ARCHAEOLOGICAL RESEARCH at
FORT ELIZABETH, WAIMEA, KAUAI,
HAWAIIAN ISLANDS, PHASE I

by

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The opinions, findings, and conclusions expressed in this publication are those of the author and not necessarily those of the State.
This report presents the results of a three-week study of Fort Elizabeth at Waimea, Kauai. It includes a brief historical sketch of the fort followed by a descriptive-interpretive section on the fort and two other beach-front sites.

I am grateful to Dr. Yosihiko Sinoto, Museum supervisor, for his suggestions on organization of the fieldwork inside the fort. He gave me, however, complete freedom as field director to undertake the work as I saw best; I duly appreciate this consideration. Neal Crozier and Aki Sinoto, Bishop Museum crew members, are sincerely thanked for their fine efforts in successfully completing the mapping and excavations. Jeff Perkins of Kekaha, Kauai, was the fourth crew member.

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State Parks employees on Kauai--Masato Kutaka, Isamu Gushiken, and James Marques--kindly lent us hand tools and permitted us to store our own tools in their equipment shed. Mr. Kutaka dug several backhoe trenches and also donated three cannon balls he had earlier found near the fort walls.

In the Museum, Freddie Harby, lab technician, catalogued the artifacts and undertook the midden analysis, including preparation of tables for this report. Alan Ziegler, Bishop Museum vertebrate zoologist, kindly identified the mammal and bird remains. Stell Newman, archaeologist, Hawaii State Department of Land and Natural Resources, aided in the identification of historic artifacts and provided written material for further research. Peter Gathercole, visiting summer lecturer in anthropology at the University of Hawaii, identified ramrod pipes from a musket and pistol. Jane Silverman, historian, Hawaii State Department of Land and Natural Resources, kindly provided historical documents and a compilation of historical source materials on Fort Elizabeth.

I am most grateful to the Hawaiian Mission Children's Society for their permission to quote from the Ruggles' letter and the Whitney Journals, all of which I was privileged to examine in their library.
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Patrick C. McCoy
August 1972
CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>ENVIRONMENTAL SETTING OF THE WAIMEA AREA</td>
<td>1</td>
</tr>
<tr>
<td>FORT ELIZABETH, SITE 50-KA-05-1000</td>
<td>5</td>
</tr>
<tr>
<td>Brief Historical Background</td>
<td>5</td>
</tr>
<tr>
<td>Field Techniques</td>
<td>10</td>
</tr>
<tr>
<td>Descriptive Archaeology</td>
<td>10</td>
</tr>
<tr>
<td>General Description</td>
<td>10</td>
</tr>
<tr>
<td>Wall Construction</td>
<td>13</td>
</tr>
<tr>
<td>Interior Features</td>
<td>18</td>
</tr>
<tr>
<td>Exterior Features</td>
<td>21</td>
</tr>
<tr>
<td>Cultural Materials</td>
<td>26</td>
</tr>
<tr>
<td>THE PREHISTORIC SITE, 50-KA-05-1001</td>
<td>33</td>
</tr>
<tr>
<td>Previous Archaeological Research on SW Kauai</td>
<td>33</td>
</tr>
<tr>
<td>Site Description</td>
<td>33</td>
</tr>
<tr>
<td>Descriptive Archaeology</td>
<td>34</td>
</tr>
<tr>
<td>Plan of Excavation</td>
<td>34</td>
</tr>
<tr>
<td>Summary of Work</td>
<td>35</td>
</tr>
<tr>
<td>Physical Stratigraphy</td>
<td>36</td>
</tr>
<tr>
<td>Cultural Stratigraphy</td>
<td>36</td>
</tr>
<tr>
<td>Cultural Materials</td>
<td>40</td>
</tr>
<tr>
<td>Cultural-Historical Interpretation</td>
<td>51</td>
</tr>
<tr>
<td>SITE 50-KA-05-1002</td>
<td>55</td>
</tr>
<tr>
<td>SUMMARY AND RECOMMENDATIONS</td>
<td>55</td>
</tr>
<tr>
<td>Appendix A. Description of Geologic Units</td>
<td>56</td>
</tr>
<tr>
<td>Appendix B. Midden Material from Site 50-KA-05-1001</td>
<td>58</td>
</tr>
<tr>
<td>References</td>
<td>60</td>
</tr>
</tbody>
</table>
TABLES

Table
1 Soils in the project area ........................................ 4
2 Major historical events relating to Fort Elizabeth ............ 6
3 Numerical frequency of artifact categories in site
   50-KA-05-1000 ........................................ 27
4 Numerical frequency of artifact categories in site
   50-KA-05-1001 ........................................ 40
5 Midden material, site 50-KA-05-1001 .......................... 52
6 Midden material in fill from backhoe trenches at
   site 50-KA-05-1001 .................................... 54

ILLUSTRATIONS

Figure
1 Map of Kauai showing project area ............................... 2
2 Physiographic subdivisions of Kauai ............................. 3
3 Rainfall and drainage map of Kauai ............................. 4
4 Vegetation-zone map of Kauai ................................... 5
5 Map of Fort Elizabeth and related features .................... 63-65
6 Site-location map showing excavation areas .................... 11
7 Fort Elizabeth and vicinity from the sea, 1924 ................ 12
8 1885 planview map of Fort Elizabeth .......................... 14
9 Photographs of details at corner 9 ............................. 15
10 Diagrammatic sketch of stages of wall construction ............ 17
11 Juncture of steps and fort wall at corner 4 .................... 21
12 Steps at corner 4 ......................................... 22
13 Steps at corner 8 ......................................... 23
14 Stone pavement outside fort entrance .......................... 24
15 Grinding stones, cluster G, beneath wharf ..................... 26
16 Gun flints found in fort .................................... 28
17 Ramrod pipes found in fort .................................. 28
18 Nails and spike found in fort ................................ 29
19 French Phoenix button found in fort ........................... 31
20 Cowry-shell octopus lure found hidden in wall of fort at
   corner 5, test pit 6 .................................... 32
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Excavation grid in site 50-KA-05-1001, area B</td>
<td>35</td>
</tr>
<tr>
<td>22</td>
<td>Stratigraphic section of W and N faces of BT-2, site 50-KA-05-1001</td>
<td>37</td>
</tr>
<tr>
<td>23</td>
<td>BT-3 stratigraphy, site 50-KA-05-1001</td>
<td>38</td>
</tr>
<tr>
<td>24</td>
<td>Block diagram of NW corner of BT-2, site 50-KA-05-1001, showing stratigraphic sequence of cultural features exposed</td>
<td>39</td>
</tr>
<tr>
<td>25</td>
<td>Poi pounder in situ on W face of BT-2, site 50-KA-05-1001</td>
<td>39</td>
</tr>
<tr>
<td>26</td>
<td>Conus-shell adzes from W face of BT-3, site 50-KA-05-1001</td>
<td>41</td>
</tr>
<tr>
<td>27</td>
<td>Poi pounders from BT-2, site 50-KA-05-1001</td>
<td>43</td>
</tr>
<tr>
<td>28</td>
<td>Fishhooks from BT-2 and BT-3, site 50-KA-05-1001</td>
<td>44</td>
</tr>
<tr>
<td>29</td>
<td>Fishhook files from stratum II of BT-2 and BT-3, site 50-KA-05-1001</td>
<td>46</td>
</tr>
<tr>
<td>30</td>
<td>Bone picks and awl from squares S1W2 and S1E1 and BT-3 fill, site 50-KA-05-1001</td>
<td>46</td>
</tr>
<tr>
<td>31</td>
<td>Ornaments from site 50-KA-05-1001</td>
<td>48</td>
</tr>
<tr>
<td>32</td>
<td>Bottle tops and stopper from site 50-KA-05-1001</td>
<td>40</td>
</tr>
</tbody>
</table>
INTRODUCTION

An agreement between the Hawaii State Department of Land and Natural Resources and Bernice P. Bishop Museum enabled a first-phase study of Russian-built Fort Elizabeth at Waimea, Kauai, between June 19 and July 7, 1972. This investigation constituted the initial stage of a long-term project aimed at eventual restoration of the fort and development of adjacent land as a state park. The project area is located in the ahupua'a* of Makaweli in the district of Waimea, at longitude 159° 40' and latitude 21° 56' (Fig. 1).

The purpose of this first phase of the Russian fort project was twofold. First, prerequisite to further investigation of the fort was the preparation of a detailed map showing features both inside and outside of the structure. The second research aim was to determine whether or not there was any prehistoric occupation of the immediate area. The two undertakings are quite different and therefore are discussed separately.

ENVIRONMENTAL SETTING OF THE WAIMEA AREA

The initial dome-like contour of Kauai has been subjected to various types of geomorphological alterations, resulting in a highly diversified physiography. Hinds (1930:21-22) defined four physiographic subdivisions on Kauai (Fig. 2), two of which meet along the Waimea River in the project area. East of the river is a large, emerged, wave-cut platform; while this platform was elevated E of the Waimea River by tilting, the area to the W was submerged. A fringing reef grew on the submerged platform; it later died and was covered by erosional debris from the reef and the highlands to the E. These constructional plains constitute the second of the four physiographic provinces on Kauai (Hinds, 1930:35,42).

Geologically, the project area is uncomplicated, unlike many areas on Kauai. The plain above the E bank of the Waimea River is part of the Koloa volcanic series, which includes a variety of basalts. Younger, unconsolidated, alluvial sediments are found in a narrow strip along the river (Macdonald, Davis, and Fox, 1960:Pl. 1).

*An ahupua'a is an old Hawaiian land division, usually wedge-shaped and extending from the sea to the mountains.
Fig. 1. MAP OF KAUAI SHOWING PROJECT AREA.
Pedologically, the area is more diversified because of a number of different soil-forming environments—a plain, a beach, and a river bank. Soils are briefly described in Table 1. This information should be considered in evaluating the type of vegetative cover and agriculture the area could support in the aboriginal period, prior to use of chemical fertilizers.

Waimea, on the leeward side of the island, is hot and dry. The mean annual temperature at Mana, a few miles W, is 73.9°F (Cline, 1955:6). The area is distinctly arid, with a mean annual precipitation of 20 in. or less (Fig. 3). Figures on wind velocities and prevailing direction are not readily available, but we observed in a three-week period both N and S (Kona) winds; calm prevailed, but gusts were not uncommon on the shoreline.

The aboriginal vegetation pattern is difficult to reconstruct because of extensive disturbance since the introduction of sugarcane and other exotic, nonfood species, which have become dominant. The project area falls within the Hosaka and Ripperton (1955) vegetation zone A encompassing the arid region of southwestern Kauai (Fig. 4). It follows that ground cover is sparse in this semi-desert environment. The predominant vegetation was classified by Hosaka and Ripperton (1955:99) as the lowland-shrub type. Kiawe (Prosopis pallida) is currently the dominant species in the vicinity of the fort. Scattered kukui nuts (Aleurites moluccana) around the fort indicate the former presence of this tree.
Table 1. Soils in the Project Area: Classification and Description based on Cline (1955).

<table>
<thead>
<tr>
<th>Soil Order</th>
<th>Soil Group</th>
<th>Salient Characteristics</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zonal</td>
<td>Low-Humic Latosols</td>
<td>Clays low in plasticity and stickiness; well drained; minimal accumulation of organic matter; concentration of manganese dioxide in upper part of profile.</td>
<td>Well suited for sugarcane and pineapple.</td>
</tr>
<tr>
<td></td>
<td>Reddish-Brown Soils</td>
<td>Occur in areas with rainfall between 20 and 60 in.; primary minerals dominate; chemical weathering is slow.</td>
<td>Generally poor for agriculture.</td>
</tr>
<tr>
<td>Intra-zonal</td>
<td>Dark Magnesium Clays</td>
<td>Occur on lowlands influenced by seepage water from lavas.</td>
<td>Used to moderate extent for sugarcane.</td>
</tr>
<tr>
<td>Azonal</td>
<td>Regosols</td>
<td>Beach sands; little or no profile development.</td>
<td>Poorly suited for agriculture; dominant use for grazing.</td>
</tr>
<tr>
<td></td>
<td>Lithosols</td>
<td>Occur on rough, broken, stony uplands; little or no profile development.</td>
<td>Poorly suited for agriculture.</td>
</tr>
</tbody>
</table>

Fig. 3. RAINFALL AND DRAINAGE MAP OF KAUAI. Drainage from U.S. Geological Survey, Water-supply paper 318. Rainfall data from U.S. Weather Bureau. Boundaries of drainage basins indicated by heavy lines. Scale: 1 in. = 8.85 miles (from Hinds, 1930:13).
Fig. 4. VEGETATION-ZONE MAP OF KAUA'I (based on Ripperton and Hosaka, 1942; Cline, 1955).

