (Cordy 1975:63) that, on the basis of R-mode multivariate statistical analyses, basaltic glass flakes are functionally associated with the working of bone materials, particularly the initial stages of bone fishhook manufacture. The activities suggested by the prehistoric artifact assemblage from the mound site most reasonably seem to be general activities such as those suggested earlier in relation to the uses of basaltic glass--food processing and preparation, processing and preparation of plant materials, and fine woodworking.

NON-ARTIFACTUAL REMAINS

The range and general distribution of non-artifactual remains recovered during salvage excavations at Site 50-OA-G5-37 are summarized on the basis of presence or absence in Table 6-19. Included are types of floral and faunal remains, and provenience according to layer and horizontal feature. Field methods utilized for recovery of these remains have already been summarized. Charcoal pieces were the only materials found in other than very limited quantity. In addition to material included in radiocarbon samples, only those pieces with potential for floral remains identification were retained. All bone and shell material was retained.

Table 6-19.

SUMMARY OF NON-ARTIFACTUAL REMAINS

CATEGORY	PROVENIENCE																			
	Layer Deposits							Horizontal Feature* and Layer												
								1	2	4	6	8	14	20	32	40	41
	I	II	III	IVa	IVb	V	VI	I	I	III	III	III	III	III	III	I	V
Floral Remains																	
Lichen			+**							+							
Fern			+**								+						
Pandanus			+			+**				+	+		+				
Grass			+**							+					+		+
Bamboo			+**			+α**				+α			+		+		
Saccharum			+**			+α**				+							+α
Heteropogon			+**							+							+
Sedge			+**							+							
Cyperus			+α**							+α							
Cocos			+							+		+	+				
Aleurites	+	+†	+						+	+			+				+
Euphorbia			+α**								+α		+				
Hibiscus			+							+	+				+		
Thespesia			+							+							
Calophyllum			+α**								+		+α				
Psidium	+**															+	
Metrosideros			+**								+						
Lagenaria			+**								+						
Tuber fragment			+**								+				+		
Fruit fragment			+**										+				
Endocarp(?) frag.			+**										+				
Charcoal	+	+††	+	+	+	+††		+	+	+	+	+	+		+	+	+
Faunal Remains																	
Mammal bone	+**							+									
Large mammal bone		+†	+†														
Human bone	+**								+								
Sus bone			+**											+			
Achatina shell		+†															

*HF-3,5,7,9-13,15-19,21-31,33-39,42-49 all had only charcoal, as fill component.

**Present (identified) for specific layer-associated features.

†Disturbed provenience; most likely from Layer I.

††Present as a few small dispersed fragments.

αPresent as alternative possibility only. See Table 6-20 for details.

Floral Remains

Plant material constituted by far the principal component of the non-artifactual remains recovered. Almost all of the macrofossil material is in carbonized form, and was recovered from both horizontal features and layer deposits. The floral remains were examined and identified by Dr. D.E. Yen, Bishop Museum Ethnobotanist. His identifications and notes are presented in Table 6-20. A selection of the recovered floral remains are shown in Figures 6-26, 6-27, and 6-28.

Many of the identified floral remains are from species of prehistoric economic importance--for subsistence, ceremonial, medicinal, and industrial use--such as *hala* (screwpine, *Pandanus* sp.), *'ohe* (bamboo, genus unknown), *ko* (sugar, *Saccharum officinarum* L.), *pili* (tanglehead grass, *Heteropogon contortus* [L.] Beauv.), *makaloa* (sedge, *Cyperus laevigatus* L.), *niu* (coconut, *Cocos nucifera* L.), *kukui* (candlenut, *Aleurites moluccana* [L.] Willd.), *'akoko* (*Euphorbia* spp.), *hau* (hibiscus, *Hibiscus tiliaceus* L.), *milo* (*Thespesia populnea* [L.] Sol.), *kamani* (*Calophyllum inophyllum* L.), *'ohi'a* (*Metrosideros* sp.), and *ipu* (bottle gourd, *Lagenaria siceraria* [Molina] Standley). Also identified were other items such as lichen, fern, grass, sedge, and fragments of tuber, fruit, and endocarp from several otherwise unidentified remains, as well as historically introduced guava (*Psidium* sp.).

In addition to the macrofossil remains, a considerable amount of microfossil material was found to be present in the site deposits. Results of the preliminary pollen analysis, conducted as one aspect of the soil sample analyses, revealed the presence of well-preserved pollen grains in every layer of the mound, and in deposits from several of the peripheral excavation units. This material has not yet been identified--such detailed analytical work is far beyond the scope of the preliminary analysis, which was simply to determine presence or absence of microfossil remains.

Faunal Remains

Excluding the human bone from the historic burial pit (HF-2), recovered bone totals only 407.14 grams. Of this, 179.0 grams represents the concentration of pig (*Sus scrofa* L.) bone from HF-20, and 199.95 grams represents two pieces of large mammal bone, probably cow, recovered from a disturbed area in the E end of the mound. A single piece of shell (0.25 grams) removed from the same disturbed area, was identified as African snail (*Achatina fulica* Bowdich), a historically introduced, large pulmonate gastropod.

Discussion

Non-artifactual remains were quite restricted both in the range and quantity of materials present. Faunal remains were almost completely absent from the prehistoric cultural deposits. A small amount of pig bone was recovered, but no dog or bird bone. Remains of shellfish were completely absent. Floral remains were relatively abundant, but limited in variety. The floral remains are significant in that all of the identified remains are of species appropriate to a local environment similar to that presently existing in the project area (disregarding specific historically introduced plant species and recent land modifications). Thus in terms of such factors as temperature, wind, rainfall, soils,

Table 6-20.

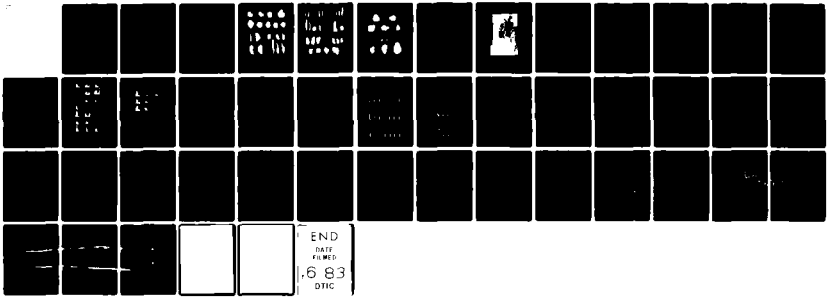
IDENTIFICATION OF FLORAL REMAINS

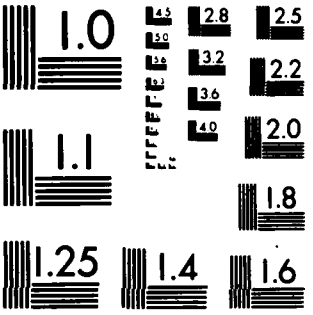
Sample No.	Provenience Layer and Feature or Square	Plant Part	Identification	Confidence	Notes
FR-28a	I-HF-40	Fruit fragments, including pericarp & seeds	*[illegible]*	Good	(Fig. 6-28-g)
-30a	I-HF-40	Fruit fragments, including [illegible]ricarp & seeds	*[illegible]*	Good	
-27a	III-122(top)	Fruit (key)	*Pandanus*	Good	(Fig. 6-26c)
-27b	III-122(top)	Misc. fragments	*Pandanus*	No Comment	Possibly several fragments
-29	III-J-K14	Wood fragments	Unknown	No Comment	
-43	III-J24	Wood fragments	Unknown	No Comment	
-31	III-K17	Wood fragments	Unknown	No Comment	
- 1a	III-HF-4	Trunkwood fragment	Unknown	No Comment	Section of cut or split wood--possible artifact(?)
- 2a	III-HF-4	Trunkwood fragment	*Cocos*	Fair	
- 2b	III-HF-4	Wood fragment	Unknown	No Comment	Tapered--possible tip or point of artifact
- 2[illegible]	III-HF-4	Stem (stalk) fragment	Bamboo* or *Saccharum*	Fair	
- 3a	III-[illegible]F-4	Female inflorescence	*Cocos*	Fair	(Fig. 6-26c)
- 3b	III-HF-4	Trunkwood fragment	*Hibiscus*	Fair	
- 4a	III-HF-4	Stem (stalk) fragment	*Saccharum*	Poor	
- 5a	III-HF-4	Trunkwood fragments	Unknown	No Comment	Absence of external features suggests fragments from reasonably large trees
- 6a	III-HF-4	Trunkwood fragments	*Hibiscus*	Fair	
- 6b	III-HF-4	Endocarp fragment	*Aleurites*	Poor	(Fig. 6-28d)
- 7a	III-HF-4	Stem (stalk) section	Cyperaceae*	Fair	Relatively large diameter (Fig. 6-27a)
- 7b	III-HF-4	Stem (stalk) sect[illegible]	Gramineae*	Fair	Large diameter, hollow stem (Fig. 6-27b)
- 8a	III-HF-4	Trunkwood and bark fragments	*[illegible]*	Fair-Good	Relatively large fragments (Fig. 6-27g)
- 9a	III-HF-4	Trunkwood and bark fragments	*[illegible]*	Good	Relatively large fragments (Fig. 6-27h)
- 9b	III-HF-4	Trunkwood fragments	*Hibiscus*	Poor	
-10a	III-HF-4	Stem (stalk) fragments	*Saccharum*	Good	Stem fragment includes portion of nodes (Fig. 6-27d)
-10b	III-HF-4	Endocarp fragment (immature)	*[illegible]*	Poor	
[illegible]	III-HF-4	Outer trunk fragment	*[illegible]*	Very Poor	Perhaps should be more fibrous
[illegible]	III-HF-4	Stem (stalk) fragment	*[illegible]*	Poor	Grass, possibly [illegible] because of apparent pedicels

* [illegible] unknown.

AD-A128 210 ARCHAEOLOGICAL INVESTIGATIONS IN UPLAND KANEOHE: SURVEY AND SALVAGE EXCAV..(U) BERNICE P BISHOP MUSEUM HONOLULU HI DEPT OF ANTHROPOLOGY P H ROSENDAHL ET AL. JUN 76 3/3

UNCLASSIFIED 76-1 DACW84-75-C-0020 F/G 8/7 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 6-20 (cont'd)

Sample No.	Provenience: Layer and Feature or Square	Plant Part	Identification	Confidence	Notes
-11	III-HF-4	Complete fragments	Lichene*	Doubtful	Possibly freshwater lichen (Fig. 6-28f)
-12a	III-HF-4	Leaf fragments	*Pandanus*	Poor	Alternative possibility: sedge, possibly *Cyperus (makaloa)*
-12b	III-HF-4	Stem (stalk) fragments	Gramineae*	Good	
-13	III-HF-6	Trunkwood fragment	Unknown	No Comment	Large wood fragment
14a	III-HF-6	Pericarp fragment	*Lagenaria*	Fair	Possible artifact fragment; modified (cut) edge of vessel (Fig. 6-28c)
-14b	III-HF-6	Branch fragment	*Pandanus*	Fair	Small fragment
-14c	III-HF-6	Trunkwood fragments	*Metrosideros*	Poor-Fair	Possible *'ohi'a lehua; M. collina* (Forst.) Gray, subsp. *polymorpha* (Gaud.) Rock (Fig. 6-27f)
-15	III-HF-6	Misc. wood fragments	Unknown	No Comment	
-16a	III-HF-6	Misc. wood fragments	Unknown	No Comment	Possible artifact; possible intentional cut on one side of largest piece
-17a	III-HF-6	Fruit (key) fragments and pieces	*Pandanus*	Fair-Good	
-17b	III-HF-6	Pericarp fragment	*Calophyllum*	Doubtful	Alternative possibility: *Euphorbia ('akoko)* [compare to No. 21b] (Fig. 6-28a)
-17c	III-HF-6	Unidentified fragment	Unknown	No Comment	Potenitally distinctive appearance
-18a	III-HF-6	Fruit (key), crown portion	*Pandanus*	Poor	
-18b	III-HF-6	Wood fragment	*Hibiscus*	Doubtful	
-44a	III-HF-6	Leaf petiole fragments	Filicineae*	Good	Possibly from use of ferns in covering earth oven (Fig. 6-27c)
-44b	III-HF-6	Pericarp fragments	*Lagenaria*	Fair-Good	
-44c	III-HF-6	Tuber fragments	Unknown	Very Poor	Possible tuber; not wood
-44d	III-HF-6	Stem fragments	Bamboo*	Good	
-44e	III-HF-6	Pericarp fragments	*Lagenaria*	Good	
-38	III-HF-6	Misc. fragments	Unknown	No Comment	
FR-32a	III-HF-8	Mesocarp (husk) pieces	*Cocos*	Good	(Fig. 6-26h)
-37a	III-HF-8	Mesocarp (husk) pieces	*Cocos*	Good	(Fig. 6-26i)
-19a	III-HF-14	Fruit fragments, including seed locules and portions of bases and crowns	*Pandanus*	Good	Appearance suggests possibly charred or cooked, then cracked to remove seeds for consumption (Fig. 6-26d)

*Genus unknown

Table 6-20 (cont'd)

Sample No.	Provenience Layer and Feature or Square	Plant Part	Identification	Confidence	Notes
-19b	III-HF-14	Endocarp fragment	*Aleurites*	Good	
-19c	III-HF-14	Wood fragment	*Cocos*	Poor	(Fig. 6-26g)
-20a	III-HF-14	Trunkwood fragments	*Cocos*	Good	
-20b	III-HF-14	Endocarp fragments	*Aleurites*	Fair	Not carbonized, but weathered (Fig. 6-28c)
-21a	III-HF-14	Trunkwood fragment	*Cocos*	Fair	(Fig. 6-26f)
-21b	III-HF-14	Pericarp fragment	*Euphorbia*	Doubtful	Alternative possibility: *Calophyllum (kamani)* [compare to No. 17b] (Fig. 6-28b)
-21c	III-HF14	Fruit (key) fragment	*Pandanus*	Doubtful	Curious central seed locule (Fig (Fig. 6-26a)
-21d	III-HF-14	Fruit fragment	Unknown	No Comment	Distinctive seed locule
-21e	III-HF-14	Endocarp(?) fragment	Unknown	No Comment	Potentially distinctive appearance
-22a	III-HF-14	Mesocarp (husk) fibers	*Cocos*	Good	
-23a	III-HF-14	Fruit (key) base fragments	*Pandanus*	Good	(Fig. 6-26b)
-41a	III-HF-14	Mesocarp (husk) fragments	*Cocos*	Good	
-41b	III-HF-14	Fruit fragment	Unknown	No Comment	Potentially distinctive seed locule
-41c	III-HF-14	Fruit (key) fragment	*Pandanus*	Good	
-41d	III-HF-14	Stem fragment	Unknown	No Comment	Potentially distinctive hollow stem
-41e	III-HF-14	Stem fragment	Bamboo*	Poor	
-42a	III-HF-14	Endocarp fragment	*Aleurites*	Good	Not carbonized
-33a	III-HF-16	Mesocarp (husk)	*Cocos*	Good	
-34	III-HF-16	Wood fragments	Unknown	No Comment	
-35	III-HF-17	Misc. fragments	Unknown	No Comment	
-36	III-HF-17	Misc. fragments	Unknown	No Comment	
-39a	III-HF-32	Wood fragments	Unknown	No Comment	Some fragments very dense
-40a	III-HF-32	Stem fragments	Gramineae*	Good	
-40b	III-HF-32	Stem fragments	Bamboo*	Fair	
-40c	III-HF-32	Tuber fragments	Unknown	Poor	Possible tubers, not wood (Fig. 6-27i)
-40d	III-HF-32	Wood fragment	Unknown	No Comment	Possible artifact; possible section of intentionally(?) cut wooden shaft
-40e	III-HF-32	Wood fragments	*Hibiscus*	Fair	
-40f(1)	III-HF-32	Stem fragment	Bamboo*	Good	Fig. 6-27e)
-40f(2)	III-HF-32	Stem fragment	Bamboo*	Good	Possible artifact; possible fragment with end rounded and sloped cross section (Fig. 6-27e)
-40g	III-HF-32	Wood fragment	Unknown	No Comment	Possible artifact; possible intentional groove
-24a	V-HF-41	Stem (stalk) fragments	*Saccharum*	Very Poor	Fibrous skin; alternative possibility: bamboo*
-25a	V-HF-41	Leaf fragment	*Pandanus*	Poor	
-25b	V-HF-41	Endocarp fragment	*Aleurites*	Fair-Good	
-26a	V-HF-41	Endocarp fragment	*Aleurites*	Fair-Good	
-26b	V-HF-41	Bark fragment	*Pandanus*	Fair	

*Genus unknown.