Zone A - leeward coastal area; low shrubs and kiawe, generally sparse
Zone B - coastal and above A; same vegetation as A but more extensive
Zone C - leeward above B but can extend to sea on windward
  C₁ - sealevel to 2500 ft; good ground cover; open stands of shrubs with grass
  C₂ - 2500 - 4000 ft; once heavily forested, now more open; ohia lehua and koa predominant
Zone D - windward sides of higher mountain areas
  D₁ - guava predominant, with ohia lehua, hala, kukui, and ferns
  D₂ - ohia lehua predominant, with koa, some guava and ferns

BRIEF HISTORICAL BACKGROUND

A relatively rich corpus of written and graphic information exists for Fort Elizabeth--it includes journal entries, letters, secondary descriptions based on earlier accounts, maps, and photographs. A large

*The Hawaii State site designation is interpreted as follows: the 50 indicates Hawaii, the 50th state; KA represents the Island of Kauai; 05 is the USGS Quad Map number in which the site is found; the last number is the individual site number. The Bishop Museum number for this site is 50-KA-C2-14.
part of this data is presented in Richard A. Pierce's (1965) scholarly work *Russia's Hawaiian Adventure, 1815-1817*, and Klaus Mehnert's (1939) earlier, shorter treatment, *The Russians in Hawaii 1804-1819*. Both of these works have been standard references for later researchers, whose interests have been focused on extracting information bearing directly on archaeological investigation and eventual restoration of the fort. I refer here to manuscripts by Silverman (Ms.), historian with the Department of Land and Natural Resources, State of Hawaii, and Kikuchi (Ms.a), instructor of anthropology at Kauai Community College. The brief historical sketch presented here draws heavily on these manuscripts, which are compilations of major events and facts presented in chronological order.

The intention of this section is to: 1) summarize briefly the sequence of events from construction of the fort in 1816 to its dismantlement in 1864, and 2) relate information important in archaeological interpretation of the fort. A minor amount of information is directly relevant to this first-phase work, aimed primarily at mapping and description of observable surface features. A sequence of major historical events relating to the fort is presented in Table 2.

Table 2. Major Historical Events Relating to Fort Elizabeth

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>Jan 31, 1815</td>
<td>Russian-American ship <em>Bering</em> wrecked at Waimea, Kauai</td>
</tr>
<tr>
<td>May 16, 1816</td>
<td>Dr. Anton Schäffer arrived on ship <em>Otkrytie</em> to retrieve lost cargo of <em>Bering</em></td>
</tr>
<tr>
<td>Sep 12, 1816</td>
<td>Fort construction begun, following Schäffer's plans</td>
</tr>
<tr>
<td>Nov 25, 1816</td>
<td>Fort Elizabeth and two palisaded, earth fortresses on opposite side of island nearly completed by Russians</td>
</tr>
<tr>
<td>May 1817</td>
<td>Hawaiians expel Schäffer and Russians from fort</td>
</tr>
<tr>
<td>1818</td>
<td>Fort occupied by King Kaumualii, chiefs and about 150 warriors until king's death in May 1824</td>
</tr>
<tr>
<td>Apr 24, 1821</td>
<td>Reverend Whitney and family moved into new house on S side of fort</td>
</tr>
<tr>
<td>Aug 8, 1824</td>
<td>Fort Elizabeth attacked by rebellious Hawaiians, led by deceased king's son, George Kaumualii, who were dissatisfied over redistribution of land</td>
</tr>
<tr>
<td>1853</td>
<td>Only about half dozen troops occupy fort</td>
</tr>
<tr>
<td>1864</td>
<td>Fort dismantled by government order</td>
</tr>
</tbody>
</table>
During its 48-year active history (1816-1864), Fort Elizabeth was controlled by two groups, Russians and Hawaiians. The Russian period (1816-1817) was unexpectedly brief and marked by calm. The Hawaiian period was also peaceful with the exception of a short-lived rebellion in 1824 following the death of King Kaumualii. The short history of the fort is reasonably well-documented except in the final years, when it hardly functioned. Use of the fort and adjacent lands differed in time. Accordingly, there are structural remains separated in time; seriation of these and determination of function is a central problem in the fort restoration. The two periods of occupancy are discussed below.

Russian Period (1816-1817)

Beginning in 1804 the Russians had had sporadic contacts with Hawaii, principally for the purpose of obtaining foodstuffs for a trading outpost at Sitka, Alaska. One such adventure ended in misfortune—the Bering was blown ashore at Waimea Bay, Kauai, in early 1815, and the cargo was confiscated by King Kaumualii. The captain and crew returned to Sitka, whereon it was decided to send out another ship to retrieve the valuable goods. A German-born doctor, Anton Schäffer, was sent out by Governor Baranov with orders to recover the lost goods or an equitable amount of sandalwood, and at the same time attempt to obtain a monopoly on the sandalwood trade within King Kamehameha's domain. After some time in the islands, Schäffer sailed to Kauai, which he may have hoped to claim for his company.

Schäffer received in a few short days more than hoped for: return of the Bering's cargo, a pledge of allegiance by Kaumualii to Emperor Alexander I and promise to trade exclusively with the Russian-American Company, to supply the Company with sandalwood, to permit construction of trading posts anywhere and supply men to aid in their construction, and, finally, to furnish provisions to Russian ships. In return, Schäffer promised support to Kaumualii, even in the latter's wish to take over the rest of the Hawaiian empire controlled by Kamehameha (Pierce, 1965:11-12).

On September 12, 1816, construction of a fort overlooking Waimea harbor was initiated. It was given the name Fort Elizabeth in honor of Emperor Alexander's consort. The plans, prepared by Schäffer, apparently followed the accepted architectural views on fort construction prevalent in Europe at the time. There is reason to believe, on the basis of examination of illustrations (Carmichael, 1960:73, 76, 97), that the star-shaped outline was an old and persistent form of defensive enclosures in Russia, dating to the 17th century. Absence of star-like projections on the N side of the fort can probably be best explained by the assumption that Schäffer's original plans were altered after his departure in 1817, at which time that side of the fort was completed. We know from written reports that the seaward or S side was constructed first (Pierce, 1965: 28-29) and the fort was not completed under Schäffer's direction (S. Whitney, 1838:48-52).
Details of the fort construction are lacking. Schäffer did mention in his journal the employment of "three hundred" women, including the king's wives, among the workers (Pierce, 1965:191). With a labor force that large it is easy to accept Schäffer's journal entry of November 25, 1816, that the fort was nearly finished (ibid.:38). He was obviously referring only to the S side, but even that would be an impressive accomplishment in a three-month period.

Timber from the ship Kad'iaq was used in the construction of the fort and houses (ibid.:135). Reference is made to the fact that the Russians occupied houses similar to those of the local people--i.e., thatch houses (ibid.:130-131).

Following Schäffer's orders, the lands surrounding the fort were planted in a variety of garden vegetables, fruits, cotton, and wheat; all produced well except the wheat. The success of the gardens greatly pleased Kaumualii, who gave Schäffer more land up-river to cultivate. The Russian-American company meanwhile had acquired lands elsewhere on the island through royalty who deeded them in exchange for material goods or some other favors.

Despite Schäffer's seeming business successes, he had extended himself too far in inciting Kaumualii to rebel against Kamehameha. Opposition to Schäffer and his enterprises developed on Oahu and spread to Kauai. On May 8, 1816, he was seized by Kaumualii's men and told to leave Kauai at once. His attempts to make a final stand at Hanalei were futile and on July 7 he left the islands with two companions.

Hawaiian Period (1817-1864)

The Hawaiian Period, of longer duration, is less well known except for the period c. 1820, during which the Reverend Whitney and family resided at the fort and the rebellion of 1824 occurred. In 1820, King Kaumualii began building the Whitney house, described as:

"...a convenient house 40 feet by 22, thatched with grass and lined with bulrushes; and this morning he has commenced building a very large house intended for a meeting & School house. This is to stand near the king's and enclosed with a wall 10 feet in height to prevent the danger of fire... we shall soon see a Temple erected on this pagan Isle (and on the very ground too, where a short time since stood a celebrated Morai)" (Ruggles, Ms.)

"It stands at the place of landing, near the water's edge, and but a few rods east of the mouth of the Wimaah [sic.] river. On one side it is enclosed by the king's dwelling house and by a semi-circular wall 10 feet high; and on the other by the ceaseless waves of the Pacific. In front is a small battery; and back of the wall, which encloses nearly an acre of ground, stands the fort, on the high bank of the river, covering the village" (Bingham, 1925:225).
A note in Mr. Whitney's journal on strong winds (January 18, 1822) is of special interest in assessing the probability of older Hawaiian gardens on the open promontory above Waimea harbor:

"For several days past we have had a strong south wind which has blown the salt spray from the sea so as to kill nearly everything of the vegetable kind in the yard front of our house. Some castor oil trees and a butiful grape vine growing up by the side of my window for a shade...are wilted and dying" (S. Whitney, Ms.).

If such winds occurred fairly regularly in the past, it is likely that the promontory was not planted in crops, especially since there is ample rich soil on the alluvial plains upstream.

Mention of burial inside the fort is first reported in 1822 (February 8) by Mrs. Whitney, who wrote:

"A regular procession of two and two followed the corpse [George Tamoree's oldest child]. Going into the fort in which the grave was dug, seemed like entering a burying ground, more so than anything I have witnessed since I left America" (M. Whitney, Ms.).

It is not altogether clear, but there is the impression that the fort interior already contained burial plots.

Following a rebellion and attack on the fort in 1824, led by George Kauinualii, son of the deceased king, troop size dwindled. There is little mention of the fort between 1824 and 1853, but Bates wrote an amusing description of the fort situation in 1853:

"But now every gun was dismounted; the powder magazine was used as a native dwelling; while the interior of the old ruin was cultivated for the purpose of raising sweet potatoes (convolvulus batatus). Some half dozen shoeless and stockingless—and almost everything else—less soldiers, without arms and ammunition, were lounging over the useless guns, or stretched on their backs upon the hard stones, and under a tropical sun, with mouths wide open, and fast asleep. I knew not which looked the most desolate, the ruin itself, or its ruined defenders, ycleped soldiers." (Bates, 1854:238-239).

An extract from a letter by V. Knudsen described the last few years prior to dismantlement of the fort in 1864:

"The Waimea fort was dismantled in 1864 by order of the Government. There were 38 guns, some of them very large and heavy. These were shipped to California and sold there. Two of the guns are still at the bottom of Waimea Bay, as the boat in which they were being conveyed to a schooner capsized, and they were lost...The fort contained one room, excavated in the ground, and roofed with enormous, heavy Lehua trees, with a thick layer of earth over the logs. This room was perfectly
In 1854 and until 1860, a captain lived at the fort, who had a few soldiers under him. On the King's birthday and on other occasions a salute was fired. But soon these men died off, and the fort was left tenant-less" (Alexander, 1894:18).

FIELD TECHNIQUES

Prior to this project only small-scale sketch maps had been made of the fort, none of which were suitable as base maps for further work. An initial, cursory inspection of the fort revealed numerous individual features, which meant selecting a relatively large scale if these features were to be recognizable as more than, for example, a pile of stones. Following selection of a convenient scale, the fort was mapped with a telescopic alidade and plane table. All measurements are metric. Once the outline was mapped, individual structures were located and detailed sketches were made of the more elaborate and/or better preserved features. The result is a detailed planview of the entire site (including profiles), Fig. 5, at the end of the report.

Since the fort was abandoned more than 100 years ago, it is obviously in a state of disrepair. In order to map certain sections of the wall, collapsed rubble had to be removed so that facings could be precisely defined. "Excavation" of this sort was particularly necessary at many corners.* Beyond this, excavation inside the fort was limited to small test pits aimed at providing information on the base foundation (Fig. 6).

DESCRIPTIVE ARCHAEOLOGY

General Description

Fort Elizabeth is located on the high E bank at the mouth of the Waimea River. The point commands a good view seaward and across the river to Waimea (Fig. 7).

The fort is an irregular, star-shaped, thick-walled structure. The maximum diameter, along the N-S axis, is 100 meters inside and 120 meters outside; the E-W dimension is slightly less. Except for gun locations, walls are almost uniformly 5 to 6 meters thick at the base but vary considerably in height (see Fig. 5b), depending on their location with respect to assumed points of attack. A pathway, 1 to 2 meters wide, is found on top of the wall.

* Corners were numbered for convenience in description (refer to Figs. 11 and 12).
Fig. 6. SITE-LOCATION MAP SHOWING EXCAVATION AREAS. Note that test pits inside fort walls (shaded area identified as 50-KA-05-1000) are marked by arabic numbers 1 through 8. Surface excavation areas outside fort walls are indicated by boxed A, B, and C; and backhoe trenches for controlled excavation are designated BT-1 through BT-6.
Fig. 7. FORT ELIZABETH AND VICINITY FROM THE SEA, 1924.
(Photocourtesy Hawaii State Archives)
For nearly the entire length on top of the wall are gun banks. They differ in height and width according to presumed primary points of attack and the size of artillery required to defend these points. Gun banks on the walls of the S half of the fort are piles of stones, almost consistently 5 meters long, 2 to 3 meters wide, and regularly spaced 2 to 4 meters apart. Higher ones appear to be constructed of both stones and earth. Between corners 2 and 6 there is only one, continuous, low bank on the exterior side of the pathway. It varies between 1 and 1.5 meters in width and averages 20 cm high. Thus it is barely high enough to lie behind, suggesting the positioning of troops with small guns as opposed to larger guns on the S half of the fort.

The fort was entered through a single, narrow (2-meter) opening to the NW on the river side. A straight line from this opening to corner 5 on the opposite side of the fort divides the fort into two quite dissimilar architectural segments (in both shape and wall construction). The southern, or seaward half consists of five high, star-like projections, the vertices of four of which (6 through 9) point toward the coast, and the fifth (10) toward the river. Stone steps lead to the top of each point where, according to an 1885 map drawn by George Ed G. Jackson (Fig. 8), artillery was positioned. The wall is high (4 meter maximum) and appears to be double stone facings filled primarily with earth and little rock (Fig. 9a). Independent, parallel facings adjacent to one another are evident in one place (corner 9) on the exterior side of the wall (Fig. 9b). The NE (inland) portion of the fort is a continuation of the single wall but is laid out as four straight segments joining at three corners--2, 3, and 4. The walls are free-standing and double-faced, with rubble core fill.

Differences in wall construction and form are thought to relate directly to views on defensive strategy and, perhaps, to a change in architects. Positioning of cannons on the 1885 map indicates presumed attack from the seaward side. Obviously, high earth-filled walls are better designed to withstand artillery bombardment than loose, core-filled walls. Also, ground attackers attempting to overtake the S side would be easily caught in a crossfire between the projecting walls. The plan of the fort may have been altered following the expulsion of Dr. Schäffer. As previously noted, it was not completed under his charge.

Wall Construction

The gross characteristics of the fort wall have been described and mention has been made of significant differences in height and type of fill. A provisional sequence of construction stages is offered, based on our limited investigations. It constitutes a working hypothesis to be tested by future investigation. Further research problems on wall construction are presented in the recommendations.
Fig. 8. 1885 PLANVIEW MAP OF FORT ELIZABETH. (From George Ed G. Jackson)
a. Fort wall and steps, from the north

b. Two parallel stone facings on outer wall, from the west

Fig. 9. PHOTOGRAPHS OF DETAILS AT CORNER 9.
One of the salient characteristics of the wall, particularly evident on the S, is the steep slope of the base. Available evidence indicates that the slope is an artificial rather than natural feature of the terrain. Review of the contours inside and outside of the fort on Fig. 5 and other maps of the fort area reveal a gradual slope toward the sea. Disruption of that slope cannot be explained on geomorphological grounds. It must, therefore, be of man-made origin, and is therefore thought to constitute the base embankment of the wall.

The exterior facing of the stone wall between corners 7 and 8, for example, is set into the earthen slope (Fig. 10), which means that the slope must have been formed prior to construction of the wall. Formation of a sloping earth embankment clearly constitutes the first stage of wall construction. There are two varieties of battered-earth embankments. The first (A) and more common (between corners 3 and 7) is a mound of earth, flat on top, sloping steeply seaward, but essentially vertical on the interior side (Fig. 10a). The second (B) is a flat-topped mound sloping both to the exterior and interior of the fort (Fig. 10).

Prevalence of variety A is understandable in view of the assumed major concern to insure difficulty for invaders in scaling the wall. A steep slope in the interior would serve no defensive purpose; therefore, facings are set directly into the original ground surface. The slope may be packed with stones, presumably to prevent erosion (such as the exterior slope between corners 8 and 10), or, on more gradual inclines (interior slope between corners 2 to 10) left without stones. The low slope of the interior wall between corners 1 and 3 appears to be packed with stone, but there is also a confusion of collapsed rubble.

The second stage of construction is the setting of a stone wall on the earth base. Again, there are several alternative methods of construction evident. The wall derived from the variety A base shows, on the fort interior, a vertical facing flush with the straight side of the base (Fig. 10). Parallel to this facing is a shorter facing on the outside set into the top of the earth embankment. The space between the facings is filled with small rubble and earth. Two forms are derived from the variety B base. The simplest is double-faced to the same height outside and inside, with a rubble core and earth fill. The second differs only in the addition of a narrow, low, stepped platform—typically not more than 1 meter wide and high—below the base of the upper facing; it may occur either on the exterior or interior side of the wall. Continuous stepped platforms appear to occur only on the steepest slopes (i.e., between corners 5 and 10, Fig. 9).

The construction sequence is summarized as follows:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Event</th>
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<tbody>
<tr>
<td>I</td>
<td>construction of earth embankment</td>
</tr>
<tr>
<td>II</td>
<td>construction of stone wall on earthen base involving three nearly simultaneous processes--setting of</td>
</tr>
</tbody>
</table>
vertical facings, filling with rubble core and earth, and leveling the top and packing of earth and stone walkway.

Modifications of the wall are suggested at several points. In the pathway on top of the N wall back of the Officer's Quarters, is a rectangular, stone-paved area (Fig. 5), where the wall appears to have been breached and later rebuilt. The wall between corners 4 and 6 is curious because of the curvature of the edge of the pavement on the interior side of the pathway (Fig. 5). There is reason to believe, on the basis of an exposed section near the steps of corner 4, that the curved alignment was the original interior wall facing, and that the straight facing inside of it is a later addition. Local people say that a tunnel was put through the base of the wall on the W side of the fort; its possible location is noted on Fig. 5.
Interior Features

Careful survey of the fort interior revealed a number of features, many of which were not shown on Jackson's 1885 map. Lack of detail in that map indicates that his survey was probably done in a few days; we can expect, therefore, that he mapped the locations of only major features. Too, some features may have been sufficiently obscured or altered, in the years since abandonement in 1864, that they could not be located or properly identified. Nevertheless, Jackson's map is an important and useful piece of historic data; it was referred to numerous times in the early stages of our mapping.

Some features appear to post-date 1885, thereby explaining their absence on Jackson's map. It is certain that the barracks, for example, was modified following abandonement for troop use. Other features differ significantly in construction from known military features, suggesting later Hawaiian structures. In short, there is a temporal span of features dating from 1816 to the latter part of the 19th century, associated with either military or nonmilitary use. Determination of use and age for all features is not possible without further excavation. Identifications of some are therefore tentative at this time.

The largest feature is the barracks, located roughly in the center of the fort on a low earth mound. It measures 25 meters long and 10 meters wide. The structure is outlined by a low, loose-stone wall, 25 to 60 cm high and 50 cm to 1.5 meters wide. No structural remains are evident on top of the mound. On the W side of the barracks mound, S of the entrance steps, are four small rectangular enclosures (see Fig. 5); these are not illustrated on Jackson's 1885 map and almost certainly bear no relationship to the original use of the barracks. Their physical layout suggests burial plots; if this idea is correct, they must post-date abandonement of the fort. The pathway leading to the barracks may also have been altered slightly since 1864. The stones that define the path are loose, giving the impression that they were placed there in recent years--possibly following clearing of the fort. In its present form, the pathway is about 35 meters long and 2 meters wide.

Fifteen meters W of the barracks is the flagstaff, marked by a roughly rectangular stone mound 5 x 6 meters and 1.54 meters high. A maximum of four tiers of stones is evident at the southwest corner. The top platform, measuring 3.3 x 3 meters, is paved. In the center is a stone-lined depression 70 x 80 x 30 cm, for insertion of the flagpole. The mound was constructed on a rock outcrop of basaltic stones averaging 20 to 30 cm in diameter.

Precariously close to the barracks on the N is the magazine and armory structure. The storage area is a 3-meter-square, partially cemented, walled pit, the E wall of which has collapsed entirely; the center of the pit is partially filled. The structure that enclosed the storage pit is only partially evidenced by an incomplete stone alignment.
and a stone-lined pathway leading to it from the W. Jackson's map shows a rather large armory, which differs in outline on the S from the existing alignment. Jackson's rendering is assumed to be accurate and the wall connecting the armory and barracks (see Fig. 5) is considered a recent modification, since the stones are loose. Likewise, the long pathway of loose stones was probably reconstructed recently, following the line of an older, worn path. Between about 1854 and 1860 the armory was used as a dwelling (cf. quote from a letter by V. Knudsen, pp. 9, 10).

Adjacent to the fort wall, on the E (interior) side of the entrance, is a short stone alignment in an area identified by Jackson in 1885 as the guardroom. The alignment appears to be the E wall of the guardroom. Contiguous with the projected W wall of the guardroom is a stone pavement. Although Jackson did not illustrate the pavement, there is reason to suspect that it was contemporaneous with the guardroom.

The officers' quarters illustrated by Jackson were relocated along the N wall of the fort. The stone alignments are incomplete, but enough remain to suggest a structure roughly 5 x 2.5 meters. Immediately to the NW, at a similar distance from the N wall, is a second structure, poorly defined by two intersecting stone alignments. This feature does not show on the 1885 map, which leads one to conclude that it post-dates Jackson's survey.

East of the barracks, along the x-x' profile (see Fig. 5b), is a rectangular stone outline and pavement on a low earth mound. The outline measures approximately 5 x 4 meters and 60 cm maximum in height. The alignment is 90 cm maximum width on the E. A number of relatively large water-worn stones make up this feature. The form, size, and constructional technique of the outline suggest a late Hawaiian burial--again, most probably post-1864.

Two contiguous, low, stone-walled enclosures are found between corners 5 and 6, abutting the fort wall; interior dimensions of both are approximately 7 meters long and 2.5 to 3 meters wide. The walls are loosely constructed, averaging 1 meter in width and 50 to 60 cm in height. The back walls, against the fort, vary between 35 and 70 cm in height. The walls were constructed up against fallen rubble from the fort wall above, providing the earliest date of 1864 for the enclosure--the year the fort was abandoned and began to fall into disrepair. In the northernmost enclosure there is an entrance 70 cm wide. A 1-meter-square test pit (no. 6, Fig. 6), excavated in the middle of the S wall of the enclosure, indicated that there was no prepared floor. Artifacts recovered in the excavation are described later (pp. 26-32). The function of the structure is not certain, but overall constructional characteristics are compatible with those of late-style Hawaiian houses.