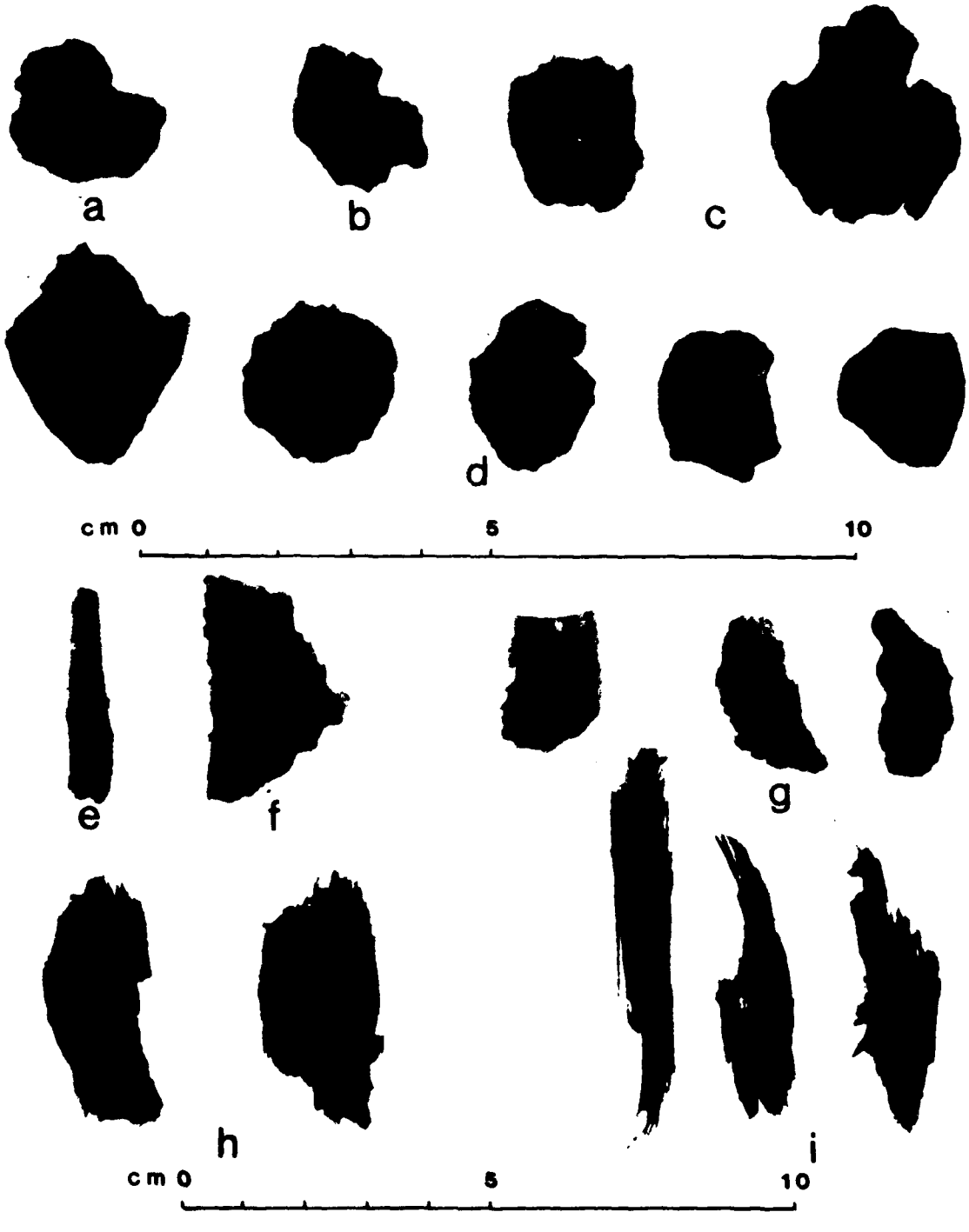


Fig. 6-26. FLORAL REMAINS. Identification and sample number (FR-) given: (a-d) *Pandanus* (a-21c, b-23a, c-27a, d-19a); (e-i) *Cocos* (e-3a, f-21a, g-19c, h-32a, i-37a). (BPBM Neg. No. OA(a)128-14a, 17a.)

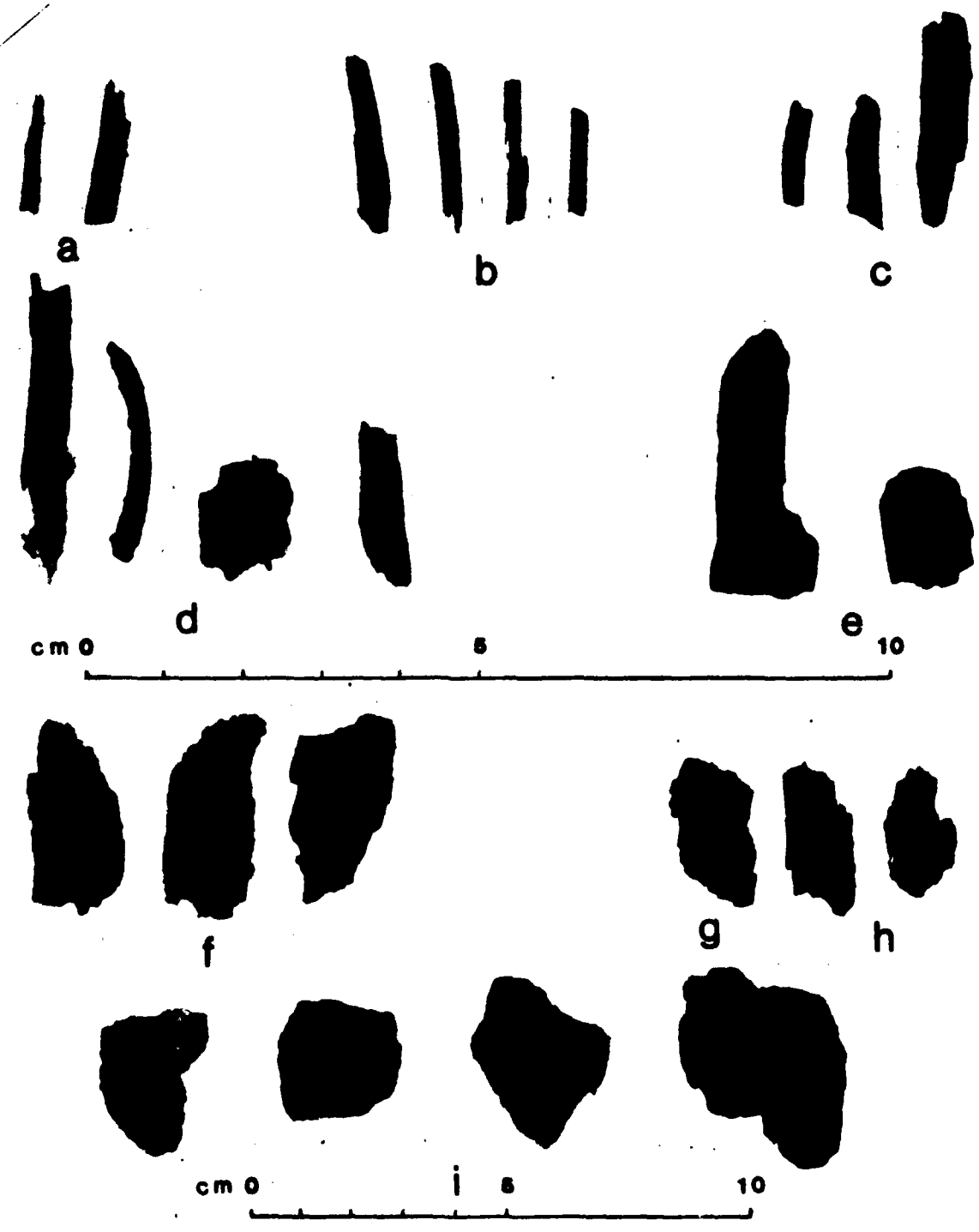


Fig. 6-27. FLORAL REMAINS. Identification and sample number (FR-) given: (a) Cyperaceae (7a); (b) Gramineae (7b); (c) Filicineae (44a); (d) *Saccharum* (10a); (e) Bamboo ($40f_1$, $40f_2$); (f) *Metrosideros* (14c); (g) *Thespesia* (8a); (h) *Thespesia* (9a); (i) unidentified tuber fragments (40c).

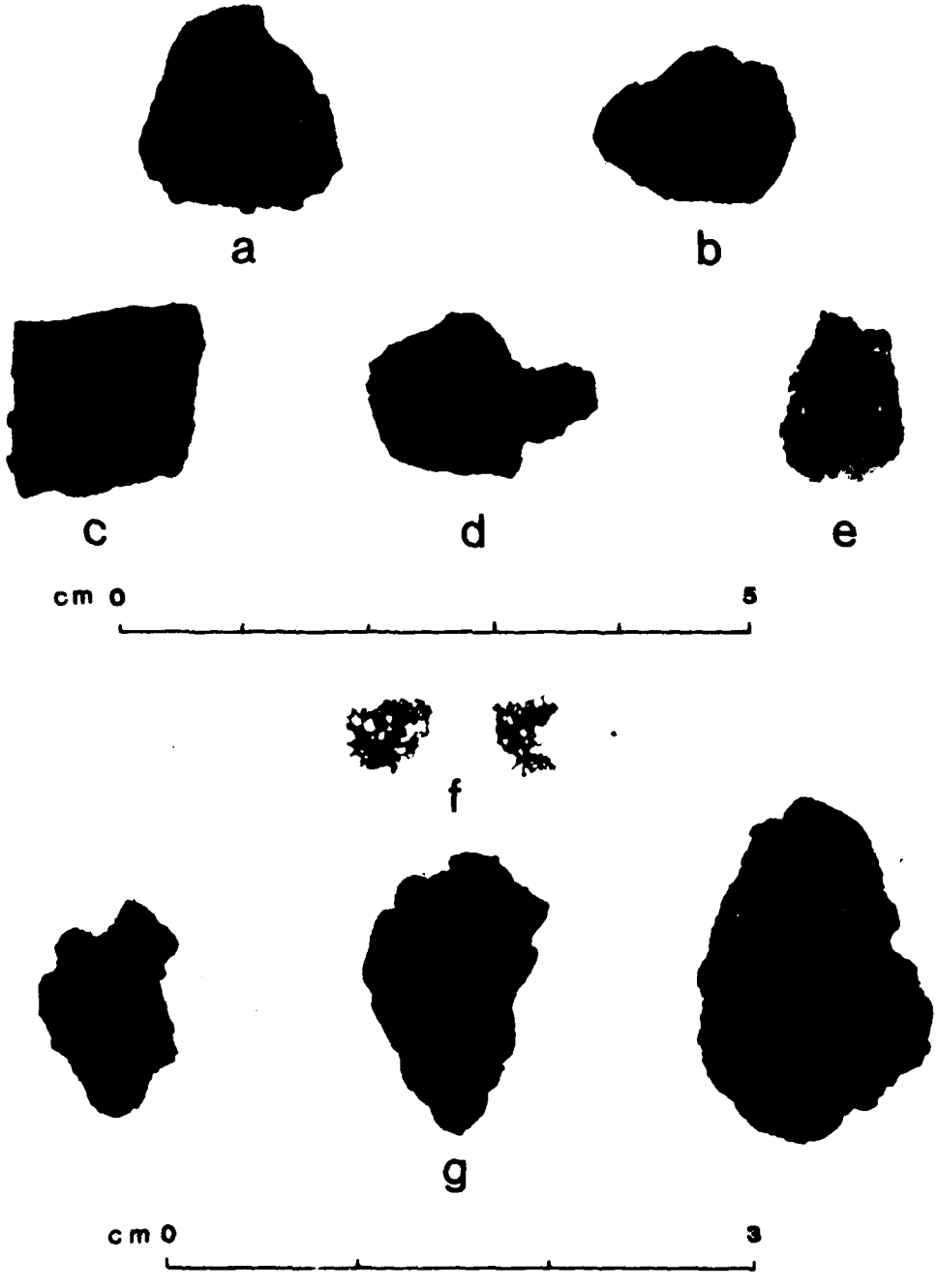


Fig. 6-28. FLORAL REMAINS. Identification and sample number (FR-) given: (a) *Callophyllum* (?) (17b); (b) *Euphorbia* (?) (21a); (c) *Lagenaria* (14a); (d) *Aleurites* (6b); (e) *Aleurites* (20b); (f) Lichene (?) (11); (g) *Psidium* (28a).

and topography, the local environment of the project area was probably much the same during the time of prehistoric occupation and exploitation as it is today.

Excluding a few disturbed areas, the remains of historically introduced floral and faunal species were present in Layer I only. Most of the identified prehistoric remains were from Layer III (deposit and features). In both variety and total amount, Layer III yielded the most material. Several of the Layer III earth ovens (HF-4, -6, -14) were particularly rich in floral remains. Consideration of the variety of identified non-artifactual remains recovered from Site 50-OA-G5-37 suggests a range of prehistoric terrestrial exploitation activities within the local area, including dryland agriculture of several cultigens, and the gathering (and possibly processing) of various natural products from the forest and the margins of the numerous freshwater streams which dissected the local area.

HUMAN BURIAL

Human skeletal remains were found in a shallow depression at the bottom of the burial-pit feature (HF-2), beneath more than 1.5 meters of pit fill (Figs. 6-10, -22). A small, upright basalt boulder was encountered in the center of the pit, about halfway down through the fill. The skeletal remains, though apparently undisturbed, were in very poor condition, quite fragile, and fragmentary. The skeleton was incomplete, but it was uncertain if this was the result of extensive deterioration and disappearance of much of the material, or the remains of an originally incomplete skeleton. A second small basalt boulder, c. 30 cm long, lay in position across where the bones of the upper torso would have been located. The remains consisted of the cranium, mandible with teeth, several phalanges, and most of the lower limb bones (Fig. 6-29).

The skeleton was oriented approximately N-S, with the cranium at the S end of the burial pit, and appeared to present an extended, supine position, with cranium facing up. The feet were apparently crossed. Associated with the skeleton were several historic items, including a celluloid hair comb and a glass perfume bottle (Figs. 6-24k, 6-24l, 6-29), and several nails and wood-and-metal fragments, possibly the remains of a crude coffin. On the basis of the limited and fragmentary remains, the skeleton was inferred to be that of a large adult female, approximately 30 to 35 years of age.* According to an informant, a former local resident interviewed by historical consultant Anne H. Takemoto, the skeleton was believed to be that of a German laborer who came to work in the area between A.D. 1910-1920 (Takemoto Ms.).

SOIL SAMPLES

During salvage excavations at Site 50-OA-G5-37, the stratigraphic deposits of both the main mound structure and the peripheral area were extensively sampled.

---

*Examination by Wendall W.S. Kam, University of Hawaii graduate student in physical anthropology.

Fig. 6-29. VIEW OF HUMAN SKELETAL REMAINS. Remains and associated historic artifacts in shallow depression at bottom of burial pit (HF-2). (BPBM Neg. No. OA(a)115-18.)

Sixty-three individual soil samples, including three bulk alluvium samples, were collected, and four soil monoliths were constructed as permanent records of mound stratigraphy. Thirty-four soil samples were submitted to geological consultant Maury Morgenstein (Hawaii Marine Research, Inc.) for sediment analyses (particle size and CHN) and preliminary pollen analysis. In addition, the three bulk alluvium samples were submitted for examination of gross lithological structure. Morgenstein's full manuscript report is on file in the Department of Anthropology, B.P. Bishop Museum (Morgenstein Ms.). Table 6-21 summarizes the provenience data for the 37 samples and four monoliths, and Figure 6-30 indicates the distribution of sample and monolith proveniences for those taken from the main mound structure. The remaining 26 soil samples, not submitted for analyses, have been retained at the Museum for any possible future analyses.

Soil samples were taken from the center of exposed individual strata on freshly cleared excavation faces. Samples ranged in size from 300 to 700 grams, averaging 500 grams, and were taken by trowel and put directly into double polyethylene bags. The bulk alluvium samples were obtained by removing undisturbed, solid, rectangular blocks from individual strata. The blocks ranged from 15 to 30 cm in maximum dimension, and their exact proveniences, bearings, and orientations were carefully recorded. Soil monoliths were constructed by a simple method using a thin, plywood backing and water soluble casein glue (Dumond 1963).

Objectives

The general objectives of the soil analyses were: (1) to permit more detailed and specific characterization of the individual stratigraphic deposits; (2) to obtain information concerning (a) the source of deposits, (b) the nature of deposition, and (c) post-depositional modifications or changes; and (3) to determine potential for subsequent detailed palynological investigations. Within this framework of general objectives, several specific questions were formulated:

1. Was the earthen mound an artificial construction feature, or a remnant feature? If the latter, was it a natural or intentional structure?
2. Concerning mound Layers II and IV:
   a. Primary or secondary deposits?
   b. Natural or cultural deposits?
   c. Nature of the material?
   d. Extent of time period represented by each deposit?
3. What was the source of the fill within the burial pit (HF-2)?
4. Was mound Layer I a natural or cultural deposit?
5. Concerning mound Layers III and V:
   a. Both were cultural deposits, but how did they differ analytically from one another?
   b. Were they habitation and/or cultivation deposits?
6. Were there any possible correlative relationships between any of the mound layers and peripheral excavation unit deposits? If so, what?
7. Did mound Layer VI (and correlating subsoil layers in various peripheral excavation units) represent a possible paleosol horizon?
8. Was there any evidence for cultivation activities in the surrounding area immediately adjacent to the mound? If so, what was the nature of the cultivation (wet or dry) and the period of cultivation (prehistoric, historic, or recent)?

9. Were pollen grains present in any of the various mound or peripheral area deposits? If present, what were their general condition, quality, and range of variation?

Particle Size Analysis

Particle size analysis was done for 34 samples (excluding the bulk alluvium samples, SS-61, -62, -63) using standard wet sieving techniques. The dry weight percentage of sediment constituents for the size range from <0.061 mm to 9.520 mm was determined for each sample, and the results are presented in Table 6-22. Particle size composition for the 0.061 mm to 9.520 mm sediment constituents for mound control section samples and selected peripheral excavation unit samples are plotted as histograms in Figures 6-31 and 6-32. The sediment samples were all heavily skewed in their fine fraction constituents (Σ 0.061 and <0.061 mm), and the <0.061 mm constituents are not included in the histograms.