Adjacent to the southern enclosure above is an incomplete rectangular stone outline approximately 6 x 3 meters. The E side, adjacent to the fort wall, is not visible. The structure was not located on the 1885 map and its identification remains unknown.
Below the steps in corner 7 is one of the two "quarters" mapped by Jackson in 1885. Parts of the S and W base walls were buried, but they were located during excavation (test pit 7), permitting us to map the full outline accurately. The structure measures 9 x 6 meters. Paving and segments of two stone alignments were located immediately adjacent to the quarters on the landward side.

The second quarters is located below the steps in corner 8. The outline, again, had been partially obscured by slope wash, requiring probing (test pit 8) to locate the NE corner. The interior dimensions are 9 x 4 meters, approximating the size of the quarters next to corner 7.

On the flat ground below corner 9 are two features, both of which probably post-date abandonment of the fort. One is a low, loose-stone wall joining on both ends the collapsed rubble at the base of the fort wall. It appears to be an enclosing wall, but for what purpose is unclear. The second feature is a small (c. 3.5 x 3 meters), incomplete, rectangular stone outline for which no function can be determined to date.

Widely scattered on the fort grounds are numerous small piles of stones. Most of them are loose (no soil has accumulated around the base), indicating recent origin; they should not be confused with older features. Two larger mounds appear to date to an earlier period, however, and have been included on the planview map (see Fig. 5).

A large part of the survey period inside the fort was devoted to examining the stone stairways. Jackson's map (Fig. 9) showed eight stairways in 1885. Since that time those in corners 2 and 6 have been modified so as to be hardly recognizable. Removal of loose rubble from the latter section revealed only two stepped facings, unlike the larger stairways elsewhere in the fort.

The steps of corner 4 were selected for more extensive investigation since they contrasted in design with the higher, steeper steps on the S half of the fort. Too, it was a convenient location for determining the constructional sequence of the steps and fort wall--i.e., whether the steps had been constructed before or after the fort wall. Excavation of slope-wash fill at the juncture of the fort wall and these steps (test pit 5, Fig. 6), and also at corner 8 demonstrated the sequence: construction of the wall first, followed by the steps that are flush with the base of the wall (Fig. 11). Comparatively, the steps at corner 4 (Fig. 12) are much wider and descend more gradually than those of corner 8 (Fig. 13), for example. All stairways, however, were laid out in a similar manner--large, quadrangular-shaped stones were placed end to end with their longest axis oriented horizontally, and smaller stones and earth were filled in around them.
Exterior Features

Features outside of the fort are confined to the W and S sides, although Hawaiian thatch houses probably were built on the N and E, but have left no trace, especially since the whole area has been bulldozed for sugarcane. The Whitney house (c. 1821) and large enclosing walls on the S side of the fort were apparently bulldozed, as we could not locate any structural remains in their said location (cf. quote by Bingham on p. 8).

Immediately outside of the entrance (on the NW side) are isolated areas of stone pavement, an excavated pit, and fragmentary stone alignments, all of which lie in the area mapped by Jackson as a trading house. The northern portion of the site--including a small erosional gully that extends SW, and a large enclosing wall (see Fig. 5)--has been disturbed by bulldozers. The effect of the gully has not been entirely detrimental because the slope wash has buried pavement in places. The pit, c. 2 meters square by 1 meter deep, may have been a storage area.
a. Perspective sketch and profile of steps

b. View along wall, showing steps

Fig. 12. STEPS AT CORNER 4.
a. Perspective sketch of steps

b. View from N of steps

Fig. 13. STEPS AT CORNER 8.
Students were employed in exposing a large area of partially buried pavement adjacent to the fort wall, W of the entrance (see Fig. 5). Excavation was extended to the edge of tumbled wall stones to determine whether or not the pavement lies beneath the fort wall. In one area, at least, the pavement extends up to a large, collapsed slab. The interface of the pavement stones and slab was chinked with smaller stones, according to Kikuchi. The pavement does not lie under the fort wall, however, which indicates that it was built later—sometime during the period of fort disrepair in the mid- to late-19th century. The pavement consists of relatively large, flat stones juxtaposed in a careful, close-fitting manner (Fig. 14). It is an impressive feature and gives evidence of the stone-working abilities of Hawaiians, even at this period long after European contact.

Below the enclosing wall associated with the trading house is a long retaining wall, part of which was constructed on lava bedrock (see Fig. 5). It parallels the river bank, extending to a point in-between corners 9 and 10 of the fort. At that point it is intersected by a shorter, curved stone wall that approaches corner 10, where it terminates in a low, crude enclosure 5 meters in diameter.

Near the intersection of the walls just described are the incomplete remains of a low "platform" denoted by two buried stone alignments joining at nearly a right angle; it resembles a Hawaiian house site.
Below corner 9 of the fort is a well-preserved, rectangular, stone-walled, earthen-floor enclosure having interior dimensions of 3.5 x 2 meters, with a wall height of c. 1.5 meters. It is constructed of large stones, several of which are in an upright position. There is a suggestion of an entrance on the N side. The use/function of this enclosure is unknown.

Just N of the river mouth is a small, triangular-shaped, stone enclosure and a curved stone wall, both well separated from previously described features. One side, 8.5 meters long, is bedrock. The other two sides are 10 and 5 meters long and 40 to 70 cm high. The walls are constructed of relatively large stones (70-cm diameter), similar in size to stones in the outside facing of the fort wall.

Below the fort entrance, directly on the river bank, is a large, well-built, stone platform assumed to be a wharf for loading and unloading boat cargo (see Fig. 5). The platform is 16 meters long, 4 meters wide, and, on the NW corner, 2.5 meters high. The large stones (70 cm to 1 meter long, 40 to 60 cm wide, and 30 cm thick on the average), are stacked horizontally, with an average of four courses. The surface is presently uneven, but there appears to have been some attempt to lay a flat pavement. The wharf was constructed on an exposed basalt outcrop, part of which was used earlier as an adz grinding-stone locality. The significance of the superposition is discussed in the following paragraph on grinding-stone complexes. The height of the wharf above the present river level is also significant; the seemingly high position is indicative of a probably higher water level in the past.

Scattered along the river bank at water level and just above it are eight clusters of bedrock adz grinding stones. Clusters were designated with capital letters A through H, beginning on the down-river side of the river bank. Examination of the clusters revealed three distinctive types of grinding surfaces based on the manner in which the adz was ground:

1. Circular, oval, or polygonal-shaped, shallow depressions; average dimensions are 20-35 cm diameter and 5 cm deep; polygonal-shaped surfaces are usually pentagonal or hexagonal

2. Linear, round-bottomed grooves, often occurring in pairs, c. 5 cm apart and parallel to each other; lengths range from 30-40 cm; widths, 8-13 cm; depth, 3-5 cm

3. Linear, V-bottom grooves; dimensions are similar to type 2.

Cluster G is of particular importance since it lies beneath the historic wharf described above (Fig. 15). While there is no absolute date for the wharf, the grinding stones must pre-date its construction. Cluster H is also interesting as a possible time marker because the slab on which the grinding surfaces are located has separated and tilted almost 90 deg from the outcrop to which it was formerly attached. The edges of the slab are still relatively sharp, yet the whole stone shows evidence of post-cleavage weathering.
CULTURAL MATERIALS

A surface collection of artifacts was made inside and in the immediate area outside of the fort. Cultural material recovered in excavation was limited to test pit 6 (see Fig. 6). The entire collection has been classified into 14 broad categories (Table 3). Dr. Stell Newman kindly aided in the identification of historic artifacts and provided reference material for further information. Mr. Peter Gathercole identified the ramrod pipes from a musket and pistol.

Information about each category includes a category name and brief description. The number of specimens, the materials from which they were made, and a summary of metric dimensions is presented. Comments are added where necessary. Unless otherwise stated, the provenience of all artifacts is surface.
Table 3. Numerical Frequency of Artifact Categories in Site 50-KA-05-1000.

<table>
<thead>
<tr>
<th>Category</th>
<th>No.</th>
<th>Category</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>musket balls</td>
<td>3</td>
<td>glass fragments</td>
<td>6</td>
</tr>
<tr>
<td>cannon balls</td>
<td>3</td>
<td>buttons</td>
<td>2</td>
</tr>
<tr>
<td>gun flints</td>
<td>3</td>
<td>beads</td>
<td>1</td>
</tr>
<tr>
<td>ramrod pipes</td>
<td>3</td>
<td>coins</td>
<td>1</td>
</tr>
<tr>
<td>nails, spikes</td>
<td>10</td>
<td>adzes</td>
<td>2</td>
</tr>
<tr>
<td>miscellaneous metal fragments</td>
<td>4</td>
<td>worked stone</td>
<td>1</td>
</tr>
<tr>
<td>ceramic sherds</td>
<td>6</td>
<td>octopus lure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Artifacts</strong></td>
<td><strong>46</strong></td>
</tr>
</tbody>
</table>

Category 1: Musket balls

Description: round lead balls, commonly referred to as "grape shot"
Number: 3
Material: lead
Dimensions: 16-20-mm diameter

Category 2: Cannon balls

Description: weathered cannon balls
Number: 3
Material: iron
Dimensions: 1) 83-mm (3.2-in.) diameter, 1.9 kg (4.75 lb); 2) 90-mm (3.5-in.) diameter, 2.3 kg (5.75 lb); 3) 150-mm (6-in.) diameter, 10 kg (25 lb)
Provenience: all found outside of fort, near walls

Category 3: Gun flints (Fig. 16)

Description: chipped, triangular pieces of flint; two show slightly concave beds (underside); backs rounded
Number: 3
Material: flint
Dimensions: 22 x 20 x 7 mm; 25 x 20 x 6 mm; 15 x 10 x 4 mm
Comments: based on color, one appears to be French (honey-colored), two English (gray-black) (Hume, 1970:220); gray-black ones differ from known English flints--may be American; the triangular shapes are unusual, as most gun flints are square
Category 4: Ramrod pipes (Fig. 17)

Description: cylindrical metal tubes attached to bottoms of muskets and flintlocks for insertion of ramrods; largest exhibits two holes for attachment to barrel and a flared opening on upper end (Fig. 17a); other two are smaller, have only single hole for attachment (Fig. 17b,c); resemble pipes for pistols; each is made from a single piece of metal.

Number: 3

Material: two larger ones are brass; smallest appears to be copper.

Dimensions: 30, 40, and 60 mm long; interior diameter c. 6 mm.