Particle-size data were manipulated by the construction of a simple size parameter fraction: A/B where A = total dry weight percent of 0.124 mm to 9.52 mm constituents, and B = total dry weight percent of 0.061 mm and <0.061 mm constituents. Table 6-23 presents the A and B values, the A/B fraction, and the dry weight percent of <0.061 mm size fraction for each sample. Figure 6-33 plots individual sample percent of <0.061 mm size fractions against their A/B ratio, to give a general picture of sediment fine fraction distribution, and Table 6-24 summarizes the results of this simple graphic analysis.

CHN (Carbon-Hydrogen-Nitrogen) Analysis

CHN analyses were done for 34 samples (excluding the bulk alluvium samples, SS-61, -62, -63) using methods similar to those reported by Morgenstein and Burnett (1972), involving use of an F & M Scientific 185 C-H-N Analyzer. The percentage dry weight of C, H, and N, and the total percentage CHN for each sample are presented in Table 6-25. The individual and total percentages CHN for the mound control section samples and selected peripheral excavation unit samples are plotted as histograms in Figures 6-34 and 6-35.

Bulk Alluvium Samples

Bulk alluvium samples from Layers II (SS-63) and IV (SS-61, -62) of the mound were taken for examination of gross lithological structure. Detailed sample provenience data are presented in Table 6-26. Microscopic examination of all three samples revealed virtually the same microstructure (clay matrix with very thin, silt microlaminations) and gradational particle size changes (mostly repetitious in cyclic form with lateral extent). On the basis of these examinations, supplemented by earlier field observations, both Layers II and IV were identified as primary alluvial deposits of natural origin, deposits which could not have been artificially constructed.

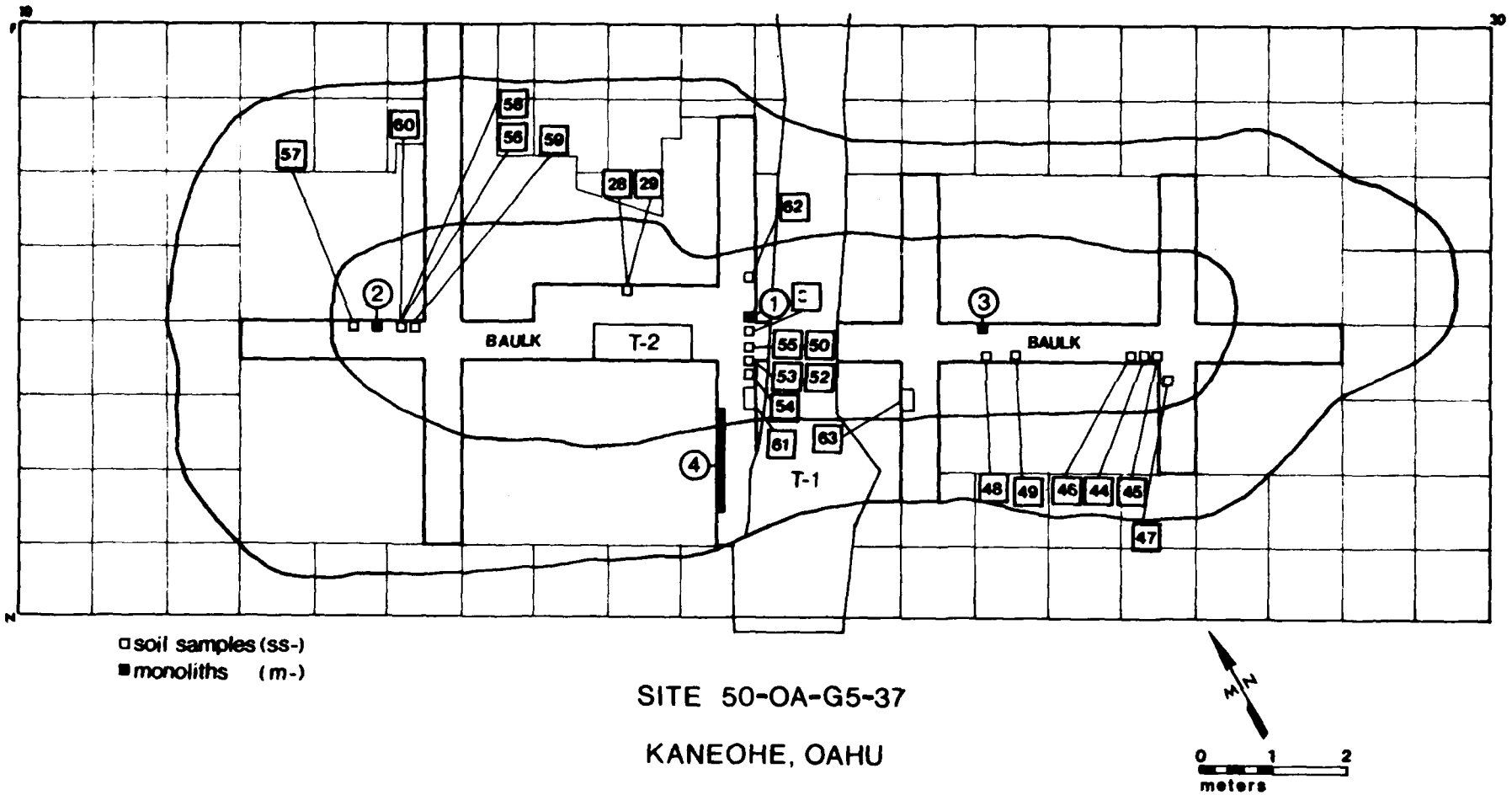


Fig. 6-30. SOIL SAMPLE AND MONOLITH PROVENIENCES. See Table 6-21 for more detailed data.

Table 6-21.

SOIL SAMPLE AND MONOLITH PROVENIENCES

Sample Number**	Provenience: Excavation Unit	Provenience: Layer	Provenience: Depth Below Surface (cm)	Notes
SS- 7	T- 4	I	0 - 5	SS-7 through -9 taken from W face of T-4, c. 75 cm from S end of trench; T-4 situated c. 3 meters NNE from mound
- 8	T- 4	II	17	
- 9	T- 4	III	32	
SS-10	T-20	I	25	SS-10 through -13 taken from S face of test pit (T-20) into historic rice paddy, c. 180 meters SE of mound
-11	T-20	II	65-70	
-12	T-20	III	85-90	
-13	T-20	IV	110	
SS-20	T-17	I	0- 9	SS-20 through -22 taken from N face of T-17, situated c. 14 meters SW of mound
-21	T-17	II	9-35	
-22	T-17	III	35-78+	
SS-28	HF- 1	Fill	7	SS-28 taken from N face of Baulk 1
-29	HF- 2	Fill	62	SS-29 taken from N face of Baulk 1
SS-39	T-15	I	0-15	SS-39 through -43 taken from W face of T-15, situated c. 10 meters SW of mound; SS-43 taken from pit or ditch feature which cuts through Layers II and III into IV, and is sealed over by I
-40	T-15	II	15-82	
-41	T-15	III	82-97	
-42	T-15	IV	97-107+	
-43	T-15	Pit(?) Fill	50-57	
SS-44	J25	I	6	SS-44 through -46 taken from S face of Baulk 1; SS-47 from W face of Baulk 5
-45	J25	II	18	
-46	J25	III	39	
-47	J25	VI	48	
SS-48	J23	II	20	SS-48 and -49 taken from S face of Baulk 1
-49	HF-15	Fill		
SS-50	J19	I	0- 8	SS-50 through -55 taken from E face of Baulk 3
-51	J19	II	16-22	
-52	J19	III	25-32	
-53	J19	IV	36-43	
-54	J19	V	50-57	
-55	J19	VI	77-83	
SS-56	J15	I & II	6	SS-56 through -60 taken from N face of Baulk 1
-57	J14	IVa	27	
-58	J15	IVb	55	
-59	HF-41	Fill	77	
-60	J-15	VI	91	
SS-61	J19-K19	IV	35-51	SS-61 through -63, bulk-alluvium samples taken from E face of Baulk 3 (SS-61 and -62) and W face of Baulk 4 (SS-63)
-62	I19	IV	36-51	
-63	J22-K22	II	10-26	
M-1	I19	I to VI	--	M-1 taken from SE corner of I19, adjacent to SS-50 through -55; representative of main-control-section stratigraphy
M-2	J14	I to VI	--	M-2 taken from NE corner of J14, adjacent to SS-56 through -60; representative of W-control-section stratigraphy
M-3	J23	I to III, VI	--	M-3 taken from NW corner of J23; representative of E-control-section stratigraphy
M-4	K19-L19	I to VI	--	M-4 taken from W face of S half of Baulk 3; representative of truncation of Layers I, III, IV, and V

*See Fig. 6-30 for proveniences and distribution of mound soil samples and monoliths.
**SS = Soil Sample; M = Monolith.

Table 6-22.

PARTICLE SIZE COMPOSITION

Soil Sample Number	Percent of Dry Weight								
	Sieve Mesh (mm)								
	9.520	3.962	1.397	0.991	0.495	0.246	0.124	0.061	<0.061
SS-7	-	0.95%	2.73%	1.55%	5.22%	7.31%	7.37%	2.95%	71.92%
8	-	2.08	2.81	1.45	5.04	6.12	6.06	1.21	75.23
9	-	0.92	3.07	2.03	7.70	7.10	6.00	3.22	69.96
10	-	-	1.67	1.10	2.35	2.19	1.69	0.19	90.81
11	-	-	0.61	0.22	0.67	0.85	0.86	0.40	96.40
12	-	0.15	0.98	0.41	0.78	0.82	0.98	0.65	95.23
13	-	-	0.06	0.02	0.11	0.16	0.36	0.61	98.68
20	-	0.02	0.23	0.22	1.215	1.55	1.65	0.02	95.00
21	-	0.38	1.27	0.49	1.77	2.18	2.83	2.13	88.95
22	-	-	0.09	0.11	1.05	2.99	3.71	3.97	88.08
28	-	1.20	2.09	1.07	2.72	3.04	3.65	0.06	86.17
29	0.84%	0.99	1.31	0.59	2.85	4.19	5.56	3.60	80.91
39	-	1.05	1.75	1.06	2.81	2.74	3.30	0.28	87.01
40	-	-	0.54	0.34	4.82	7.26	7.59	3.62	75.83
41	5.58	8.90	8.80	2.25	5.21	4.20	1.63	1.19	62.24
42	-	0.40	1.53	0.41	3.08	5.90	6.13	0.36	82.20
43	-	0.11	1.01	0.46	1.48	3.22	4.98	0.12	88.62
44	-	1.07	1.59	1.39	3.89	3.26	3.71	0.933	84.157
45	9.82	3.23	2.84	1.46	5.61	5.96	6.11	4.02	60.95
46	-								91.37
47	-								88.26
48	1.54	4.44	9.67	3.29	7.08	5.23	4.13	2.82	61.8
49	0.61	3.45	3.11	0.73	1.41	2.21	4.02	1.51*	83.31
50	-	4.32	2.16	1.88	4.36	3.61	3.42	1.95*	78.30
51	5.24	2.30	3.79	1.08	3.33	4.00	3.98	2.21	74.07
52	-	0.21	0.69	0.52	2.24	3.12	2.67	0.24*	90.51
53	16.31	4.85	2.69	0.62	2.23	3.34	5.05	4.42	60.50
54	-	0.53	0.20	0.24	3.16	3.51	5.45	2.47*	84.43
55	-	-	0.31	0.08	1.49	4.11	6.77	0.71	86.53
56	-	0.77	1.91	1.20	3.88	4.48	5.02	0.99	81.75
57	-	0.98	1.48	0.44	1.74	4.12	5.30	0.20	85.74
58_1**	-	0.32	0.96	0.81	5.86	7.60	6.31	2.27	75.86
58_2**	-	0.12	1.22	1.09	6.33	8.51	7.34	2.98	72.67
59	-	0.04	0.93	0.63	2.82	3.79	5.30	3.42	83.07
60	-	0.17	0.62	0.32	2.49	4.67	9.26	4.62	77.85

*<0.124

**Two subsamples analyzed.

Preliminary Pollen Analysis

The preliminary pollen analysis comprised the initial stage of a potential investigation into the nature of the pollen assemblage contained in the sediments from Site 50-OA-G5-37. The sediment samples represented both mound and peripheral area deposits, and included humic topsoils, alluvial muds, silts, sands

TABLE 6-23

PARTICLE SIZE COMPOSITION COMPARISONS

Soil Sample Number	A (Σ% 0.124 to 9.52 mm)	B (Σ% 0.061 to <0.061 mm)	A/B	% <0.061 mm particles
SS-7	25.13%	74.87%	0.336	71.92%
8	23.56	76.44	0.308	75.23
9	26.82	73.18	0.367	69.96
10	9.00	91.00	0.099	90.81
11	3.20	96.80	0.0103	96.40
12	4.12	95.88	0.043	95.23
13	0.71	99.29	0.007	98.68
20	4.87	95.13	0.051	95.11
21	8.92	91.08	0.098	88.95
22	7.95	92.05	0.086	88.08
28	13.77	86.23	0.160	86.17
29	15.49	84.51	0.183	80.91
39	12.71	87.29	0.146	87.01
40	20.55	79.45	0.259	75.83
41	30.57	63.43	0.577	62.24
42	17.44	82.56	0.211	82.20
43	11.26	88.74	0.127	88.62
44	14.91	85.09	0.175	84.157
45	35.03	64.97	0.539	60.95
46	8.00	92.00	0.086	91.37
47	9.67	90.33	0.107	88.26
48	35.38	64.62	0.548	61.80
49	15.18	84.82	0.179	83.31
50	19.75	80.25	0.246	78.03
51	23.72	76.28	0.311	74.07
52	9.25	90.75	0.102	90.51
53	35.08	64.92	0.540	60.50
54	13.10	86.90	0.151	84.43
55	12.76	87.24	0.146	86.53
56	17.26	82.74	0.209	81.75
57	14.06	85.94	0.164	85.74
58_2	24.35	75.65	0.322	72.67
59	13.51	86.49	0.156	83.07
60	17.53	82.47	0.213	77.85

and gravels, and highly oxidized laterite soils. Very little calcium carbonate material was present.

Thirty-five samples were analyzed, two of which (SS-58_1,-58_2) were derived from the same field sample fraction. Analyses utilized portions of the <0.061 mm size fractions resulting from the earlier particle size analyses.

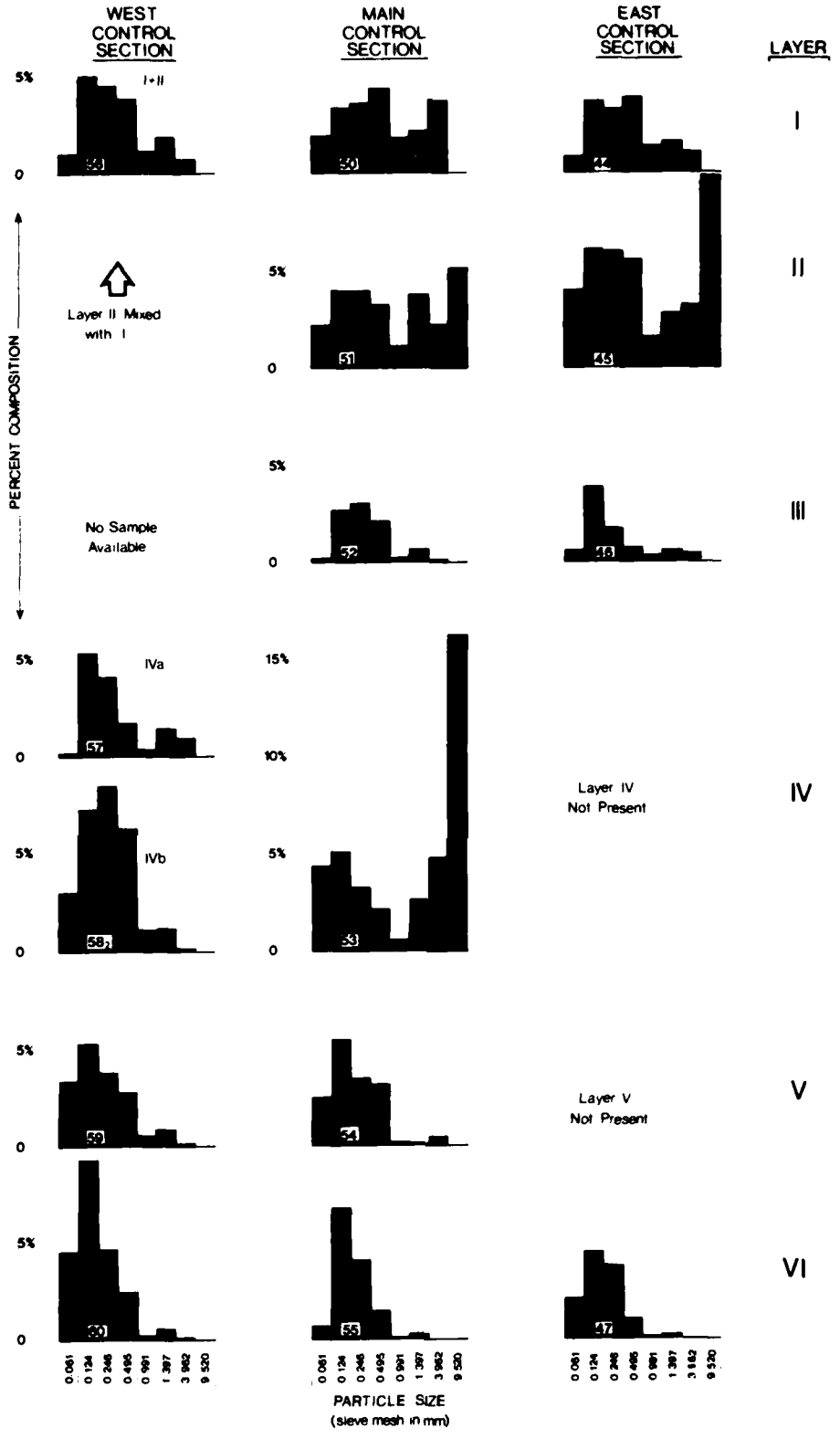


Fig. 6-31. PARTICLE SIZE COMPOSITION OF CONTROL SECTION SOIL SAMPLES. Composition % of sample dry weight, with <0.061 mm component deleted from histogram. Number within each histogram is specific soil sample (SS-) number.

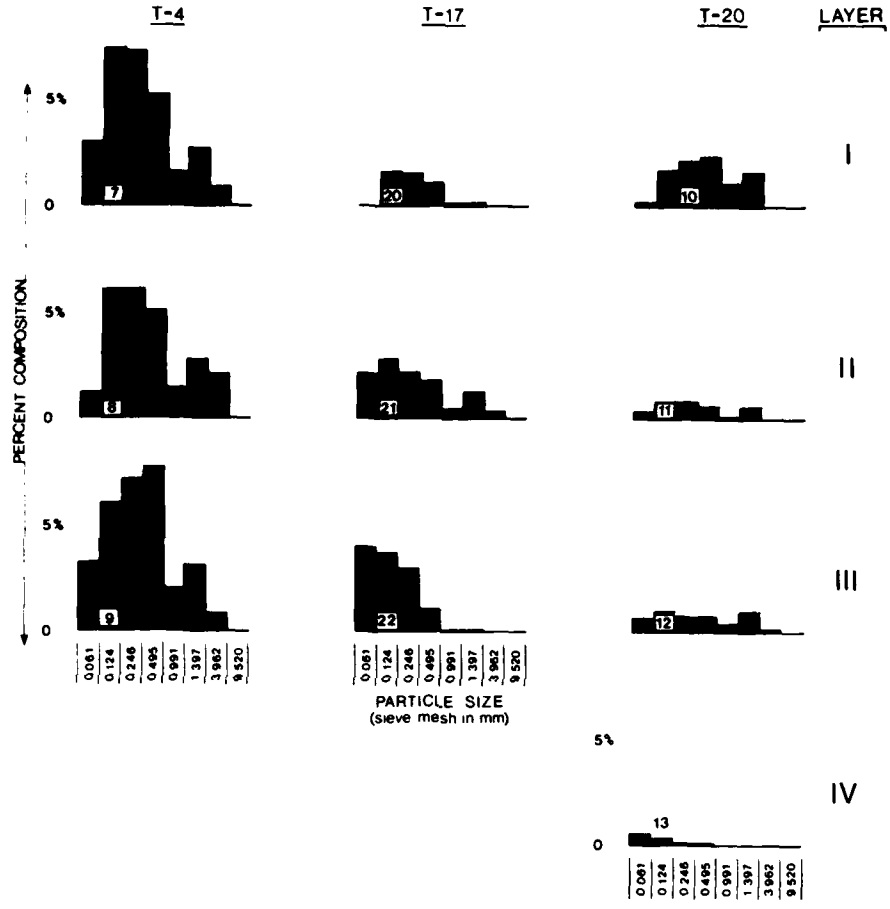


Fig. 6-32. PARTICLE SIZE COMPOSITION OF SELECTED PERIPHERAL EXCAVATION UNIT SOIL SAMPLES. Composition % of total sample dry weight, with <0.061 mm component deleted from histogram. Number within each histogram is specific soil sample (SS-) number.

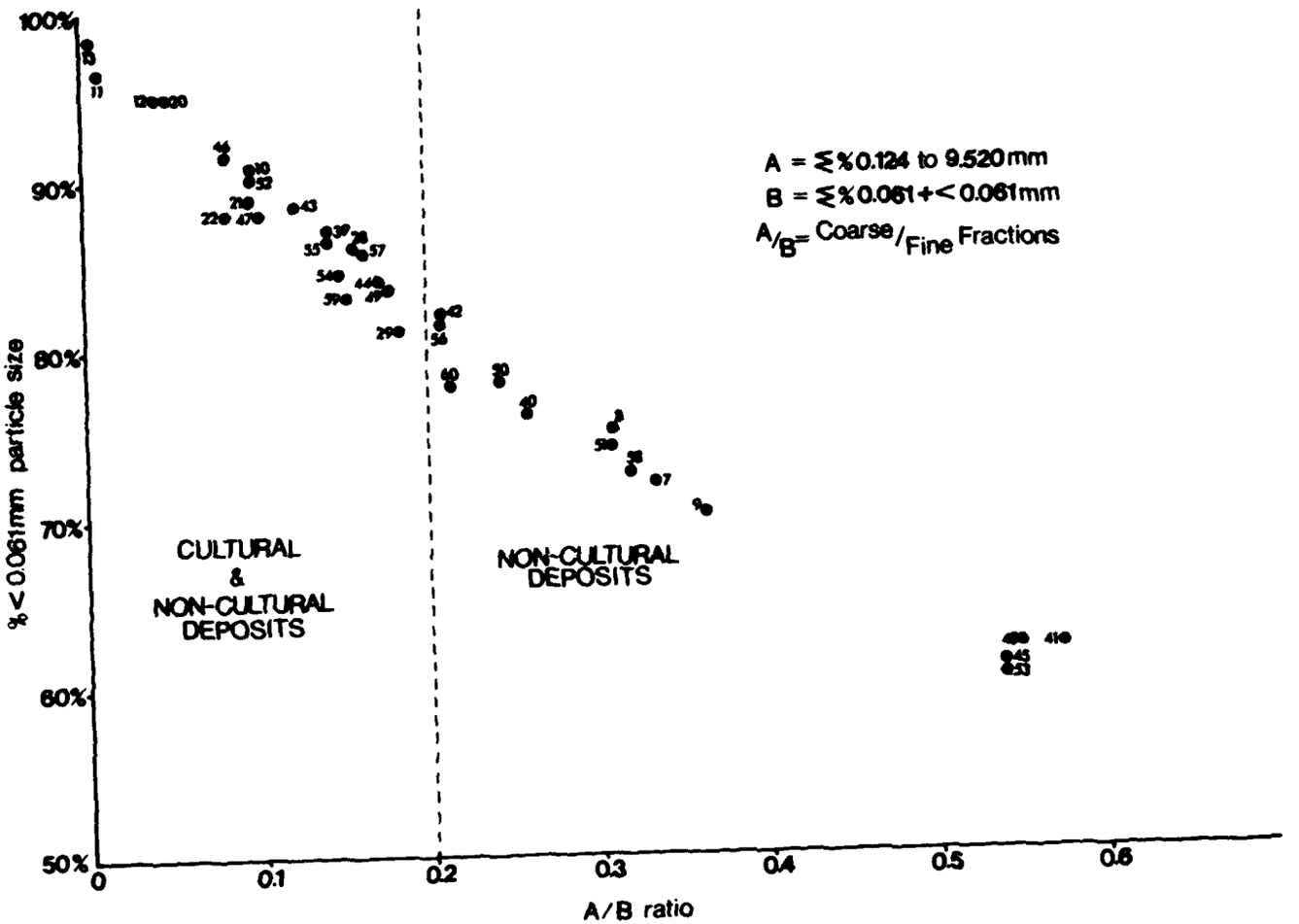


Fig. 6-33. COMPARISON OF PARTICLE SIZE COMPOSITION. Individual soil samples (SS-) plotted as a function of % 0.061 mm component and A/B ratio (coarse fraction/ fine fraction). A = Σ % 0.124 to 9.520 mm components; B = Σ % 0.061 mm and <0.061 mm components.

Table 6-24.

RESULTS OF COMPARISON OF %<0.061 mm PARTICLES WITH A/B RATIO

Soil Sample Number	Provenience		Non-Cultural			Cultural			
	Excavation Unit	Layer	Alluvial Deposit	Alluvial Subsoil	Humic Topsoil	Occupation Deposit	Occupation Feature (HF)	Possible Cultivation Deposit	
SS-41	T-15	III	+						
-48	J23	II	+						
-53	J19	IV	+						
-45	J25	II	+						
- 9	T-4	III		+					
- 7	T-4	I			+				
-58	J15	IVb	+						
-51	J19	II	+						
- 8	T-4	II						+	
-40	T-15	II						+	
-50	J19	I			+	+			
-60	J15	VI		+					
-42	T-15	IV		+					
-56	J15	I&II	+		+	+			
-29	HF-2	Fill					+		
-49	HF-15	Fill					+		
-44	J25	I			+				
-57	J15	IVa	+			+			
-28	HF-1	Fill			+		+		
-59	J15	V				+		+	
-54	J19	V				+		+	
-55	J19	VI		+					
-39	T-15	I			+				
-43	T-15	Fill	+						
-47	J25	VI		+					
-10	T-20	I			+				
-52	J19	III				+			
-21	T-17	II							
-22	T-17	III		+					
-46	J25	III				+			
-20	T-17	I			+				
-12	T-20	III						+	
-11	T-20	II						+	
-13	T-20	IV		+					

Two samples (SS-10, -50) used for procedures analysis, were destroyed in the process of determining the most efficient methods for sample preparation. Six grams of <0.061 mm material were mechanically separated, and subsequently treated in the following manner:

1. 10% HCl for removal of carbonate concentrations, reaction to completion;
2. Concentrated HF for 24 hours at ambient temperature;

Table 6-25.

CHN COMPOSITION

Soil Sample Number	Percent CHN of Dry Weight			
	%C	%H	%N	Σ %CHN
SS-7	2.66	1.59	0.211	4.461
8	1.69	1.42	0.146	3.564
9	1.30	1.47	0.129	2.899
10	17.49	2.55	1.23	21.27
11	13.30	1.77	0.930	16.00
12	6.63	2.06	0.484	9.174
13	0.991	1.65	0.096	2.737
20	7.50	1.83	0.523	9.853
21	2.15	1.60	0.188	3.938
22	0.960	1.40	0.155	2.475
28	1.87	1.43	0.180	3.480
29	1.51	1.46	0.151	3.121
39	3.60	1.74	0.271	5.611
40	0.592	1.65	0.066	2.308
41	0.364	1.59	0.039	1.993
42	0.509	1.55	0.060	2.119
43	0.977	1.63	0.100	2.707
44	0.365	1.54	0.023	1.928
45	0.985	1.58	0.104	2.669
46	2.55	1.45	0.222	4.222
47	0.855	1.64	0.102	2.597
48	1.03	1.59	0.102	2.722
49	4.51	1.74	0.230	6.480
50	4.12	1.69	0.352	6.162
51	1.60	1.58	0.085	3.265
52	2.43	1.62	0.208	4.258
53	0.927	1.51	0.107	2.544
54	1.61	1.50	0.165	3.275
55	0.717	1.41	0.080	2.207
56	2.81	1.85	0.232	4.892
57	2.08	1.46	0.138	3.678
58_2	0.541	1.56	0.061	2.162
59	0.818	1.44	0.090	2.348
60	0.669	1.45	0.083	2.202

3. Concentrated HNO_3, laboratory grade, for 5 hours;
4. 8% KOH for ½ hour; and
5. Flotation of residue in $ZnCl_2$ (Sp. Gr. 1.95).

Distilled water was used to clean the sediment between each stage of the treatment and after the final flotation. Normally, concentrated HF would be used for 2 hours after the flotation to remove any remaining silicates; it was desirable, however, to identify any remaining silicates, and so this final treatment was postponed. Finally, the material was not stained, since for the purposes of this preliminary study staining was not necessary. To permit any further investigations, the materials have been stored in glycerine jelly for future slide preparation.

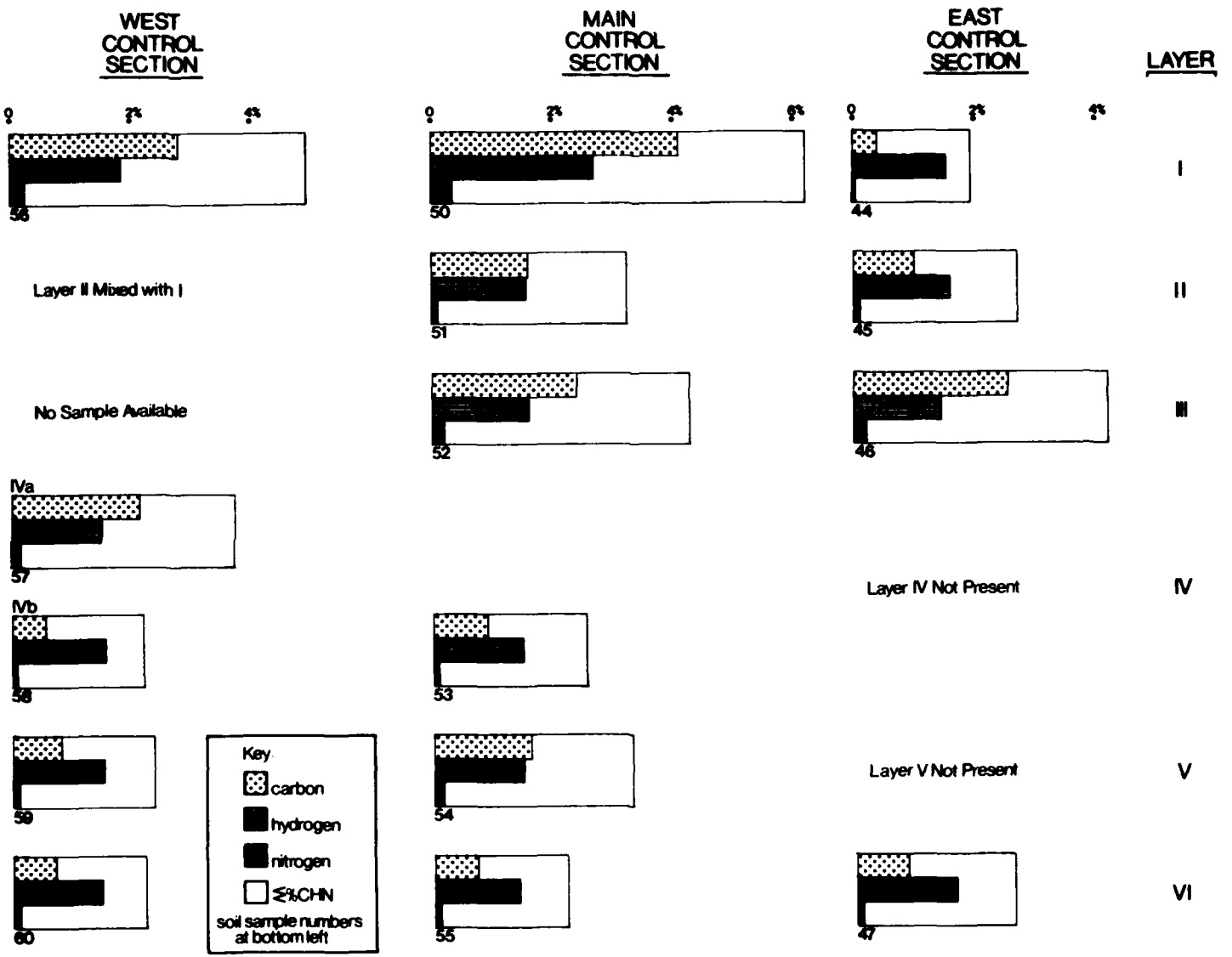


Fig. 6-34. CHN COMPOSITION OF CONTROL SECTION SOIL SAMPLES. Composition % of sample dry weight for C, H, and N and ΣCHN.