Category 5: Nails, spike (Fig. 18)

a. Description: sheathing nail; L-shaped head (Fig. 18a)
   Number: 3
   Material: copper (1); iron (2)
   Dimensions: copper--53 mm long, 3 mm thick; iron--27 mm long, 5 mm thick
   Comments: iron nails from test pit 6; (Hume, 1970:253)

b. Description: headless nail; slight indentation near top (Fig. 18b)
   Number: 1
   Material: copper
   Dimensions: 33 mm long, 4 mm thick

c. Description: short, round-headed sheathing nails (Fig. 18c-g)
   Number: 5
   Material: copper
   Dimensions: 22-35 mm long, 3-4 mm thick

d. Description: split, corroded spike; small, flat head (not shown)
   Number: 1
   Material: iron
   Dimensions: 76 mm long, 8 mm thick

Fig. 18. NAILS AND SPIKE FOUND IN FORT (actual size).
Category 6: Miscellaneous metal fragments

Description: three amorphous, flat pieces of metal; fourth, rounded piece has hole punched through it, might be part of a rifle
Number: 4
Material: lead, copper, iron
Dimensions: 20-35 mm long, 1 mm or less thick
Comments: two (artifact no. 34a, 34b) found at 40 cm in test pit 6

Category 7: Ceramics

Description: small fragments of thin crockery--plates, dishes, and one cup handle; one fragment of thick, glazed crockery--crock or bowl
Number: 6
Material: fire-baked clay
Dimensions: 17-61-mm range; average 5-6-mm thickness of chinaware
Comments: most sherds appear to be Oriental in origin, based on inspection of incomplete designs; one is English or American; finer distinctions of type, age, and source not presently available; cup handle found at 5 cm in test pit 6

Category 8: Glass

Description: irregular fragments, none bearing inscriptions; three pieces of bottle glass, one chipped on two ends; one chunky fragment of fused glass with iridescent sheen; two smaller, thin pieces with iridescent sheen
Number: 6
Dimensions: 22-45-mm range in length
Comments: one piece of bottle glass (artifact no. 33) found at 40 cm in test pit 6

Category 9: Buttons

a. Description: round, bone button; 4 circular holes
   Material: bone
   Dimensions: 12-mm diameter

b. Description: French Phoenix button from military uniform; bears inscription, "Je Renais De Mes Cendres," which translates as "I am born again from my ashes," and the number 30 (Fig. 19)
   Material: brass
   Dimensions: 25-mm diameter
Comments: ultimate source probably Haiti, whose first president, Henri Christophe, outfitted his troops with uniforms, the brass items of which bore the Phoenix bird motif; Christophe probably obtained the buttons following defeat of Napoleon's army at Waterloo, for whom the motif and insignia had been designed; an alternative possibility is that the buttons and other items were brought to the West Coast of North America following the defeat of Henri Christophe, whose army no longer needed them; almost certainly the buttons were being distributed before 1835 along the West Coast, where they became a popular trade item with the Indians (O'Brien, 1970:201-206; 237-241)
Category 10: Beads

Description: wound bead; yellow; round; flat ends
Number: 1
Material: unknown
Dimensions: 7-mm diameter
Provenience: test pit 6, 40 cm
Comments: age and source unknown

Category 11: Coins

Description: 1935 Philadelphia Mint Mercury dime
Number: 1
Material: silver
Dimensions: 18-mm diameter

Category 12: Adzes

a. Description: partial blade and bevel; quadrangular; one side and back polished; bevel angle c. 60 deg
Number: 1
Material: basalt
Dimensions: 40 x 34 x 20 mm

b. Description: split cone shell; triangular shape; sides and end ground flat; broad, semicircular blade with 40-deg angle
Number: 1
Material: Conus sp. shell
Dimensions: 44-mm shell; blade breadth, 22 mm
Comments: typologically the same as two adzes from site 50-KA-05-1001 (Fig. 26)

Category 13: Worked stone

Description: small piece of ground and polished slate
Number: 1
Material: slate
Dimensions: 21 x 17 x 2 mm
Category 14: Octopus lure (Fig. 20)

Description: large cowry shell with two holes (5-mm diameter) punched through upper shell on opposite ends
Number: 1
Material: cowry shell (Cypraea mauritius Linnaeus)
Dimensions: 107 x 71 x 56 mm
Provenience: hidden in wall at corner 5, test pit 6
Comments: common form of Hawaiian octopus lure

Fig. 20. COWRY-SHELL OCTOPUS LURE FOUND HIDDEN IN WALL OF FORT AT CORNER 5, TEST PIT 6.

The limited artifact assemblage appears to be primarily American and English items, with the exception of a few Oriental ceramics. There is nothing that can be labeled Russian. It is highly probable that all of the cultural materials post-date the Russian occupation of the fort, which was brief; furthermore, goods brought to the islands by the Russian-American Company were probably mainly American, obtained on the West Coast. Even two of the gun flints may be North American in origin.
THE PREHISTORIC SITE: 50-KA-05-1001*

Test excavations on the beach front were undertaken the last four days of the project, following the completion of mapping and description of the fort and related features. These excavations confirmed earlier expectations of Hawaiian occupation in the area pre-dating the construction of the fort. Moreover, the work, even though brief, revealed a site with buried habitation features warranting further investigation.

PREVIOUS ARCHAEOLOGICAL RESEARCH ON SOUTHWESTERN KAUAI

Kauai remains one of the least-known islands, archaeologically, in the Hawaiian chain. It is understandable in recent years, at least, since most archaeology in the islands has been directed toward salvage operations on the fast-developing islands of Oahu, Hawaii, and Maui. Kauai is being developed less rapidly, with the result that there have been few contract projects. During this time, too, there has been little independent, problem-oriented research on Kauai.

Forty-one years after its publication in 1931, Bennett's Archaeology of Kauai remains the most comprehensive statement on Kauai archaeology. Like so many other surveys of the period, Bennett's work was aimed at recording well-known and impressive sites such as heiau, and, at the same time, collecting whatever traditional and historical information existed for a particular structure or locality. It is not surprising, therefore, that no habitation sites were recorded by Bennett in the immediate vicinity of the Russian fort.

A general site survey by Kikuchi and Paglinawan in 1961 and 1963 added important information for southern Kauai, but it did not extend as far W as the Waimea River. In addition to survey, Kikuchi and Paglinawan test-excavated selected sites and recovered artifactual material from vandalized sites, principally coastal rock shelters. Results of this work (Kikuchi, ms.b) and earlier test excavations by Bishop Museum at the disturbed K-10 site (Weli shelter) and the K-1 site near Mana (see Fig. 1) offer little for comparison with KA-05-1001 because of a paucity of artifactual material of known provenience. Bishop Museum excavations at the K-3 site (1957-59) yielded a large artifact assemblage; the full report on that work is in preparation (Soehren, ms.). Likewise, Pearson's (1962) population study of Hanapepe Valley does not contain any information pertinent to an understanding of site 50-KA-05-1001.

SITE DESCRIPTION

Site 50-KA-05-1001 is located c. 80 meters SSE of the fort on a flat plain just mauka of the high-tide mark. It is an open habitation site, the precise limits of which are not known. An undetermined part

*The Bishop Museum site number is 50-KA-C2-15.
of the site has been under sugarcane cultivation; as a consequence, midden and artifacts have been widely scattered, giving a spurious impression of a large, continuous site. Results of backhoe trenches and test excavations indicate decreasing midden accumulation to the landward, which means that in some areas cultivation has entirely removed the cultural deposit. Prior to excavation, a surface collection was made over most of the beach front. For convenience in description and location of artifacts the area was divided into three smaller arbitrary units, designated Areas A, B, and C (see Fig. 6).

DESCRIPTIVE ARCHAEOLOGY

Plan of Excavation

Initially, six small backhoe trenches were dug in scattered locations along the beach front to determine the horizontal extent of midden deposits and to provide stratigraphic control for hand excavation. Trench locations were selected on the basis of surface-midden concentrations and locations with respect to the old sugarcane field. Informants pointed out the seaward limits of the field, formerly demarcated by a stone wall, and trenches were put in on the undisturbed side of that line. Only in Areas A and B was there appreciable thickness of midden to warrant further test excavation in the short time at our disposal.

A 32-sq-meter area, encompassing backhoe trenches 2 and 3, (BT-2 and -3) was gridded into 2-meter squares. The plan, although too ambitious in view of the short time period, was to open large areas, which is the best possible means of exposing living surfaces, floors, and other features. The grid was oriented on the magnetic N-S axis and the squares were designated using a combination of cardinal direction and number from a datum, 00; thus one square N and W of datum is designated N1W1 (Fig. 21). This system permits expansion of excavation anywhere on the site without duplicating numbers or letters.

The site was dug in natural stratigraphic units. Cultural layers were subdivided into arbitrary 5-cm levels for convenience in excavation and description. Use of the State Department of Land and Natural Resources backhoe enabled work in natural strata. The profiles in the trenches provided the stratigraphic control.

Excavation techniques employed were hand-shovel stripping of sterile overburden and troweling of the cultural deposit below. All excavated material was sorted through a 1/8-in. mesh screen. Field notes were recorded by each excavator on Bishop Museum site forms. Provenience of artifacts is recorded by natural stratigraphic unit (all layer II or III in this case) and arbitrary level within 5 cm.
Initially, the faces of BT-2 and BT-3 were straightened vertically and the loose fill was removed. The spoil pile from the trenches was screened for artifacts and a sample of midden. While the exact provenience of this collection is unknown, it can at least be assigned to stratum II or III, which most probably are not widely separated in time. Examination of the backhoe-trench profiles revealed a probable stone wall in BT-2. Excavation of adjacent squares was planned to determine whether or not there was, in fact, a wall and, if so, how far and in what direction it extended.

Near the end of the work period, it was realized that controlled excavation of the squares could not be completed. Enough of a continuous, horizontal surface had been excavated, nevertheless, to provide important information on the depth and nature of the cultural deposit—more data than could have been collected by excavation of small test pits scattered over a larger area. Stratigraphic profiles were then drawn of the important faces of BT-2 and BT-3 and the excavation area was filled. Sheets of plastic were laid over the pits before backfilling, in the expectation that excavation might be continued at some future date.
Physical Stratigraphy

The geologic section at the excavation site is made up of five major units or strata. Three are natural deposits and two are cultural in origin. Gross characteristics of the strata are described here, using the full section exposed in BT-2; the profile of BT-3 differs only in the absence of one cultural stratum (III). A detailed description of each backhoe-trench profile is presented in Appendix A.

The basal stratum (V) exposed in BT-2 (Fig. 22) is a homogeneous, red, sandy loam of undetermined thickness. Resting disconformably on the upper surface of the basal stratum is a poorly sorted, medium-to-coarse, white beach sand (stratum IV). It contains a variety of marine shells and branch coral, but they are relatively scarce. Stratum III is a cultural deposit of waterworn pebbles ('ili'ili) and midden; it is described in more detail below, in the discussion of Cultural Stratigraphy. Stratum II, midden in a sandy matrix, lies disconformably on stratum III; the midden contains a variety of elements pointing to human habitation--fire-cracked rock, bone, shell, and artifacts. Vertical variation is evident on the E face of BT-3 (Fig. 23). The facies* has been labelled stratum IIa and is distinguished on the basis of color difference--it is brownish-yellow as opposed to the very dark, grayish-brown sand of the rest of stratum II. Resting disconformably on the midden deposit is stratum I, a red, sandy loam not too unlike stratum V of BT-2. This is the overburden referred to earlier and the soil is highly suited for sugarcane production. Two small isolated pockets of mixed soil are present on either side of a probable rock wall in stratum II. They are provisionally labeled Ia, since the soil is primarily stratum I. It is inferred to have been derived from above and mixed with stratum II in the construction of the possible wall.

Cultural Stratigraphy

Cultural features are apparent in the N and W profiles of BT-2. Stratum III, a concentration of waterworn pebbles and midden of 25-cm maximum thickness, is tentatively labeled a house floor. It truncates on the W face close to a vertical configuration of stones suggesting a second feature--a man-made wall (Figs. 22 and 24). This end point would appear to have been one side of the dwelling. A poi-pounder fragment was found in situ (Figs. 22 and 25) among the probable wall stones. The contact between the pebble floor and stratum IV is sharp and abrupt, indicating deposition of the pebbles directly on the sterile beach deposit.

*The two geologic terms used here are defined as follows:
"disconformably" refers to two strata that developed at different times and under different conditions but that are parallel or roughly parallel in position; the surface that separates them is called an unconformity of which a disconformity is one type
"facies" refers to vertical variation in a stratum, which may be recognized on the basis of slight differences in soil color, texture, or sorting

-36-
Fig. 22. STRATIGRAPHIC SECTION OF W AND N FACES OF BT-2, SITE 50-KA-05-1001.
Fig. 23. BT-3 STRATIGRAPHY, SITE 50-KA-05-1001.
Fig. 24. BLOCK DIAGRAM OF NW CORNER OF BT-2, SITE 50-KA-05-1001, SHOWING STRATIGRAPHIC SEQUENCE OF CULTURAL FEATURES EXPOSED.