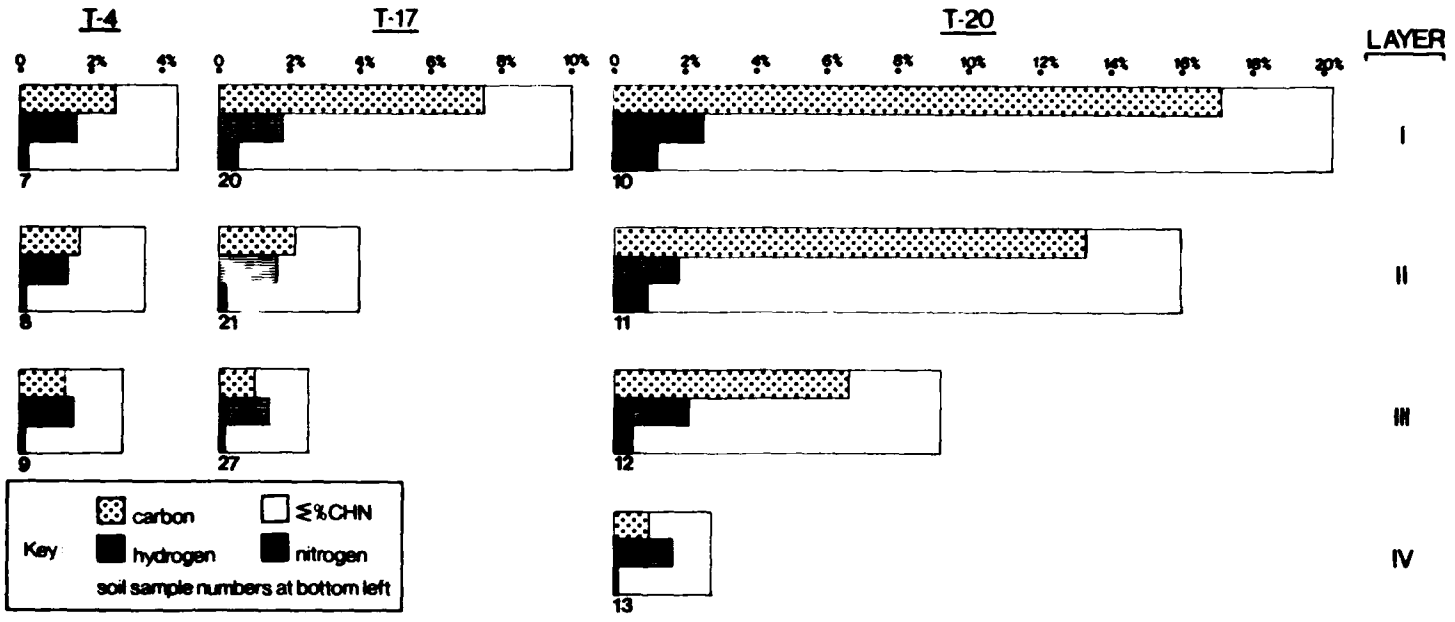


Fig. 6-35. CHN COMPOSITION OF SELECT PERIPHERAL EXCAVATION UNIT SOIL SAMPLES. Composition % of dry weight for C, H, and N, and ΣCHN.

Table 6-26.

BULK ALLUVIUM SAMPLE DATA

Soil Sample Number	Provenience		Orientation of Face, Vertical Plane	Horizontal Inclination of Layer in Vertical Face
	Layer	Baulk, Face, Square		
SS-61	IV	Baulk 3, East Face, J19-K19	33° E of Magnetic N	3°30'
SS-62	IV	Baulk 3, East Face, I19	34° E of Magnetic N	4°30' (top) 14°30' (bottom)
SS-63	II	Baulk 4, West Face, J22-K22	30° E of Magnetic N	2°30'

Pollen grains were observed in each of the samples. Though perhaps somewhat limited in range of forms, grain quantity ranged from common to abundant, and preservation was generally good to excellent. The variations in pollen concentrations among all of the samples studied indicate the potential for significant data yield from any future further studies.

Discussion of Results

The soil sample analyses were generally successful in: (1) achieving more detailed and specific characterization of the individual deposits; (2) providing information concerning the source, nature of deposition, and post-depositional modifications of the various deposits; and (3) suggesting the potential for detailed palynological investigations. The results of the analyses can be presented in terms of the specific questions outlined earlier, summarizing the conclusions discussed in greater detail in the consultant report (Morgenstein Ms.).

On the bases of field observation of the stratigraphic units and their relationships, and laboratory analyses of samples from individual stratigraphic units, it was concluded that the earthen mound was a remnant feature, and not an intentionally constructed feature. The appearance of the "mound" was the result of post-depositional modifications of the immediately adjacent area--the removal of extensive portions of the earlier deposits.

Mound Layers II and IV were both determined to represent primary, natural deposits of alluvium, with each deposit representing a period of time not necessarily longer than that necessary for a single, natural deposition event

(flood). The fill of the burial pit (HF-2) was composed of a mixture of mound Layers II, III, IV, V, and VI. Mound Layer I probably represented a combination of natural and cultural deposits derived from a very short span of prehistoric occupation following the natural deposition of Layer II, and the subsequent natural development of a humic topsoil which incorporated the cultural remains that were present.

On the basis of horizontal features, portable remains, and nature of the soil deposits, both Layers III and V were interpreted as cultural deposits. In terms of the soil sample analyses, Layer III differed from Layer V in both particle size and CHN composition. Layer III was characterized by a greater fine fraction percent--90.51% to 84.43%--as well as a differing overall composition. In terms of particle-size composition, Layer V was more similar to Layer VI than Layer III was to VI. Layer III had a higher total percent CHN than Layer V, as well as a higher percent of C, H, and N. Layer V had a proportionately higher percent H than Layer III.

Based on the soil sample analyses results alone, it could not be established with any certainty whether occupation Layers III and V were habitation or cultivation deposits. The results did suggest, however, the possibility that Layer V was principally a cultivation deposit, probably utilized for dryland cultivation, while Layer III was more likely principally a habitation deposit, possibly with dryland cultivation closely associated. To a large degree, this possible distinction between Layers III and V is supported by other lines of excavative evidence.

With the exception of the existing humic topsoil and the sterile subsoil material, no correlative relationships could be established between the various mound layers and any of the strata exposed in any of the peripheral excavation units. There were obvious similarities between deposits having similar sources and modes of transport and deposition, but no evidence of any direct correlation between specific deposits could be defined. Mound Layers II, III, IV, and V were not identified in any of the peripheral excavation units adjacent to the mound itself.

Results of the particle size and CHN analyses did suggest that mound Layer VI represented a paleosol horizon and that possibly Layer III of T-17 did also. Both layers represented the same subsoil deposit. It appeared most likely that in the rest of the area immediately surrounding the mound, as tested by the peripheral excavation units, the upper portion of the subsoil was substantially altered or removed, probably as part of the same historical activity that resulted in the mound structure.

In addition to the surface structural remains of historic low terraces, evidence for cultivation activities was provided by the soil sample analyses for several of the peripheral excavation units, including T-4 (Layer II), T-1 NE Ext. (III), T-1 SW Ext. (II), T-17 (II), T-20 (II), and possibly T-13 (II), T-18 (II, III), and T-19 (II, III). The stratigraphy and results of the soil sample analyses strongly suggested irrigated pondfield cultivation at several excavation units--T-20, T-17, T-18, and possibly T-1 SW Extension and T-19. The specific nature of cultivation activity--wet or dryland--could not be determined with more certainty for other excavation units. Dryland cultivation was suggested by appearances, but it was also quite possibly evidence of irrigated cultivation of such short time span as to be insufficient for formation of characteristic pondfield stratigraphy.

Pollen grains were present in every soil sample examined. Generally in good quantity and condition, they showed a relatively limited range of distinctive types. At the same time, the results of the preliminary pollen analysis indicated definite potential for further investigation.

CONCLUSION

This conclusion is composed of three basic parts: (1) an argument for the interpretation of the earthen mound as a relatively recent historic feature constituting an artificially contrived remnant of a multiple component, subsurface, prehistoric occupation site rather than a prehistoric habitation mound (the non-mound argument); (2) an outline and discussion of the (a) site occupation sequence, and (b) cultural interpretation; and (3) an evaluation of the significance of Site 50-OA-G5-37 to Hawaiian prehistory. The section ends with a summary of the major points of the conclusion.

NON-MOUND ARGUMENT

On the basis of several lines of salvage excavation evidence--from field investigations and detailed laboratory and special consultant analyses--a strong argument can be advanced that Site 50-OA-G5-37 was not a stratified prehistoric habitation mound as hypothesized on the basis of the earlier survey and test excavations. Rather, the elongated, asymmetrical mound was a relatively recent historic structure resulting from extensive modification of the surrounding area--the lowering of the adjacent ground surface by removal and redistribution of soil, probably in connection with historic agricultural activity. The apparent mound structure was therefore actually a small remnant of earlier and more extensive, stratified prehistoric cultural deposits.

Excavation Evidence

Evidence for the non-mound argument derives principally from the study, analysis, and interpretation of the site stratigraphy and horizontal features, and portable cultural remains--both the artifacts and the non-artifactual remains--and the results of the soil sample analyses.

The nature and appearance of the mound and peripheral excavation unit stratigraphy compose the first major body of direct evidence. The obvious sharp truncation of essentially level, natural and cultural layers (II, III, IV, and V) at their horizontal extents on all sides of the mound is striking, particularly in contrast to the absence of overlapping layer peripheries characterestic of intentionally constructed, artificial mounds. The horizontal limits of these layers (II through V), from the lowest (V) upward, are for the most part contained within the periphery of the preceding layer. The overall stratigraphy of the mound is appropriate, not to a section through an artificially constructed feature, but to a section into a multiple component, subsurface site in which successive occupations involved some horizontal shifting of the central focus of occupation within the same general site area. At the same time, the

non-cultural aspects of the mound stratigraphy are appropriate to a natural alluvial terrace (Layer VI) which has experienced repeated natural flooding and deposition of graded alluvial material (Layers IV and II).

The relative elevation of the mound layers above the surrounding ground surface is another aspect of the stratigraphic evidence supporting the non-mound argument. The strongest points concern (1) the sterile subsoil (VI) surface, which is both distinctively elevated and level, but only beneath the mound; and (2) the presence of sterile, primary alluvial deposits (II, IV), elevated considerably above the existing ground surface surrounding the mound, and which lie above and seal in cultural deposits (III, V). The final major piece of stratigraphic evidence is the absence, from the peripheral excavation units, of any deposits which can be correlated with mound Layers II, III, IV or V.

The composition, appearance, and distribution of horizontal features compose the second major body of direct evidence. Many features, on all sides of the mound, were clearly and sharply truncated, or cut and partially removed, by the sloping sides of the mound. This condition is obviously the result of some action subsequent to human occupation represented by the various features. This same truncation action, clearly angled or inclined in nature, was responsible for the horizontal position of several features and feature remnants outside of the apparent horizontal extent of their associated layers.

The absence of any meaningful overall pattern of prehistoric features within the limits of the mound cultural layers further supports the interpretation of the mound as a remnant feature. The distribution of features did suggest some partial patterning, such as an incomplete alignment of postholes and possibly associated firepits and ovens; but the overall distribution of mound features suggested no obvious complete patterns, and bore no reasonable or logical relationship to the size, shape, or orientation of the mound, such as might be expected had the mound been a habitation feature. Rather, the distribution of the prehistoric horizontal features makes sense only if regarded as a partial, and not at all representative, sample of features formerly present--the features contained in the remnant of a larger occupation site. Closely related to and supporting this interpretation was the total absence of any possibly associated prehistoric horizontal features from the area immediately surrounding the mound.

In contrast to the non-patterned distribution of prehistoric subsurface mound features, the central position of the historic, low, stone platform (HF-1) and burial pit (HF-2) was meaningful in relation to the size and location of the mound. Associated historic artifacts date the burial and platform monument most likely to the early part of the 20th century. The pit itself was quite deep and regular in shape, with vertical sides resulting from the probable use of metal shovels, and had been excavated from Layer I, through intervening natural and cultural layers, and into sterile subsoil Layer VI. The central position and survival of the burial pit and platform monument can be explained by the same factors responsible for the formation and location of the mound feature itself, by regarding the mound as a relatively recent historic feature constructed with recognition or knowledge of the low stone platform as a burial marker monument.

The nature and distribution of the portable cultural remains, both artifacts and non-artifactual materials, compose a third major body of evidence supporting the non-mound argument. As with the horizontal features, the distribution of the portable remains within the periphery of the mound displayed no

reasonable or meaningful pattern, except to be denser in the areas having more features, and thus should best be regarded as a non-representative sample, in terms of spatial distribution, though not necessarily in terms of composition of assemblages. Similar, too, was the total absence of any possibly associated prehistoric cultural remains from the adjacent area immediately surrounding the mound.

The sharp contrast in the differential range, composition, and quantity of the portable remains from the various layers strongly implied differential nature of occupations. The differences in portable remains, especially the virtually complete absence of remains from Layer V, suggests (to some degree) occupational differences of a specific nature--possibly agricultural activities for Layer V and habitation for Layer III.

The results of the various soil sample analyses compose a fourth major body of evidence for the non-mound argument. To a great extent, these results support and strengthen many of the points advanced on the basis of stratigraphic analysis. Of principal importance are conclusions regarding: (1) the differential nature of the various mound layers (natural and cultural); (2) the natural sources and *in situ* development of the mound layers, rather than any artificial and/or intentional depositions; and (3) the lack of correlation between mound Layers II through V and any of the peripheral excavation unit deposits. On the basis of field observation and the soil sample laboratory analyses, geological consultant Maury Morgenstein concluded that: (1) the mound definitely constituted a remnant feature, not an intentionally formed structure resulting from successive artificial fill depositions and periods of habitation; and (2) the mound was not a natural remnant, a product of natural erosional forces, but rather the product of intentional post-deposition modification of the immediately adjacent terrain.

Other Evidence

In addition to the direct evidence derived from the salvage excavations, several additional points, mostly indirect evidence, can be advanced in support of the non-mound argument. First, there is the apparent uniqueness of the site. As a stratified, prehistoric Hawaiian habitation mound, 50-OA-G5-37 has no known or recorded similar type of site anywhere in the Hawaiian Islands, despite many years of archaeological survey and an extensive known range of site types. Furthermore, there are no similar mound sites reported for anywhere in Eastern Polynesia. And finally, in Western Polynesia, where mound sites are found, those mounds are not at all similar in either external physical characteristics or internal structure (Samoa--Green and Davidson [eds.] 1969, 1974; Kikuchi 1963; Tonga--Davidson 1969, 1971; McKern 1929; Rogers 1974; Futuna and Uvea--Kirch, in press).

Secondly, a consideration of the physical characteristics, location, and orientation of Site 50-OA-G5-37 provides no obvious reasons accounting for such site attributes. Furthermore, it might be suggested that the relative dimensions of the mound--long and narrow--seem inappropriate or possibly inadequate for a habitation mound.

Finally, historical research of the project area and immediately surrounding upland Kaneohe area (Takemoto Ms.; Kelly, Report 2), supplemented by the archaeological knowledge of several historic period habitation and exploitation

sites within the area (Reports 3 and 4), provide points of indirect evidence which add support to the postulated historic origin of the mound structure. The subsurface cultural deposits of the mound constitute the only definite prehistoric occupation evidence identified within the upland Kaneohe project area, and therefore, few specific statements can be made about prehistoric occupation within the project area. Both documentary and archaeological sources portray extensive historic occupation, both habitation and agricultural exploitation. During the early historic period, occupation was by native Hawaiians and apparently involved principally dryland and irrigated agricultural activities. From the later part of the 19th century to the middle of the 20th century, the project area, and specifically the general site area, was occupied by Oriental farmers--mostly Chinese until c. A.D. 1910-1920, followed by Japanese. Both groups lived in the area and cultivated rice and taro, as well as other types of marketable produce. The same time span also includes larger scale ranching and agricultural (sugarcane, pineapple) activities within the general project area. Thus, it is quite possible that the formation of the mound structure was the result of historic land modification related to some kind of early 20th century agricultural activity in the general site area along Kamo'oali'i Stream.

Upon critical consideration of several lines of evidence--both direct archaeological and other indirect sources--a strong and convincing argument can be made that the earthen mound, Site 50-OA-G5-37, was a relatively recent historic feature resulting from extensive modification of the surrounding general area, the lowering of the adjacent ground surface, probably in connection with local agricultural activities. Thus, the mound constituted simply a small remnant of more extensive, stratified, prehistoric cultural deposits, rather than a unique, prehistoric, Hawaiian habitation mound.

OCCUPATION SEQUENCE AND INTERPRETATION

Discussion of the occupation sequence and interpretation of the mound site is premised on the assumption that the site comprised only a remnant of a more extensive, stratified, subsurface, prehistoric site, and therefore it is unknown what kind of sample of the pre-disturbance original site--in terms of size, cultural features, and portable remains--the known remnant constituted. Acknowledgement of this limitation provides for the somewhat tentative nature of the following discussion.

Occupation Sequence

The occupation sequence evidenced by the mound deposits at Site 50-OA-G5-37 is outlined in Figure 6-36. This summary includes the general nature of the phase evidenced by specific stratigraphic deposits, and so far as possible, suggests the general time depth involved.

Layer VI represented the pre-occupation local environmental setting. Most likely forested to some degree, with *Aleurites* (*kukui*) and *Pandanus* (*hala*) being the dominant forms, the site area comprised a natural alluvial terrace along Kamo'oali'i Stream. A natural humic topsoil probably developed atop the well-weathered, sterile, alluvial subsoil. There is no definite direct evidence for any cultural activity to be associated with this phase in

ESTIMATED APPROXIMATE A.D.DATE	STRATIGRAPHIC LAYER	GENERAL NATURE OF PHASE
?		?
	VI	Pre-occupation (Non-cultural)
1565	V	Initial Occupation (Cultivation)
	IV	Natural Flooding (Non-cultural)
	III*	Initial Re-occupation (Habitation)
	III	Major Occupation (Habitation)
	II	Natural Flooding (Non-cultural)
1655		*Final Re-occupation* (Limited habitation?)
		Abandonment
1900?		Historic burial (Historic habitation and cultivation in general area)
	I	Mound "Construction"
1940/50		Final Abandonment
1975		Present

*Evidenced by disturbed portion of Layer IV designated IVa.

Fig. 6-36. OUTLINE OF TENTATIVE OCCUPATION SEQUENCE FOR SITE 50-OA-G5-37.

the development of the site, but it is possible that natural events or cultural activity, such as natural forest fires, native exploitation of forest resources, or possibly even early dryland cultivation, could have taken place in the general site area but were not of sufficient intensity or extent to leave any definite remains beyond the tenuous hints offered by Layer VI.