Fig. 25. POI POUNDER IN SITU ON W FACE OF BT-2, SITE 50-KA-05-1001.
Superimposed on the possible house wall is feature 2, uncovered in the excavation of square S1W2, stratum II. It is a roughly circular arrangement of stones 1 meter in diameter. The outer stones, defining the perimeter, were set with the sides in an upright position. Excavation was stopped before we were able to determine whether or not the pebble floor extended beneath feature 2. Charcoal specks, sea-urchin spines, and bone in the center of the feature suggest a possible cooking oven (imu), or at least the residue of a cleaned oven. Full interpretation of the feature will depend on the completion of its excavation, which was impossible during this project because of lack of time.

Adjacent to feature 2 in square S1W2 at the same level (30-35 cm) was a concentration of stones and several fragments of bone labeled feature 1. Some of the stones were fire-cracked. Their distribution and proximity to feature 2 suggest a possible association--they may be discarded cooking stones from the possible oven (feature 2). In any event, the two configurations of stone clearly represent a living surface--probably the last occupation of the aforementioned house.

In sum, there are two discrete cultural deposits, indicating a multi-component site. The temporal relationship and differences, if any, in the artifact assemblages of the components cannot be established at this time. More meaningful interpretation is dependent on larger-scale excavations.

CULTURAL MATERIALS

The entire collection of artifacts from the site has been classified into 13 broad categories (Table 4), both functional and descriptive. Finer distinctions of form are noted in the descriptions following. The categories are not arranged in any hierarchial scheme, but they are ordered so that similar categories follow one another.


<table>
<thead>
<tr>
<th>Category</th>
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<td>1. adzes</td>
<td>4</td>
<td>8. gaming stones</td>
<td>1</td>
</tr>
<tr>
<td>2. abrading stones</td>
<td>5</td>
<td>9. ornaments</td>
<td>5</td>
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<td>3. poi pounders</td>
<td>3</td>
<td>10. worked stone, bone and shell</td>
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</tr>
<tr>
<td>4. fishhooks</td>
<td>9</td>
<td>11. nails</td>
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<td>12. hammered metal wire</td>
<td>2</td>
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<td>6. bone picks</td>
<td>3</td>
<td>13. glass bottles, fragments, stopper</td>
<td>3</td>
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<tr>
<td>7. bone awls</td>
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<td></td>
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<td>Total Artifacts</td>
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-40-
Information about each category includes a category name and brief description which is intended to be accurate but succinct. The number of specimens, the materials from which they were made, and a summary of metric dimensions are presented. Finally, comments are added where necessary. The provenience of artifacts recovered in the screening of backhoe-trench spoil piles is simply noted as BT-2 or BT-3.

Category 1: Adzes (4)

a. Description: partial blade and bevel; quadrangular; sides, front, and back highly polished; most of bevel surface rough; bevel angle, 65 deg
   Material: basalt
   Dimensions: 60 x 42 x 32 mm
   Provenience: surface, area B

b. Description: thin, irregular-shaped fragment; quadrangular cross section; tapered toward edge; surfaces polished; straight sides
   Material: basalt
   Dimensions: 51 x 31 x 10 mm
   Provenience: surface, area B

c. Description: split cone shell; triangular shape; sides and end ground flat; broad, semicircular blade with 45-45-deg angle (Fig. 26a).
   Material: Conus sp. shell
   Dimensions: length 46 mm, blade width 22 mm
   Provenience: W face of BT-3, stratum II, 20-cm depth

d. Description: split cone shell; roughly triangular shape; sides and end ground flat; broad, semicircular blade with 33-deg angle (Fig. 26b)
   Material: Conus sp. shell
   Dimensions: length 45 mm, blade width 21 mm
   Provenience: BT-3

Fig. 26. CONUS-SHELL ADZES FROM W FACE OF BT-3, SITE 50-KA-05-1001 (actual size).
Category 2: Abrading stones (5)

a. Description: fragmentary discoidal stone; edge appears pecked; upper surface smooth; slightly concave
   Material: basalt
   Dimensions: 67 x 40 x 17 mm
   Provenience: BT-2

b. Description: pentagonal-shaped dike stone; one surface slightly concave and polished
   Material: basalt
   Dimensions: 72 x 65 x 43 mm
   Provenience: BT-2

c. Description: thin slab of pahoehoe lava; broken; rectangular; one surface polished
   Material: basalt
   Dimensions: 113 x 92 x 31 mm
   Provenience: BT-2
   Comments: common type of portable abrader in Hawaii

d. Description: two smooth surfaces on short piece of coral; quadrangular cross section
   Material: *Porites* sp. coral
   Dimensions: 40 x 22 x 17 mm
   Provenience: area A, surface

e. Description: flat, smooth surface on irregular piece of coral
   Material: *Porites* sp. coral
   Dimensions: 39 x 23 x 20 mm
   Provenience: BT-2

Category 3: Pōi pounders (3) (Fig. 27)

a. Description: bottom and small segment of neck; bottom and sides smoothed, but pitted
   Material: altered basalt
   Dimensions: base diameter, 91 mm; height, 75 mm; thickness of neck indeterminable
   Provenience: W face of BT-2, stratum II, 20-cm depth
   Comments: see Figs. 22 and 25

b. Description: top and small segment of neck; top and sides pitted--apparently never completely polished over entire surface
   Material: basalt
   Dimensions: base diameter, 52 mm; height, 35 mm; thickness of neck indeterminable
   Provenience: BT-2

c. Description: upper section of neck
   Material: lithified coral sandstone
   Dimensions: bottom diameter 51 mm; top diameter 40 mm; height 42 mm
   Provenience: BT-2
   Comments: unusual material for a pounder
Category 4: Fishhooks (9) (Fig. 28); head-type descriptions follow Sinoto (1968:59)

a. Description: one-piece jabbing hook with inner shank and point barb; shank and point straight; head type HT4 (Fig. 28g)
   Material: bone
   Dimensions: point length, 18 mm; shank length, 32 mm; width, 10 mm
   Provenience: BT-2

b. Description: broken, one-piece jabbing hook with inner shank barb; shank straight; head type HT2a (Fig. 28h)
   Material: bone
   Dimensions: shank length, 31 mm
   Provenience: BT-3

c. Description: broken, one-piece jabbing hook; shank straight; point angled; head and point tip missing (Fig. 28a)
   Material: pearl shell
   Dimensions: projected shank length, 18 mm; width, 7 mm
   Provenience: BT-2

d. Description: broken, one-piece jabbing hook; point missing; shank straight; head type HT2a (Fig. 28d)
   Material: pearl shell
   Dimensions: shank length, 18 mm
   Provenience: BT-3
Category 4 - continued

e. Description: broken, one-piece jabbing hook; shank slightly curved; head type HT4 (Fig. 28c)
   Material: pearl shell
   Dimensions: indeterminable
   Provenience: BT-3

f. Description: broken, one-piece jabbing hook; straight shank; head type HT4 (Fig. 28b)
   Material: pearl shell
   Dimensions: indeterminable
   Provenience: N1W1, surface

g. Description: broken, one-piece jabbing hook; head and point tip missing (Fig. 28e)
   Material: pearl shell
   Dimensions: indeterminable
   Provenience: BT-3

h. Description: incomplete bonito point; hole for lashing not completely drilled; lipped (Fig. 28i)
   Material: bone
   Dimensions: length, 29 mm
   Provenience: S1W2, stratum II, 15-20 cm
   Comments: projection at proximal end and curvature of point are unusual for Hawaiian bonito points

i. Description: possible hook shank; incomplete (Fig. 28f)
   Material: bone
   Dimensions: indeterminable
   Provenience: BT-2

Fig. 28. FISHHOOKS FROM BT-2 AND BT-3, SITE 50-KA-05-1001. (actual size).
Category 5: Fishhook files and abraders (16) (Fig. 29)

a. Sea-urchin-spine files

Description: pointed and square-ended, bevelled working points; ends both thick and thin
Number: 6
Dimensions: average not calculated since most are incomplete (Fig. 29g-j)
Provenience: stratum II
Comments: cross section and kind of point vary according to specific use

b. Porites sp. coral files

Description: incomplete sections; round to flat-elliptical in cross section; tapered to narrow working end (Fig. 29d-f)
Number: 5
Dimensions: indeterminable
Provenience: stratum II

c. Stone files

Description: incomplete pieces; oval to elliptical in cross section; two show faceted, pointed, working ends (Fig. 29a-c)
Number: 3
Material: basalt
Dimensions: indeterminable
Provenience: surface and stratum II

d. Coral abraders

Description: Porites sp. coral pieces ground flat; quadrangular cross section
Number: 2
Dimensions: 39 x 22 x 17 mm; 39 x 23 x 16 mm
Provenience: BT-2; area A, surface

Category 6: Bone picks (Fig. 30b-c)

Description: cut bird bone, tapered to point, tip broken; good-sized petrel or shearwater (probably Pterodroma or Puffinus spp.)
Number: 3
Dimensions: two nearly complete specimens 55 mm long
Provenience: S1W2, 18 cm; BT-3
Comments: described in literature as pipipi (pickers)--for taking meat out of shell

Category 7: Bone awl (Fig. 30a)

Description: splinter of mammal bone ground and polished to point on one end
Dimensions: 45 cm long
Provenience: S1E1, stratum I, 15-20 cm
Fig. 29. FISHHOOK FILES FROM STRATUM II OF BT-2 AND BT-3, SITE 50-KA-05-1001 (actual size).

Fig. 30. BONE PICKS AND AWL FROM SQUARES S1W2 and S1E1 and BT-3 FILL, SITE 50-KA-05-1001 (actual size).
Category 8: Game stone ('ulu maika)

Description: partial discoidal stone; pecked
Material: coralline
Dimensions: estimated diameter, 61 mm; thickness, 35 mm
Provenience: area B, surface

Category 9: Ornaments (5) (Fig. 31)

a. Description: dog-tooth pendants; 2- and 3-mm-diameter holes drilled through root of canine tooth (Fig. 31a, b)
   Number: 2
   Material: dog canine tooth
   Dimensions: 36 and 34 mm long
   Provenience: area C, surface

b. Description: cut and ground dog canine tooth; V-shaped cuts made into root opposite each other, apparently for lashing (Fig. 31c)
   Material: dog canine tooth
   Dimensions: 31 mm long
   Provenience: BT-2
   Comments: unusual piece; tentatively classified as ornament

c. Description: cone shell with 9-mm-diameter hole cut into one side (Fig. 31d)
   Material: Conus sp.
   Dimensions: 21 mm long
   Provenience: area B, surface

d. Description: circular glass bead; straight sided, 4-mm diameter hole through center; flat ends (Fig. 31g)
   Material: glass
   Dimensions: 18-mm diameter; 14-mm thickness
   Provenience: SLW1, 0-10 cm, stratum I
   Comments: regular hole and depth suggest it is historic; probably Chinese

Category 10: Worked stone, bone, and shell (This is a residual category of items defying accurate functional classification, except for the adz flakes.)

Stone

a. Description: polished adz flakes from sharpening
   Number: 7
   Material: basalt
   Dimensions: range 18-42 mm long, 3-7 mm thick
   Provenience: stratum II

b. Description: thin piece of ground slate
   Number: 1
   Material: slate
   Dimensions: 40 x 30 x 4 mm
   Provenience: area B, surface
Fig. 31. ORNAMENTS FROM SITE 50-KA-05-1001 (actual size).