Layer V evidenced the earliest substantial occupation of the site. The archaeological evidence from Layer V suggested that the nature of occupation is best interpreted as agricultural--dryland cultivation involving swidden (slash and burn) techniques. The possibility of concurrent temporary habitation involving simple shelters was suggested, but the overall time span of cultural occupation represented by Layer V was uncertain.

Layer IV represented a non-cultural phase of site development involving natural flooding and deposition of primary alluvial material, most likely from nearby Kamo'oali'i Stream. The cause of such flooding is uncertain. It could have been simply a natural result of intense rainfall in the *mauka* watershed area, but it might also be considered as possibly indirect evidence of land-surface degradation related to artificial alteration and removal of forest cover resulting from dryland swidden (slash and burn) cultivation in the *mauka* lands. The time span represented by Layer IV, both deposition and subsequent time until the reoccupation evidenced by Layer IVa, was probably relatively short, as it was apparently insufficient for development of a natural humic topsoil.

Layer IVa evidenced the initial reoccupation of the site area. The nature of occupation is quite uncertain, but occupation was characterized by the excavation of several pits and the limited mixing of charcoal into the upper portion of Layer IV. The occupation represented was probably the initial activities of the extensive Layer III occupation. A very short time span is indicated, and, as will be discussed later, the nature of cultural activity represented might also be agricultural, though somewhat different from that suggested by Layer V.

Layer III represented the major or most intensive occupation of the site area. The archaeological evidence indicated habitation, probably extended and recurrent, as the principal nature of occupation. The site could well have been temporarily abandoned and reoccupied several times during the phase of site development represented by Layer III. Site habitation was probably associated with local dryland cultivation and/or the exploitation of natural forest resources.

Layer II evidenced a non-cultural phase very similar to that described for Layer IV. Again, the time span involved was apparently quite short.

Layer I incorporates evidence of several phases in the development of the site, none of which could be sorted out, as there were no definable stratigraphic subunits of Layer I. The sequence of events outlined for Layer I represents a logical sequence of events that occurred at the site and in the general site area during a time span which involved the continuing gradual development of a humic topsoil above the mound deposit and eventually the surrounding area deposits. Limited archaeological evidence suggests a final prehistoric reoccupation of the site not long after the deposition of Layer II. The nature of occupation is not clear, but a very short span of habitation appears to be a probability, followed soon after by the final prehistoric

abandonment of the site area. The historic burial associated with Layer I was the next cultural event that could be specifically associated with the site, but this event was undoubtedly only one resulting from the historic period occupation--both Hawaiian, and later Oriental and other non-Hawaiian occupation--of the general site area. This historic occupation included both habitation and agricultural exploitation in the area; the latter could have involved, subsequent to the burial event, activities and land modifications that produced the earthen mound feature that survived beyond the recent historic occupational abandonment of the general site area by the middle of this century.

Site Interpretation

The following discussion considers in greater detail the nature of prehistoric and historic human occupation, both habitation and exploitation, indicated by the archaeological evidence derived from the salvage excavations. The site interpretation is concerned principally with the subsurface mound deposits, and the interpretation of these deposits in terms of the nature of human occupation they represented. As with the earlier discussion of the occupation sequence, in which the general nature of the cultural and non-cultural phases of site development were mentioned, the remnant nature of the site deposits must be taken into consideration.

The occupation sequence evidenced by the mound deposits comprises a maximum of four distinct phases of prehistoric occupation (Layers V, IVa, III, and lower portion of I), and an uncertain number of historic occupation phases, which for convenience will be considered as constituting a single continuity. Regarding the nature of occupation evidenced by the specific subsurface deposits, a distinctive contrast can be made between the principal cultural deposits, Layers III and V. While the upper layer (III) indicated habitation, the lower layer (V) suggested agricultural activity--most likely dryland swidden cultivation. Evidence for this interpretation consisted principally of: (1) contrasts in the nature, appearance, and content of the two cultural deposits--organic materials, portable artifacts, and horizontal features; and (2) contrasts with and similarities to previously investigated inland habitation and cultivation sites in Hawaii (Ayres 1970; Crozier 1974, Ms.; Denison and Forman 1971; Green [ed.] 1969, 1970; Hommon and Barrera 1971; Hommon and Bevacqua 1973; Kirch and Kelly [eds.] 1975; Ladd [ed.] 1973; Ladd and Yen [eds.] 1972; Newman n.d.; Rosendahl 1972a, b).

The archaeological evidence from Layer III, mainly the horizontal features, portable remains, and age determinations, clearly argues for habitation, most likely recurrent, temporary, and extended. Thus Layer III represents a sequence of an indeterminant number of occupations, abandonments, and reoccupations, probably associated with agricultural activities, and/or with the exploitation of natural forest products and resources, in the general area. Forest exploitation activities include a variety of not necessarily exclusive possibilities, such as procurement of wood, fiber, bark, wild plants, birds, and feral pigs for a wide range of subsistence, industrial, medicinal, and ceremonial uses.

Archaeological evidence for the interpretation of mound Layer V as a dryland cultivation deposit includes the following specific points: (1) absence of firepits or ovens--both HF-41, a burning feature, and HF-34, a charcoal

concentration, appeared to be remains of site clearing activity rather than habitation features; (2) the possible absence of layer associated postholes--HF-27 and -30 were both in a root disturbed area, and could easily have been features cut from Layer III or perhaps IVa; HF-37 was probably a root mold, not a posthole, leaving only HF-28 as the single possible posthole associated with Layer V (alternatively, these features might even have been cultivation features--planting holes made by a digging stick ('ō'ō) rather than postholes; (3) the virtual absence of portable artifacts from Layer V; (4) the nature of the identified floral remains from Layer V--remains possibly representing clearing and burning of (a) cultigen survivals, (b) natural vegetation, and/or (c) mulching materials; and (5) soil analyses results--both particle size and CHN analyses results.

A variety of associated agricultural activities can be postulated. The documented historic period irrigated pondfield cultivation of taro and rice along Kamo'oali'i Stream and numerous other small streams of the general region suggest the possibility of prehistoric pondfield cultivation of taro in the site area during the prehistoric phases of occupation; but the nature and appearance of Layer V, including the paucity of horizontal features, as well as consideration of local topography, suggested dryland cultivation, probably of dryland taro (*kalo*, *Colocasia esculenta* [L.] Schott). Dryland cultivation is more likely to have been the principal form of agricultural exploitation. Ethnographic and ethnohistoric sources such as Handy (1940), Handy & Handy (1972), and Kamakau (1976) offer several accounts of dryland-taro cultivation methods, involving such practices as clearing of vegetation cover by cutting, burning, planting in holes made with digging sticks, and extensive mulching, using materials such as grasses, fern leaves, ti, ginger, and banana leaves, and sugarcane stalks.

The same ethnographic and ethnohistoric sources cited above suggest many cultigens which could have been grown, in addition to dryland taro and sweet potatoes (*'uala*, *Ipomoea batatas* [L.] Lam.) on the higher lands between the small streams, and wet taro along the streams and in small swamps in the general locale of the site. The possibilities comprise a wide range of subsistence, industrial, medicinal, and ceremonial cultigens, including *Pandanus*, *wauke* (paper mulberry, *Broussonetia papyrifera* [L.] Vent.), bananas (*mai'a*, *Musa* spp.), *'awa* (kava, *Piper methysticum* Forst. f.), *olonā* (*Touchardia latifolia* Gaud.), breadfruit (*'ulu*, *Artocarpus altilis* [Park. ex. Z] Fosb.), yams (*uhi*, *Dioscorea alata* L.), *pia* (Polynesian arrowroot, *Tacca leontopetaloides* [L.] O. Ktze.), sugarcane, bamboo, and ti (*ki*, *Cordyline terminalis* [L.] Kunth).

The restricted archaeological remains associated with Layer IVa make suggestions for the nature of prehistoric occupation evidenced by that layer much more tenuous than for Layers III or V. Layer IVa contained several pits, all excavated into the disturbed, sterile, primary alluvium of Layer IV. These pits were interpreted as representing the earliest phase of occupation evidenced by the extensive Layer III occupation. The pit fill was composed of loose alluvial material and numerous pieces and fragments of charcoal and/or decomposed (non-carbonized) organic material. The appearance of the pits and their fill suggested a method of dryland cultivation of taro in *kukui*-forest clearings (*pā kukui*) cited by Handy and Handy (1972:109-110) in which holes, up to 9 feet in circumference and a bit more than 3 feet deep, were excavated, filled with *kukui* leaves (and wood and bark as well), and covered over with soil. The wet *kukui* debris decomposed quickly, and taro cuttings were then planted in the

holes filled with rich humus. This method reportedly produced exceedingly large taro corms. The method involving excavated pits would probably work equally well with many kinds of organic material, and could have been utilized for planting of other cultigens, such as yams.

Little can be said regarding the nature of the terminal prehistoric occupation evidenced by the portable remains recovered from Layer I. The occupation represented was apparently of a temporary habitation nature, and quite short in overall time span. It constituted the final prehistoric occupation of the site, as far as can be determined.

The nature of historic occupation evidenced by mound Layer I (deposits and features) and by the deposits of the various peripheral excavation units has been summarized in the earlier part of the Conclusion concerning the general nature and sequence of occupation at the site. Historic occupation in the site area involved both habitation and a variety of agricultural activities. The first historic occupation event for which the mound site yielded archaeological evidence was the historic burial in the pit excavated through Layers II, III, IV and V and into VI, and the subsequent construction of the overlying platform monument. Historical research of the project area has indicated that the general site area was under rice cultivation prior to A.D. 1910, and most likely under taro, as well as rice, earlier. The deposits revealed in several of the peripheral excavation units evidenced irrigated pondfield cultivation, and the cultigen involved could have been taro or rice.

The final historic occupation event for which there was direct archaeological evidence was the relatively recent creation of the mound feature. This event was most likely associated with historic agriculture and land modification activities which continued in the general site area, in conjunction with local permanent habitation, up to as recently as the middle of this century.

SIGNIFICANCE

While Site 50-OA-G5-37 was not found to be the unique type of Hawaiian site presumed earlier on the basis of the test excavations--a stratified, prehistoric, habitation mound--the salvage excavations did reveal a site significant in another way. The investigation of the site, only a remnant of more extensive deposits, revealed an aspect of Hawaiian prehistory about which relatively very little is known--the nature and time depth of prehistoric aboriginal inland occupation and terrestrial exploitation.

Site 50-OA-G5-37 can still be regarded as a unique prehistoric Hawaiian site in that it comprised, though only a remnant, a stratified subsurface, multiple component, prehistoric, inland occupation site yielding evidence of both habitation and agricultural exploitation. Given this interpretation, the site was thus unique for Hawaii in that all prehistoric inland habitation and agricultural sites archaeologically investigated to date in the Hawaiian Islands have been identified and selected for investigation on the basis of their existing surface structural remains. Thus the excavations of the mound site, while salvaging only the surviving remnant of a more extensive site, have yielded information of significance for investigating and understanding an as yet poorly defined aspect of Hawaiian prehistory--the nature and time depth

of prehistoric, inland occupation and exploitation, particularly occupation and exploitation activities for which there are no surviving surface structural remains.

SUMMARY OF MAJOR POINTS

Five major conclusions can be drawn from the archaeological salvage investigation of Site 50-OA-G5-37. First, the earthen mound was not an intentionally built, prehistoric, habitation mound. Rather, it was a relatively recent, historically created structure resulting from the extensive modification of the surrounding area--the lowering of the adjacent ground surface through removal and redistribution of soil, probably in conjunction with historic agricultural activities, possibly rice cultivation.

Secondly, the earthen mound constituted the surviving remnant of more-extensive prehistoric deposits that comprised a subsurface, stratified, multiple component, prehistoric inland occupation site. The site was occupied, most likely in a pattern of recurrent occupation, abandonment, and reoccupation, during an estimated maximum time span of approximately 325 years, A.D. 1425-1750.

Thirdly, the two major phases of prehistoric occupation evidenced by the mound deposits (Layers III and V) represented a contrast in the nature of aboriginal site occupation. The lower deposit (Layer V) suggested dryland swidden (slash and burn) cultivation, probably of taro, while the upper deposit (Layer III) indicated residential occupation, probably extended, recurrent habitation, in connection with agricultural activities and/or the exploitation of natural forest resources.

Fourthly, historic occupation of the general site area, as suggested by Layer I, was probably characterized by irrigated-pondfield cultivation of taro and rice, and accompanied by permanent residential occupation. Specific historic events evidenced by the archaeological data derived from the mound site were (1) the interment of the historic burial into the existing prehistoric site deposits, and (2) the subsequent creation of the mound structure in a manner so as to preserve the burial indicated by the low, stone-platform monument. It was this latter event that inadvertently also preserved the remnant of the more extensive prehistoric deposits.

Finally, the site represented by the mound remnant constituted a rare, possibly unique, type of Hawaiian site--a subsurface prehistoric inland occupation site lacking any prehistoric surface structural remains. Thus, the site was of particular significance in that it yielded valuable information about a poorly known aspect of Hawaiian prehistory--the nature, variability, and time depth of aboriginal inland habitation and terrestrial exploitation.

LITERATURE CITED

Ayres, William S.
1970 *Archaeological Survey and Excavations: Kamana-nui Valley, Moanalua Ahupua'a; South Halawa Valley, Halawa Ahupua'a.* Departmental Report Series 70-8. Dept. Anthropology, B.P. Bishop Museum.

Barrera, William M., Jr., and Patrick V. Kirch
1973 "Basaltic-Glass Artifacts from Hawaii: Their Dating and Prehistoric Uses." *JPS* 82(2):176-187.

Clark, R.M.
1975 "A Calibration Curve for Radiocarbon Dates." *Antiquity* XLIX, No. 196: 251-266.

Cleghorn, Paul L.
Ms. Phase II, Part 2 Archaeological Salvage Operations at Site 50-MA-B10-1, Wailea, Kihei, Maui (1975). Manuscript in Dept. Anthropology, B.P. Bishop Museum.

Cordy, Ross. H.
1975 "Hawaiian Activity Sets: Initial Results of R-Mode Multivariate Statistical Analyses." *New Zealand Arch. Assoc. Newsletter* 18(2): 59-75.

Crozier, S. Neal
1974 "Precontact Archaeological Contrasts of Three Valley Systems on Oahu, Hawaii." Unpublished M.A. Thesis (Anthropology). University of Victoria (B.C.).

Ms. A Preliminary Report on the Phase II, Part 2 Survey of H-3 Highway Corridor in the South Halawa Valley, Oahu (1972). Manuscript in Dept. Anthropology, B.P. Bishop Museum.

Davidson, Janet M.
1969 "Archaeological Excavations in Two Burial Mounds at 'Atale, Tongatapu." *Records of the Auckland Institute and Museum* 6(4-6):251-286.

1971 "Preliminary Report on an Archaeological Survey of the Uava'u Group, Tonga." IN "Cook Bicentenary Expedition in the South-west Pacific." R. Fraser (comp.). *Bulletin of the Royal Society of New Zealand* 8:29-40.

Denison, David O., and Arthur S. Forman
1971 *Archaeological Investigations in South Halawa Valley, Ewa District, Island of Oahu--Phase II.* Departmental Report Series 71-9. Dept. Anthropology, B.P. Bishop Museum.

Dumond, D.E.
1963 "A Practical Field Method for the Preservation of Soil Profiles from Archaeological Cuts." *American Antiquity* 29(1):116-118.

Green, R.C. (ed.)
1969 *Makaha Valley Historical Project: Interim Report No. 1.* Pacific Anthropological Records No. 4. Dept. Anthropology, B.P. Bishop Museum.

Green, R.C. (ed.)
1970 *Makaha Valley Historical Project: Interim Report No. 2.* Pacific Anthropological Records No. 10. Dept. Anthropology, B.P. Bishop Museum.

Green, R. C., and Janet M. Davidson (eds.)
1969 *Archaeology in Western Samoa, Volume 1.* Bulletin of the Auckland Institute and Museum, No. 6.

1974 *Archaeology in Western Samoa, Volume 2.* Bulletin of the Auckland Institute and Museum, No. 7.

Handy, E.S. Craighill
1940 *The Hawaiian Planter, Vol. 1.* B.P. Bishop Mus. Bull. 161. Honolulu.

Handy, E.S. Craighill, and Elizabeth Green Handy
1972 *Native Planters in Old Hawaii.* B.P. Bishop Mus. Bull. 233. Honolulu.

Hommon, Robert J., and William Barrera, Jr.
1971 *Archaeological Survey of Kahana Valley, Ko'olauloa District, Island of Oahu.* Departmental Report Series 71-3. Dept. Anthropology, B.P. Bishop Museum.

Hommon, Robert J., and Robert F. Bevacqua
1973 *Excavations in Kahana Valley, Oahu, 1972.* Departmental Report Series 73-2. Dept. Anthropology, B.P. Bishop Museum.

Kamakau, Samuel M.
1976 *The Works of the People of Old: Na Hana aka Po'e Kahiko.* Mary Kawena Pukui (trans.); Dorothy B. Barrère (ed.). B.P. Bishop Mus. Spec. Pub. 61. Honolulu.

Kikuchi, William K.
1963 "Archaeological Surface Remains in American Samoa." Unpublished M.A. Thesis (Anthropology). University of Hawaii.

Kirch, Patrick Vinton
In press "Ethnoarchaeological Investigations in Futuna and Uvea (Western Polynesia): A Preliminary Report." *JPS.*

Ms. Marine Exploitation in Prehistoric Hawaii: Archaeological Investigations at Kalāhuipua'a, Hawaii Island (1976). Manuscript in Dept. Anthropology, B.P. Bishop Museum.

Kirch, Patrick Vinton, and Marion Kelly (eds.)
1975 *Prehistory and Ecology in a Windward Hawaiian Valley: Halawa Valley, Molokai.* Pacific Anthropological Records No. 24. Dept. Anthropology, B.P. Bishop Museum.

Ladd, Edmund J. (ed.)
1973 *Makaha Valley Historical Project: Interim Report No. 4.* Pacific Anthropological Records No. 19. Dept. Anthropology, B.P. Bishop Museum.

Ladd, Edmund J., and Douglas E. Yen (eds.)
1972 *Makaha Valley Historical Project: Interim Report No. 3.* Pacific Anthropological Records No. 18. Dept. Anthropology, B.P. Bishop Museum.

Macdonald, Gordon A., and Agatin T. Abbott
1970 *Volcanoes in the Sea. The Geology of Hawaii.* Honolulu: University of Hawaii Press.

McKern, W.C.
1929 *Archaeology of Tonga.* B.P. Bishop Mus. Bull. 60. Honolulu.

McCoy, Patrick C.
1974 "A Stratified Earthen Habitation Mound on Windward Oahu, Hawaii." *JPS* 83(2):227-233.

Morgenstein, Maury
1969 "Composition and Development of Palagonite in Deep-Sea Sediments from the Atlantic and Pacific Oceans." Unpublished M.A. Thesis. Syracuse University.

Ms. Manuscript Report on Sedimentation Analyses and Preliminary Palynomorph Analysis of Soil Samples from Site 50-OA-G5-37, Upland Kaneohe, Oahu. Manuscript in Dept. Anthropology, B.P. Bishop Museum.

Morgenstein, Maury, and William C. Burnett
1972 "Report 5. Geologic Observations at an Agricultural Area in the Upper Makaha Valley." IN Ladd and Yen (eds.) 1972:95-110.

Morgenstein, Maury, and Thomas J. Riley
1974 "Hydration-Rind Dating of Basaltic Glass: A New Method for Archaeological Chronologies." *Asian Perspectives* XVII(2):145-159.

Morgenstein, Maury, and Paul Rosendahl
In press "Basaltic Glass Hydration Dating." IN *Advances in Obsidian Glass Studies: Archaeological and Geological Perspectives.* R. E. Taylor (ed.). Park Ridge, New Jersey: Noyes Press.

Neal, Marie C.
1965 *In Gardens of Hawaii.* B. P. Bishop Mus. Spec. Pub. 50. Honolulu.

Newman, T. Stell
n.d. Hawaiian Fishing and Farming on the Island of Hawaii in A.D. 1778. Division of State Parks, Department of Land and Natural Resources, State of Hawaii. (Distributed in 1970.)

Olsson, Ingrid U. (ed.)
1970 *Radiocarbon Variations and Absolute Chronology.* Proceedings of the Twelfth Nobel Symposium, Uppsala, Sweden (August 1969). New York: John Wiley and Sons.

Polach, Henry, and Jack Golson
1968 "The Collection and Submission of Radiocarbon Samples." IN *Australian Archaeology: A Guide to Field Techniques.* J. Mulvaney (ed.). Australian Institute of Aboriginal Studies, Manual No. 4. Canberra.

Pukui, Mary Kawena, and Samuel H. Elbert
1971 *Hawaiian Dictionary.* Honolulu: University of Hawaii Press.

Ralph, E. K., H. N. Michael, and M. C. Han
1973 "Radiocarbon Dates and Reality." *MASCA Newsletter* 9(1):1-20.

Rogers, Garth
1974 "Archaeological Discoveries on Niuatoputapu Island, Tonga." *JPS* 83(3):308-348.

Rosendahl, Paul H.
1972a "Aboriginal Agriculture and Residence Patterns in Upland Lapakahi, Island of Hawaii." Unpublished Ph.D. Dissertation (Anthropology). University of Hawaii.

1972b *Archaeological Salvage of the Hapuna-Anaehoomalu Section of the Kailua-Kawaihae Road (Queen Kaahumanu Highway), Island of Hawaii.* Departmental Report Series 72-5. Dept. Anthropology, B. P. Bishop Museum.

Ms. A Preliminary Report Upon Completion of Archaeological Fieldwork in the Upper Kamo'oali'i Stream Drainage Area, Kāne'ohe, Ko'olaupoko, O'ahu, Hawai'i (1975). Manuscript in Dept. Anthropology, B. P. Bishop Museum.

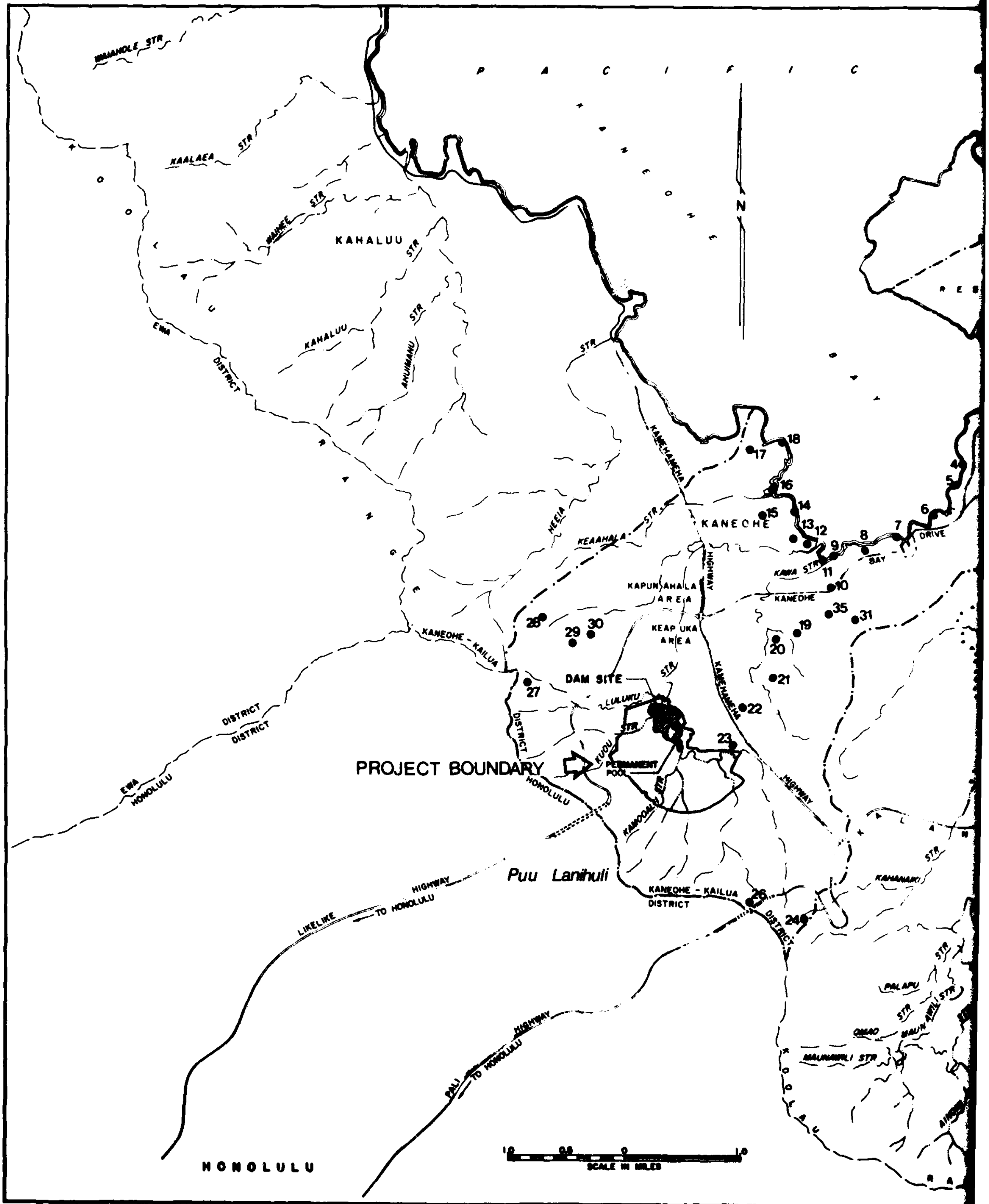
Stearns, Harold T., and Knute N. Vaksvik
1935 *Geology and Ground-Water Resources of the Island of Oahu, Hawaii.* Bulletin 1, Division of Hydrography, Territory of Hawaii.

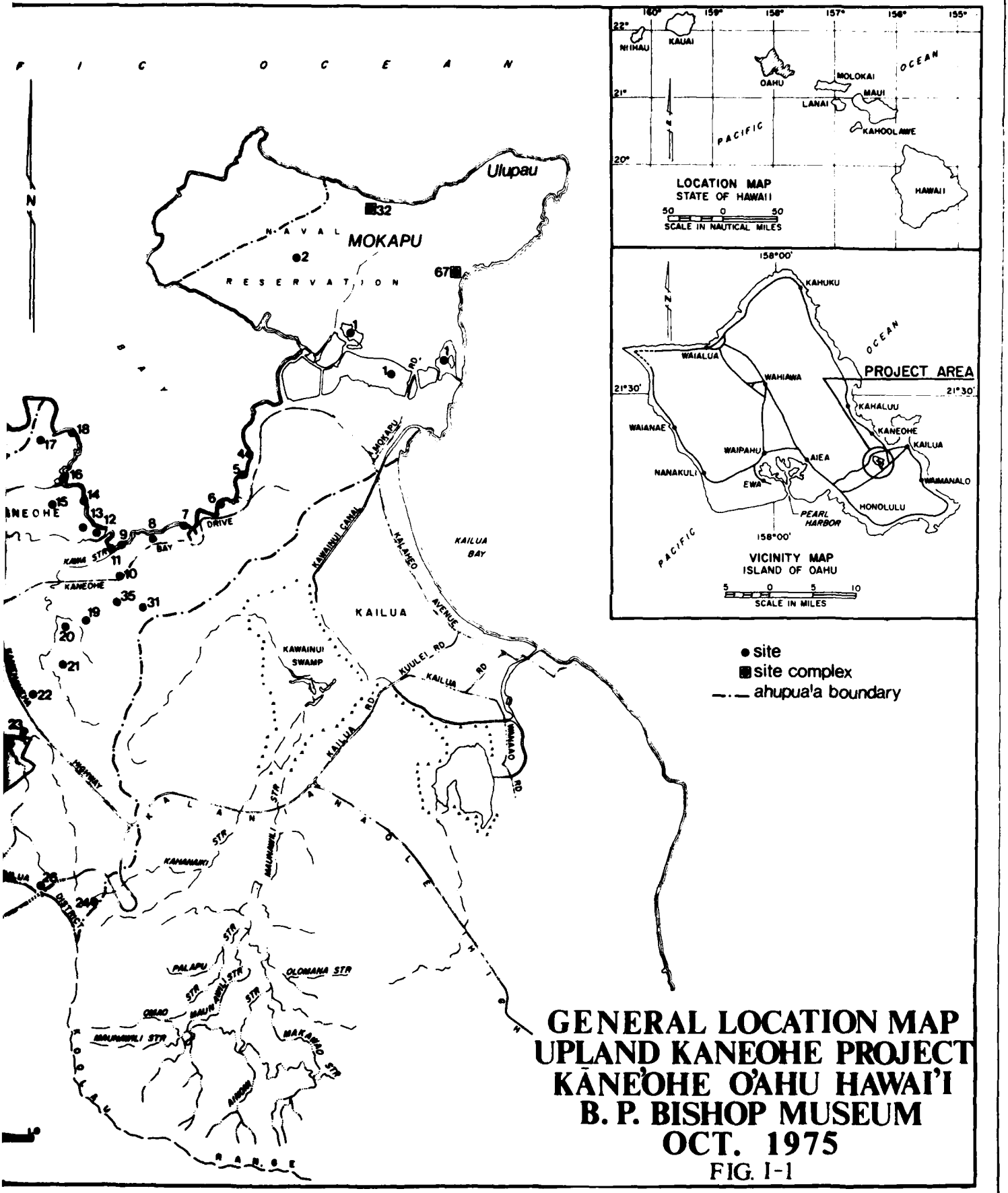
Stuiver, Minze, and Hans E. Suess
1966 "On the Relationship between Radiocarbon Dates and True Sample Ages." *Radiocarbon* 8:534-540. (Table 1, p. 537).

Suess, Hans E.
1965 "Secular Variations of the Cosmic-Ray-Produced Carbon 14 in the Atmosphere and Their Interpretations." *Journal of Geophysical Research* 70(3):5937-5952.

1970 "Bristlecone-pine Calibration of the Radiocarbon Time-Scale 5200 B.C. to the Present." IN Olsson (ed.) 1970:303-309.

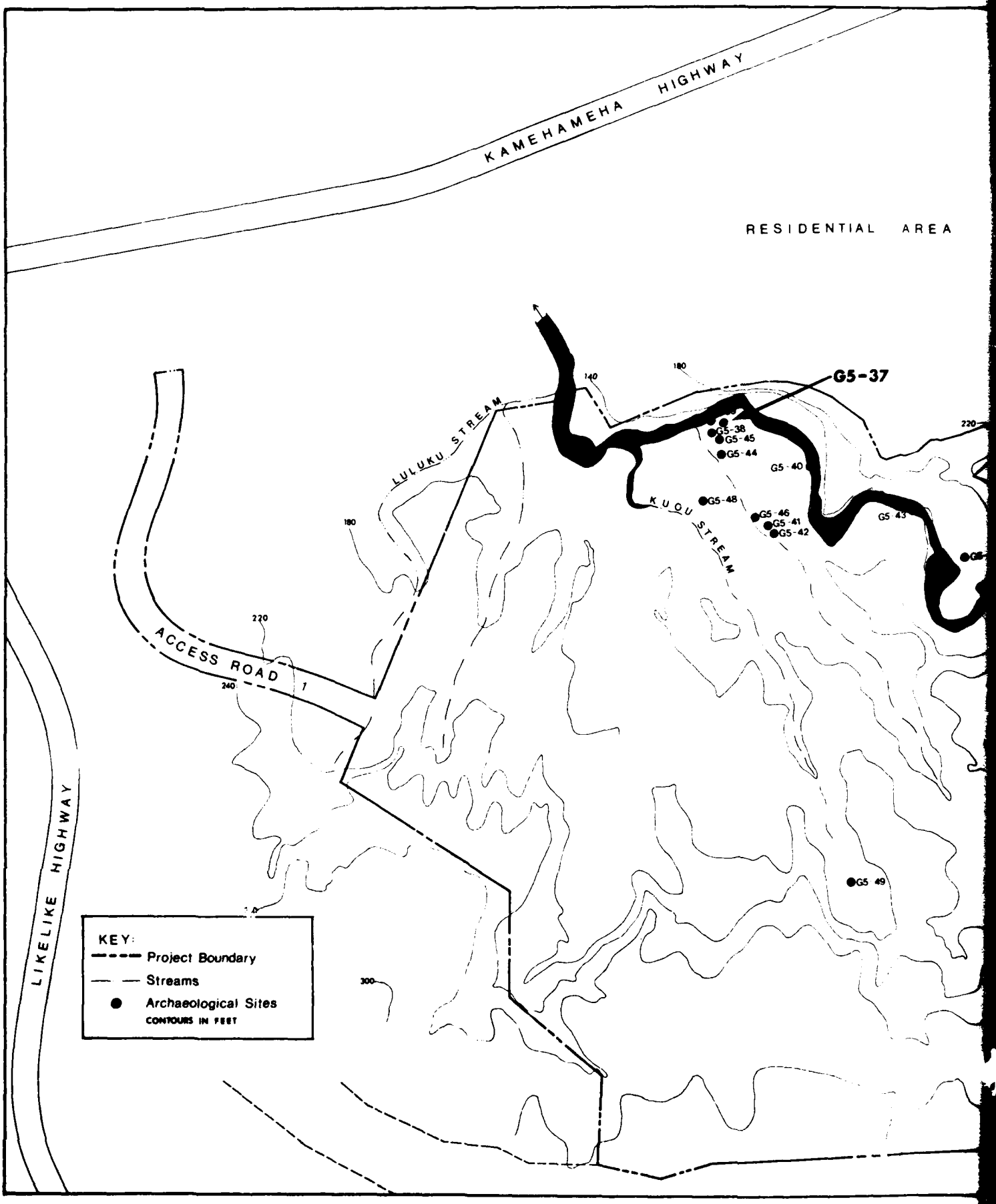
Takemoto, Anne H.
Ms. Historical/Cultural Essay Report on the Upper Kamo'oali'i Stream Drainage and Surrounding Area of Kaneohe, Oahu (1976). Manuscript on file in Dept. Anthropology, B. P. Bishop Museum.