Category 10 - continued

Stone

c. Description: small fragment of polished stone; bevelled side; probable oval cross section  
Number: 1  
Material: stone  
Dimensions: 10 x 10 x 4 mm  
Provenience: BT-2  
Comments: possible fishhook-file fragment

Bone

Description: cut and burned piece of shaft of mammal long bone; facet cut on one end, was probably continuous (a ring) before breaking  
Number: 1  
Material: bone  
Dimensions: 21 x 14 x 2 mm  
Provenience: BT-3

Shell

a. Description: ground shell; aperture side and tubercles ground flat (Fig. 31e, f)  
Number: 2  
Material: shell (Drupa and Conus spp.)  
Dimensions: 15 and 20 mm long  
Provenience: S1W1, 15-20 cm, stratum II (Conus sp.); BT-3 (Drupa sp.)  
Comments: use unknown
Category 10 - continued

Shell

b. Description: cut shell
   Number: 2
   Material: pearl shell
   Dimensions: 28 x 22 x 3 mm; 15 x 14 x 1 mm
   Provenience: areas A and B, surface

Category 11: Nails (2)

a. Description: bent, broad-headed, sheathing nail
   Material: copper
   Dimensions: 30 mm long; head 15 mm wide
   Provenience: S1E2, 0-10 cm, stratum I

b. Description: corroded, flat-headed nail
   Material: iron
   Dimensions: 23 mm long; head 7 mm wide
   Provenience: S1W1, 10-15 cm

Category 12: Hammered metal wire

Description: hammered metal wire; bent; tapered to point on each end
Number: 2
Material: iron
Dimensions: each approximately 89 mm long, 4 mm thick
Provenience: BT-2, BT-3
Comments: curvature and dimensions suggest attempt to fashion fishhooks

Category 13: Glass bottle tops and stopper (Fig. 32)

a. Description: broken bottle tops; short necks; slight flare at top
   Number: 2
   Dimensions: inside diameters of necks, 12 and 14 mm
   Provenience: area C, surface
   Comments: tentatively dated between 1850 and 1910; probably medicine bottles

b. Description: glass stopper; flat top; sides beaded
   Number: 1
   Dimensions: 36 mm long; top 24 mm in diameter
   Provenience: area A, surface
   Comments: probably stopper for perfume bottle
The artifact assemblage from site 50-KA-05-1001, although not large, includes a sufficiently broad range of functional categories to indicate a habitation site as opposed to some other site type. This conclusion is easily derived independently from both stratigraphic interpretation and midden analysis. The numbers of artifacts in individual categories are not great enough to determine the full range of typological variation, but there is fair diversity in fishhook forms in the few examples recovered. Distribution analysis was not undertaken since precise provenience was lacking for most artifacts.

The predominance of pearl-shell fishhooks is consistent with Sinoto's (1967:356) findings at the K1 and K3 sites (see Fig. 1) on Kauai. The sample is too small to make further statements on the percent frequency of barbs on bone and shell hooks.

**Dating**

No absolute dates are available for the site. Insufficient charcoal was present to permit establishing a radiocarbon date. Hydration-rind dating of the one piece of volcanic glass recovered in the excavation yielded a date of 3400 years B.P., which measures the antiquity of the flow rather than the site as a cultural entity (Maury Morgenstein, Hawaii Institute of Geophysics, personal communication). Paucity of temporally diagnostic artifacts makes it difficult to establish even a relative date for the site.

Absence of historic artifacts below 10 cm suggests that the site pre-dates the construction of Fort Elizabeth in 1816. On the basis of fishhook typology and acceptance of Sinoto's (1968) sequence for the Hawaiian Islands, the site appears to be late prehistoric. This assumption requires that the sequence developed on the Island of Hawaii be valid also for Kauai. Other artifacts recovered in the excavation are presently useless as time-horizon markers.

**Midden Analysis**

Quantitative samples of midden were not collected in view of the nature of excavation dictated by a short field period. Analysis is therefore semiquantitative (presence-absence only); nevertheless, the
sample yields important environmental data (Appendix B) and information critical to interpretation of the site. Horizontal and vertical distribution of midden material is presented in Table 5, and midden found in BT-2 and BT-3 is listed in Table 6.

Most of the marine invertebrates found in the site live in the littoral or supralittoral environment. The invertebrate fauna is predominantly univalves, the most common of which were the pitchy sea snail (*Nerita picea*) and cowry (*Cypraea caputserpentis*). The striate mussel (*Brachydontes cerebristriatus*), a bivalve, was the most common shell in the site. All of these species occur in shallow-water, rocky areas. One brackish-water species, *Neritina vespertina*, occurred in fair abundance; it is no longer reported at the mouth of the Waimea River (probably because of silting) but is said to occur still in the cleaner water upstream. The black limpet (*Helcioniscus exeratus*), locally called 'opihi, is still collected in the immediate site area but did not occur in any great frequency in the midden. Echinoderms are represented by two varieties of sea urchin.

The vertebrate fauna includes mammal, bird, fish, and amphibian. The presence of the Polynesian dog, pig, chicken, and rat supports the thesis of a habitation site. Wild birds are limited to an unidentified, medium-sized duck, Hawaiian stilt, and large shearwater. The one amphibian, a burrowing toad, is a recent introduction. Paucity of all bone indicates few individuals.

On the basis of limited excavation and random sampling of midden, bone and shell appear to be relatively sparse in this site compared with many other Hawaiian coastal sites. In the small area excavated, midden was dispersed and did not occur in discrete lenses.

CULTURAL-HISTORICAL INTERPRETATION

All data considered, the site is interpreted as a multiple-component, late-prehistoric, habitation site. A primarily marine-subsistence base is suggested by artifact types and midden. More meaningful interpretation will depend on further, extensive, controlled excavations and rigorous analysis of greater amounts of field data.
Table 5. Midden Material, Site 50-KA-05-1001.

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<tr>
<th>Material</th>
<th>Presence of Midden Material in Given Locations and Depths (cm)</th>
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**SHELL**

Gastropoda (Univalves)

- *Conus catus* Hwass  
- *Conus ceylanensis* Sowerby  
- *Conus imperialis* Linnaeus  
- *Conus quercinus* Hwass  
- *Conus textile* Linnaeus  
- *Conus spp.*  
- *Nassarius grinbergenic* Beck  
- *Columella zebra* Gray  
- *Monilia tuberculata*  
- *Blainville*  
- *Drepanella uncinus* Linnaeus  
- *Nassa uncinus* Bruguère  
- *Cymatium pileare* Linnaeus  
- *Cymatium sp.*  
- *Tritonalia tritonis*  
- *Cassimaria vibex* (var. hawaiiensis) Dall  
- *Cypraea caputserpentis* Linnaeus  
- *Cypraea sulcidentata* Gray  
- *Strombus maculatus* Nuttall  
- *Clava obeliscus* Bruguère  
- *Littorina pintado* Wood  
- *Nipponix pilosus*  
- *imbricatus* Gould  
- *Helcioniscus exaratus*  
- *Sowerby*  
- *Trocus intertextus* Kiener  
- *Nerita picea* Recluz  
- *Nerita polita* Linnaeus  
- *Nerita vespertina* Nuttall  
- *Melampus castaneus*  
- *(Muhlfeld)*
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<th>Category</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>Amphibian</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><em>Buffonidae</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bird</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Gallus gallus</em> (Linnaeus)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procellarid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Isuridae</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Sca rus spp.</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unidentified</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### Table 6. Midden Material in Fill from Backhoe Trenches at Site 50-KA-05-1001

<table>
<thead>
<tr>
<th>Material</th>
<th>BT-2</th>
<th>BT-3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHELL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gastropoda (Univalves)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Terebra strigillata</em> Linnaeus</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Conus <em>catus</em> Hwass</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Conus <em>imperialis</em> Linnaeus</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Conus spp.</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Columbella zebra</em> Gray</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Morula tuberculata</em> Blainville</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Drupa ricinus</em> Linnaeus</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Nassa sertum</em> Bruguèire</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Cymatium pileare</em> Linnaeus</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Cymatium tuberosum</em> Lamarck</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Cymatium sp.</em></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><em>Casmaria vibex</em> (var. hawaiensis) Dall</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Cypraea caputserpentis</em> Linnaeus</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Cypraea isabella</em> Linnaeus</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><em>Cypraea reticulata</em> Martyn</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><em>Strombus maculatus</em> Nuttall</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Clava obeliscus</em> Bruguèire</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Littorina pintado</em> Wood</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Hipponix pilosus imbricatus</em> Gould</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Helcioniscus exaratus</em> Nuttall</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Trochus intextus</em> Kiener</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Nerita picea</em> Reclus</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><em>Nerita polita</em> Linnaeus</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><em>Nerita vesperpina</em> Nuttall</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Worm shell</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pelecypoda (Bivalves)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Isognomon (Melina) californicum</em> Conrad</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><em>Spondylus hawaiensis</em> Dall</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Antigona reticulata</em> (Blainville)</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><strong>Echinoderms (Sea Urchins)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Echinometra oblongata</em> (Blainville)</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><em>Heterocentrotus mammillatus</em> (Linnaeus)</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><strong>BONE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mammal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Rattus exulans hawaiensis</em> Stone</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><em>Canis familiaris familiaris</em> Linnaeus</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><em>Sus scrofa</em> scrofa* Linnaeus</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Unidentified</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><strong>Bird</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium-sized duck</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Himantopus mexicanus</em> (P.L.S. Müller)</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><strong>Fish</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Isuridae</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unidentified</td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>
Site 50-KA-1002 is a right-angle stone alignment just above the high-tide mark and parallel to the shoreline. It is located approximately 27 meters W of area B of site 50-KA-05-1001. The long side is 13 meters and the short, 5 meters. Along most of its length it is a single-course wall of large basaltic stones, the long axes of which are placed end to end. In two places along the long side a second course exists.

This feature bears no obvious relationship to the fort or the open midden site, and for that reason has been given a separate designation. Its function is not readily apparent. Historic burials are reported along this section of the beach, however, and therein may lie some association.

SUMMARY AND RECOMMENDATIONS

Mapping and test excavations were undertaken during a three-week period at the early-19th-century Fort Elizabeth and a nearby pre-contact site at Waimea, Kauai. Information recovered in this preliminary investigation constitutes a database for a more problem-oriented second phase of restoration.

The most important contribution of this first-phase work is the detailed map and corresponding descriptions of structural features associated with the fort. These, combined with rich historical data, provide for more sound interpretation of site usage during its short history than historic data alone. The next obvious step in the restoration is removal of rubble and extensive excavations of the wall and independent structures.

A trench through the wall on the S is required to test the hypothesis of construction stages. Following the removal of collapsed rubble, it should be possible to determine whether or not the wall on a given side was built from opposite directions, and if there were modifications of the wall as suggested in this paper. A greater artifact recovery is expected in the excavation of structures, which should permit more refined interpretations of use and age than presently possible. Features interpreted as burials merit further investigation, and disposition of remains, if present, demands serious thought by the State.

Excavations on the beachfront revealed a pre-contact site (50-KA-05-1001) that merits further investigation. This buried habitation site contains several features (including a possible house floor) and a relatively rich artifact assemblage. Few sites of this type have been excavated in the Hawaiian Islands. This one should be excavated more fully; a large horizontal surface should be opened to expose living floors and features in their entirety. This approach to excavation would provide maximum information for cultural-historical interpretation.

* The Bishop Museum site number is 50-KA-C2-16.
APPENDIX A. DESCRIPTION OF GEOLOGIC UNITS

Stratigraphic Section on South Wall of BT-1

<table>
<thead>
<tr>
<th>Geologic Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratum I</td>
<td>very dark grayish-brown (10 YR 3.5/2)* loamy sand; well-sorted; sand component is fine; includes O0 and A soil horizons; 6-8 cm thickness; clear to smooth boundary to:</td>
</tr>
<tr>
<td>II</td>
<td>dark grayish-brown (10 YR 4/2) loamy sand; contains few small waterworn pebbles and shell; 10± cm thickness; clear to smooth boundary to:</td>
</tr>
<tr>
<td>III</td>
<td>dark grayish-brown (10 YR 4/2) fine loamy sand; sand component is well-sorted, fine to medium, crushed coral; few shells and small waterworn pebbles (2-3 mm diameter); 20 cm thickness; clear to abrupt boundary to:</td>
</tr>
<tr>
<td>IV</td>
<td>dark-gray, fine sand (10 YR 4/1); contains fire-cracked rock, shells, waterworn pebbles and charcoal; 15± cm thickness; clear to abrupt boundary to:</td>
</tr>
<tr>
<td>V</td>
<td>dark grayish-brown (10 YR 4/2) fine loamy sand; sand component is well-sorted, fine to medium, crushed coral; few shells and small waterworn pebbles; thickness unknown</td>
</tr>
</tbody>
</table>

Stratigraphic Section on West Face of BT-2 (SW1)

| I             | dark reddish-brown (2.5 YR 3/4) sandy loam; friable; granular to crumb; plastic, slightly sticky; sand component is fine, dark-colored particles; clear to abrupt boundary to: |
| II            | very dark grayish-brown (10 YR 3/2) unconsolidated loamy sand; granular; nonplastic, nonsticky; clear to abrupt boundary to: |
| III           | waterworn pebbles in a very dark grayish-brown (10 YR 3/2) unconsolidated, loamy sand matrix; interpreted as a possible house floor |
| IV            | pink (5 YR 7/4) sand; color varies to white when dry; fine to coarse; coarse component of well-rounded basalt cobbles and coral; fine component of crushed shells and coral; clear to abrupt boundary to: |
| V             | dusky-to-dark-red (wet 10 R 3.5/6) sandy loam; blocky; plastic, nonsticky |

* Based on Munsell Color Chart
Stratigraphic Section on East Wall of BT-3

<table>
<thead>
<tr>
<th>Geologic Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratum I</td>
<td>dark-red (2.5 YR 3/6) sandy loam; compact; blocky; plastic, non-sticky; contains charcoal specks and minute shell fragments deposited during modern cultivation; clear to abrupt boundary to:</td>
</tr>
<tr>
<td>II</td>
<td>very dark, grayish-brown (10 YR 3/2.5) loamy sand; well-sorted; non-plastic, non-sticky; contains fine shell, coral and waterworn pebbles; one discontinuous facies--brownish-yellow (10 YR 6/7) sand; clear to abrupt boundary to:</td>
</tr>
<tr>
<td>III</td>
<td>pink (5 YR 7/4) sand; color varies to white when dry; medium to coarse; poorly sorted--less-than-1-mm to 13-cm-diameter size range; coarse component of well-rounded porous basalt and coral; fine component of crushed shell and coral; clear to abrupt boundary to:</td>
</tr>
<tr>
<td>IV</td>
<td>dusky-red to dark-red (10 R 3.5/6-wet) sandy loam; blocky; plastic, non-sticky</td>
</tr>
</tbody>
</table>

Stratigraphic Section on South Wall of BT-4

| I              | dark-yellowish-brown (10 YR 3.5/4) loamy sand; upper 2-3 cm is the 00 and A soil horizon; slightly plastic, non-sticky; 5-cm thickness; clear to smooth boundary to: |
| II             | light-brownish-gray (10 YR 6/2.5) sand; fine to medium; well-rounded; lateral variation in sorting; lenses of stratum I occur near upper boundary; 40-cm thickness; clear to abrupt boundary to: |
| III            | dark-reddish-brown to dark-red (2.5 YR 3/5) loam; blocky; plastic, slightly sticky; minute sand particles, plant fragments and charcoal near upper boundary; thickness unknown |

Stratigraphic Section on South Wall of BT-5

| I              | dark-reddish-brown (2.5 YR 3/4) loam; blocky; plow zone; contains angular and well-rounded stones 1-6 mm in diameter; 20-28-cm thickness; clear to abrupt boundary to: |
| II             | dark-reddish-brown to dark-red (2.5 YR 3/5) loam; blocky; plastic, slightly sticky; thickness unknown |

Stratigraphic Section on North Wall of BT-6

| I              | dark-reddish-brown (2.5 YR 3/4) loam; blocky; plow zone; contains angular and well-rounded stones 1-6 mm in diameter; 8-10-cm thickness; clear to abrupt boundary to: |
| II             | dark-reddish-brown to dark-red (2.5 YR 3/5) loam; blocky; plastic, slightly sticky; thickness unknown |
### Appendix B. MIDDEN MATERIAL FROM SITE 50-KA-05-1001

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Hawaiian Name</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MOLLUSC</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastropoda (Univalves)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terebra strigilata Linnaeus</td>
<td>Painted Auger Shell</td>
<td>pūpū-lo'ola</td>
<td>On reef</td>
</tr>
<tr>
<td>Conus catus Hwass</td>
<td>Cat Cone</td>
<td>pūpū-'alā</td>
<td></td>
</tr>
<tr>
<td>Conus ceylanensis Sowerby</td>
<td>Ceylon Cone</td>
<td>pūpū-'alā</td>
<td>On reef</td>
</tr>
<tr>
<td>Conus imperialis Linnaeus</td>
<td>Imperial Cone</td>
<td>pūpū-'alā</td>
<td>On reef</td>
</tr>
<tr>
<td>Conus quercinus Hwass</td>
<td>Oak Cone</td>
<td>pūpū-'alā</td>
<td>Outer reef</td>
</tr>
<tr>
<td>Conus textile Linnaeus</td>
<td>Cloth of Gold Cone</td>
<td>pūpū-'alā</td>
<td>On reef</td>
</tr>
<tr>
<td>Nassarius graphiferus Beck</td>
<td>Painted Basket Shell</td>
<td></td>
<td>On sand-covered reef</td>
</tr>
<tr>
<td>Columbella zebra Gray</td>
<td>Zebra Dove Shell</td>
<td></td>
<td>Near shore, under stones, in seaweed</td>
</tr>
<tr>
<td>Morula tuberculata Blainville</td>
<td>Tuberculate Morula</td>
<td>pūpū-makai-'awa</td>
<td>Rocky areas in shallow water</td>
</tr>
<tr>
<td>Drupa ricius Linnaeus</td>
<td>Castor Bean Drupe</td>
<td>pūpū-'awa</td>
<td>Rocky areas in shallow water; clings to rocks in strong surf</td>
</tr>
<tr>
<td>Nassa sertum Bruguieré</td>
<td>Garland Nassa</td>
<td>'a-unauna</td>
<td>Rocky areas is shallow water</td>
</tr>
<tr>
<td>Cymatium pileare Linnaeus</td>
<td>Hairy Triton</td>
<td>pūpū-'olō</td>
<td>Shallow water</td>
</tr>
<tr>
<td>Cymatium tuberosum Lamarck</td>
<td>Knobby Triton</td>
<td>pūpū-'olō</td>
<td>From shoreline to moderate depths</td>
</tr>
<tr>
<td>Tritonalia tritonis (Linnaeus)</td>
<td>Triton's Trumpet</td>
<td>pū</td>
<td>Shallow bays and off-shore water</td>
</tr>
<tr>
<td>Casmaria vibex (var. hawaiiensis) Dall</td>
<td>White Helmet Shell</td>
<td></td>
<td>Sandy bottoms in shallow water</td>
</tr>
<tr>
<td>Cypraea caputserpentis Linnaeus</td>
<td>Snakehead Cowry</td>
<td>leho-kupa</td>
<td>Holes in rocks and stones near shore</td>
</tr>
<tr>
<td>Cypraea isabella Linnaeus</td>
<td>Isabella Cowry</td>
<td>pūleho</td>
<td>Rocky shores exposed to dash of waves and outer edges of reef where surf is strong</td>
</tr>
<tr>
<td>Cypraea reticulata Martyn</td>
<td>Reticulated Cowry</td>
<td>leho</td>
<td>On reef</td>
</tr>
<tr>
<td>Cypraea sulcidentata Gray</td>
<td>Grooved-tooth Cowry</td>
<td>(leho)</td>
<td>From shallow water to depths of a few fathoms</td>
</tr>
<tr>
<td>Strombus maculatus Nuttall</td>
<td>Spotted Strombus</td>
<td>pūpū-māmāiki</td>
<td>On rocks in reef zone; often with Neriidae</td>
</tr>
<tr>
<td>Clara obeliscus Bruguieré</td>
<td>Obelisk Shell</td>
<td>(pūpū)-maka-aha</td>
<td>Shallow water, on smooth surface of stones</td>
</tr>
<tr>
<td>Littorina pintado Wood</td>
<td>Dotted Periwinkle</td>
<td>pipipi-'akōle'a</td>
<td>Heavy surf; clings to rocky shores</td>
</tr>
<tr>
<td>Hipponix pilosus imbricatus Gould</td>
<td>Hairy Hoof Shell</td>
<td></td>
<td>Among seaweed in the littoral zone</td>
</tr>
<tr>
<td>Melampus caseneus (Muhlfeld)</td>
<td>Black Limpet</td>
<td>'opīhi</td>
<td>Clings to rocks in surf zone</td>
</tr>
<tr>
<td>Helcioniscus exeratus Nuttall</td>
<td>Top Shell</td>
<td>hā'upu</td>
<td>On rocks in surf zone, often high out of water</td>
</tr>
<tr>
<td>Trochus internus Kiener</td>
<td>Pitchy Sea Snail</td>
<td>pipipi</td>
<td>Found near mouths of rivers; prefer fresh or brackish water</td>
</tr>
<tr>
<td>Merita pikea Recluz</td>
<td>Polished Nerite</td>
<td>kupē'e</td>
<td></td>
</tr>
<tr>
<td>Merita polita Linnaeus</td>
<td>Winged Nerite</td>
<td>hīhī-wai</td>
<td></td>
</tr>
<tr>
<td>Meritina vesperitina Nuttall</td>
<td>Chestnut Ear Shell</td>
<td>'eoa</td>
<td>Under stones at water's edge</td>
</tr>
<tr>
<td>Kingdom</td>
<td>Species</td>
<td>Scientific Name</td>
<td>Habitat/Description</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pelecypoda (Bivalves)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brachydonites cerebristriatus Conrad</td>
<td></td>
<td></td>
<td>Attached to reef rocks in shallow water</td>
</tr>
<tr>
<td>Isognomon (Meline) californic Conrad</td>
<td></td>
<td></td>
<td>Under surface of stones in shallow water</td>
</tr>
<tr>
<td>Antigona reticulata Linnaeus</td>
<td></td>
<td></td>
<td>Sand dweller</td>
</tr>
<tr>
<td>Echinoderm (Sea Urchins)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echinometra oblongata (Blainville)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterocentrotus mamillatus Linnaeus</td>
<td></td>
<td></td>
<td>Outer border of reef</td>
</tr>
<tr>
<td>Echinoidea (Sea Urchins)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mammal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rattus exulans hawaiiensis Stone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canis familiaris familiaris Linnaeus</td>
<td></td>
<td></td>
<td>Domestic species</td>
</tr>
<tr>
<td>Sus scrofa scrofa Linnaeus</td>
<td></td>
<td></td>
<td>Domestic species</td>
</tr>
<tr>
<td>Amphibian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffonidae</td>
<td></td>
<td></td>
<td>Recent introduction</td>
</tr>
<tr>
<td>Bird</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gallus gallus (Linnaeus)</td>
<td></td>
<td></td>
<td>Domestic species</td>
</tr>
<tr>
<td>Himantopus mexicanus (P.L.S. Müller)</td>
<td></td>
<td></td>
<td>Lagoon</td>
</tr>
<tr>
<td>Procillarid</td>
<td></td>
<td></td>
<td>Wedge-tailed shearwater near the sea</td>
</tr>
<tr>
<td>Medium-sized duck</td>
<td></td>
<td></td>
<td>Petrel nests in mountains</td>
</tr>
<tr>
<td>Fish</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scarus spp.</td>
<td></td>
<td></td>
<td>Pelagic species</td>
</tr>
<tr>
<td>Isuridae</td>
<td></td>
<td></td>
<td>Inshore, subsurge zone</td>
</tr>
</tbody>
</table>

*Wedge-tailed Shearwater

**Dark-rumped Petrel
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Fig. 5. MAP OF FORT ELIZABETH AND RELATED FEATURES
(parts b and c on p. 65).
b. Profiles of fort through planes X-X' and Y-Y'

c. Profiles of fort wall at two selected locations

Fig. 5. MAP OF FORT ELIZABETH AND RELATED FEATURES (continued from p. 63).