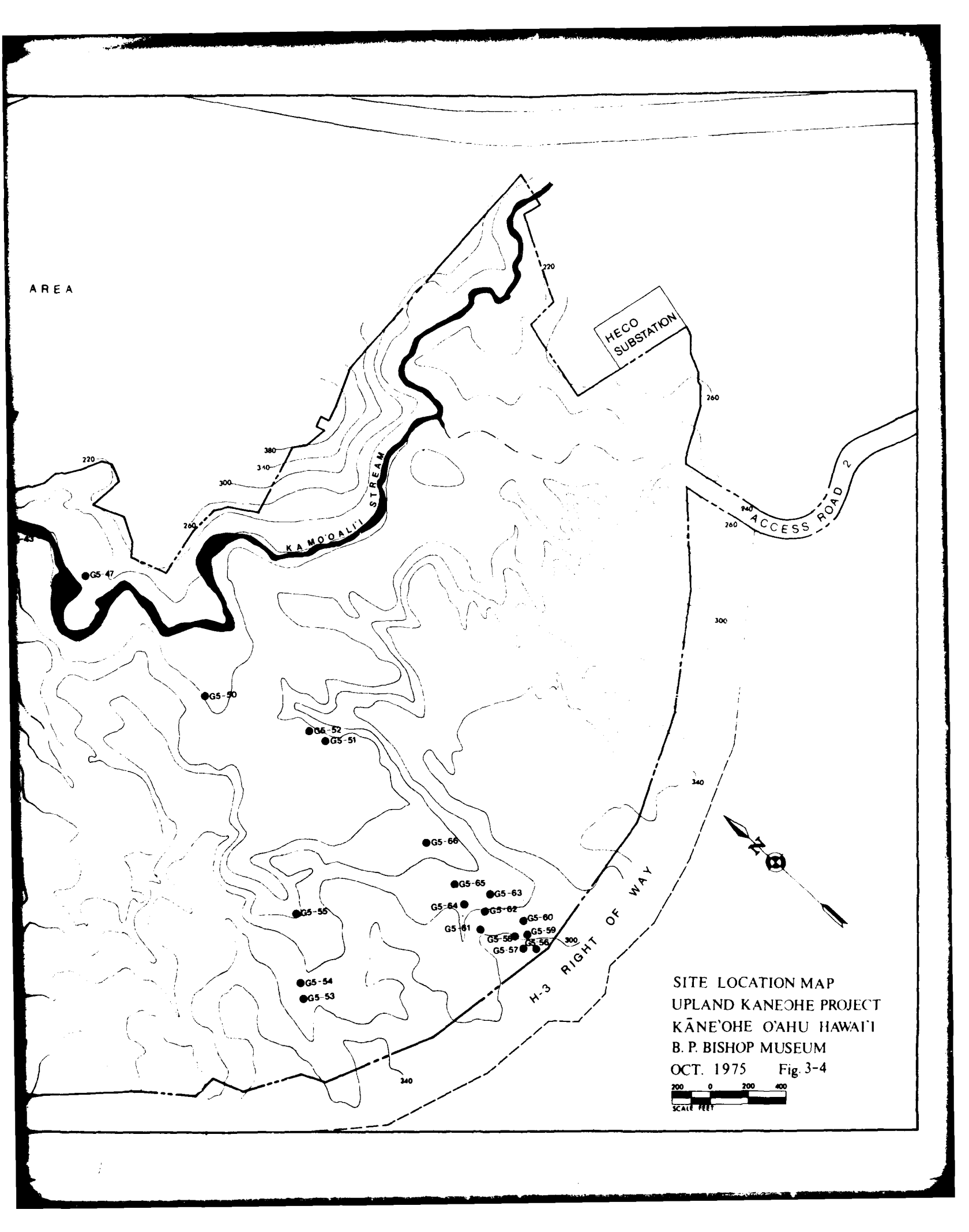

PACIFIC
KANEOHE BAY
N
WAIAHOLE STR
KAALAEA STR
WAIHEE STR
KAHALUU
KAHALUU STR
AHUIMANU STR
KOOLAU RANGE
EWA DISTRICT
HEEIA
KEAAHALA STR
KAMEHAMEHA HIGHWAY
KANEOHE
KAWA STR
BAY DRIVE
KAPUNAHALA AREA
KEAPUKA AREA
DAM SITE
LULUKU STR
KUOU STR
PERMANENT POOL
KAMOOALII STR
PROJECT BOUNDARY
KANEOHE - KAILUA DISTRICT
HONOLULU DISTRICT
EWA DISTRICT
Puu Lanihuli
LIKELIKE HIGHWAY TO HONOLULU
PALI HIGHWAY TO HONOLULU
KANEOHE - KAILUA DISTRICT
KAILUA
KAWAINUI STR
PALAPU STR
OMAO STR
MAUNAWILI STR
HONOLULU
SCALE IN MILES



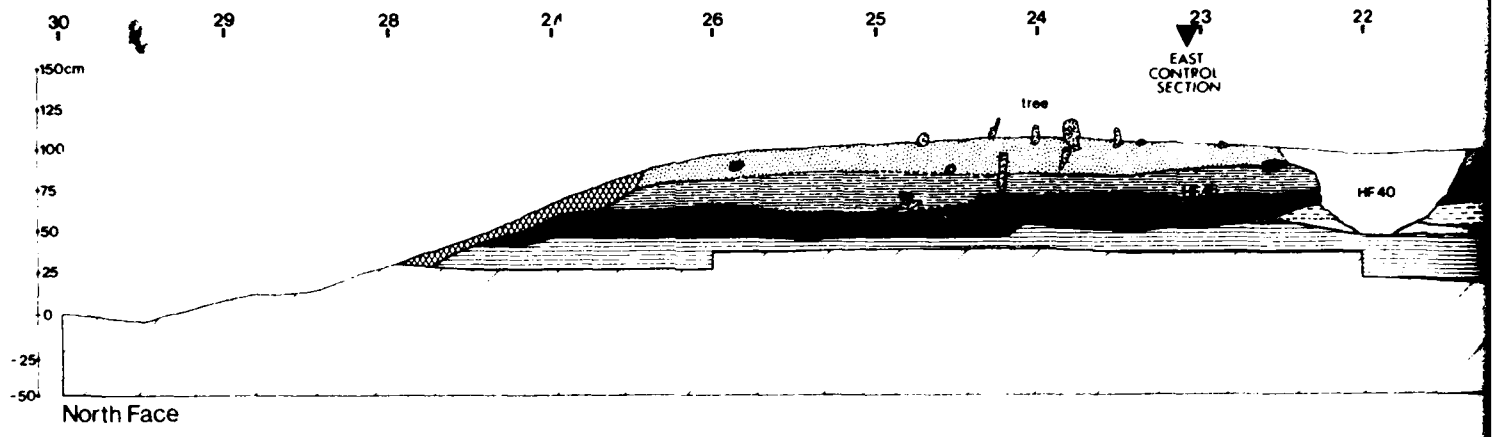
GENERAL LOCATION MAP
UPLAND KANEOHE PROJECT
KĀNE'OHE O'AHU HAWAI'I
B. P. BISHOP MUSEUM
OCT. 1975

FIG. I-1

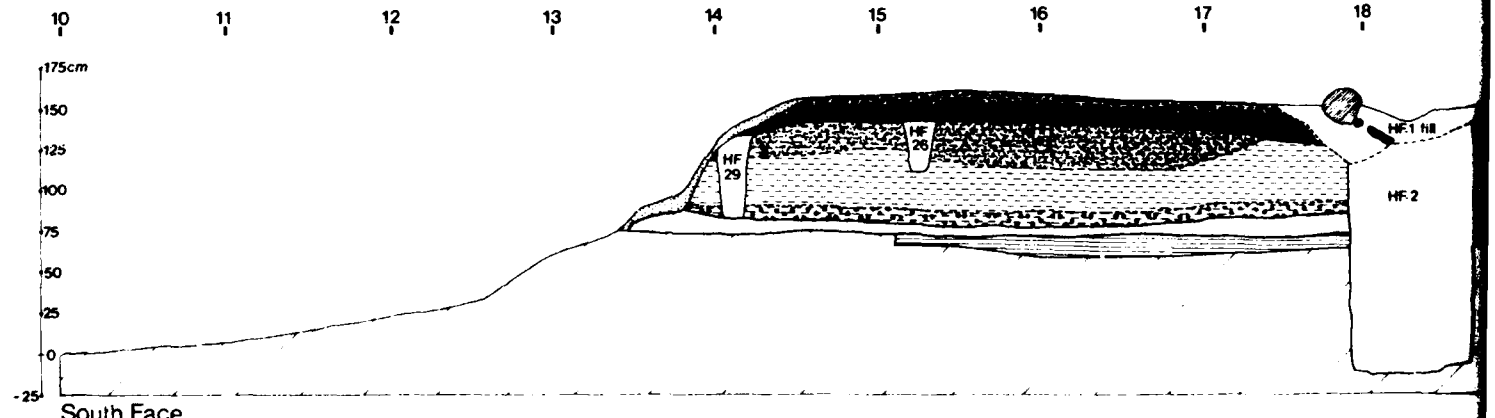

KAMEHAMEHA HIGHWAY
RESIDENTIAL AREA
G5-37
G5-38
G5-45
G5-44
G5-40
G5-48
G5-46
G5-41
G5-42
G5 43
G5 49
LULUKU STREAM
KUOU STREAM
ACCESS ROAD 1
LIKELIKE HIGHWAY
140
180
220
240
300
KEY:
Project Boundary
Streams
Archaeological Sites
CONTOURS IN FEET



SITE LOCATION MAP
UPLAND KANEOHE PROJECT
KĀNE'OHE O'AHU HAWAI'I
B. P. BISHOP MUSEUM
OCT. 1975 Fig. 3-4



North Face



South Face

50-OA-G5-37 baulk 1

Fig. 6-10. Vertical

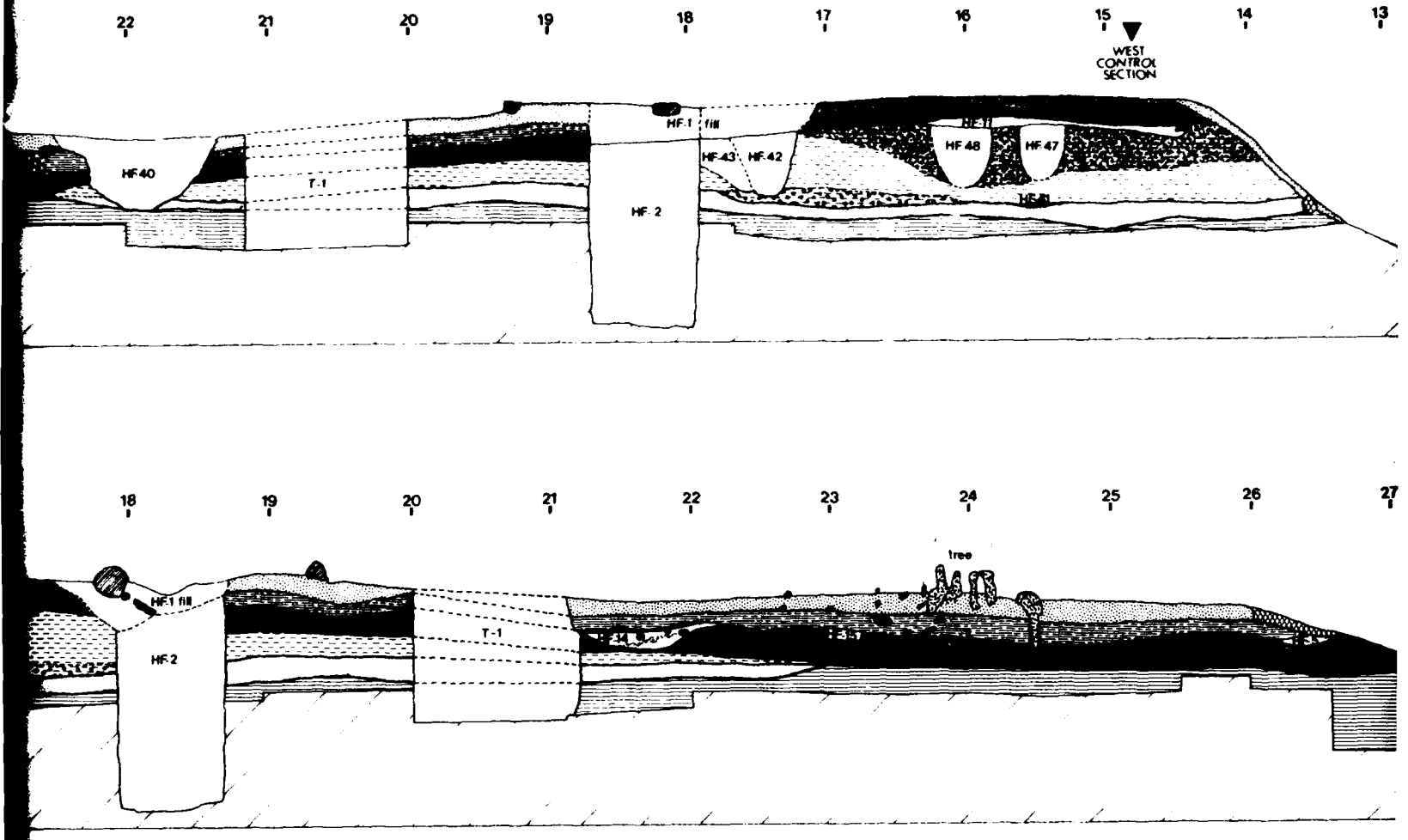
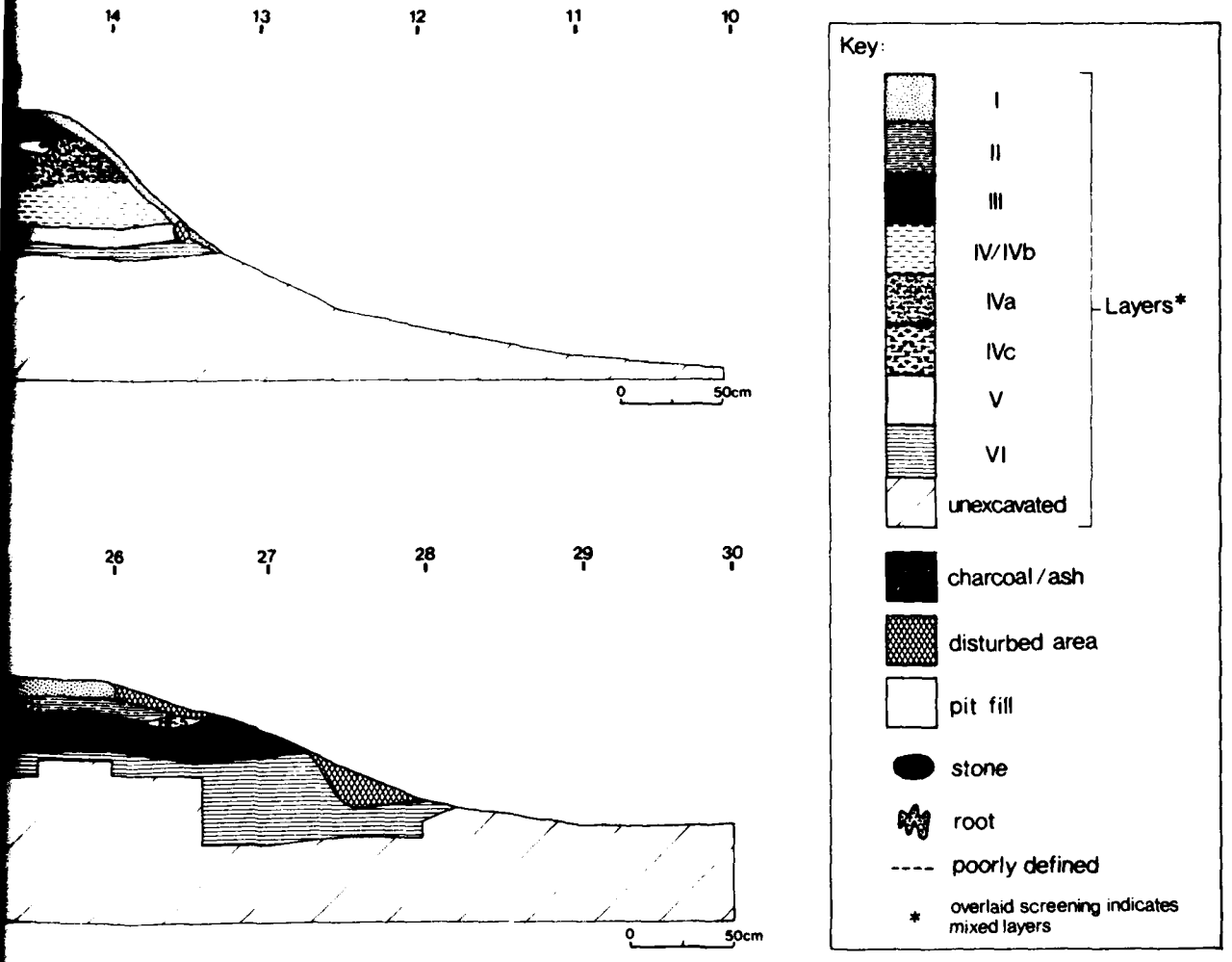


Fig. 6-10. MOUND CROSS-SECTIONS. Views of N and S faces of Baulk No. 1. Vertical scale indicates elevation above ground surface.


14
13
12
11
10
0
50cm
26
27
28
29
30
0
50cm
Key:
I
II
III
IV/IVb
IVa
IVc
V
VI
unexcavated
Layers*
charcoal/ash
disturbed area
pit fill
stone
root
poorly defined
* overlaid screening indicates mixed layers