Pre-Contact and Early Historic Cultural Landscapes in Kahikinui District, Maui: A Progress Report

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On the morning of May 28th, 1786, Jean-François de Galaup de la Pérouse in command of the French frigates *Boussole* and *Astrolabe* sighted the snow-covered summits of Mauna Loa and Mauna Kea and, soon after, that of Haleakalā. To la Pérouse "the island of Maui looked delightful," and he directed his ships to coast it one league offshore. La Pérouse and his sea-weary crew were enthralled with "waterfalls tumbling down the mountainside into the sea," as they passed the districts known to the Hawaiian inhabitants of Maui as Kīpahulu and Kaupō (Dunmore, ed. 1994:80). This idyllic landscape was soon replaced—much to the dismay of the sailors—as "the mountains receded towards the interior of the island." In la Pérouse's words,

> We saw no more waterfalls, the trees were fairly sparsely planted along the plain, and the villages, consisting only of 10 or 12 huts, were quite distant from each other. Every moment made us regret the country which we were leaving behind, and we only found shelter when we were faced with a frightful shore, where the lava had once run down as waterfalls do today in the other part of the island (Dunmore, ed. 1994:82).

This barren landscape which so disappointed la Pérouse and which occupies most of the southeastern sector of Maui was the traditional district of Kahikinui, 'Great Tahiti,' named—most probably—in memory of Tahiti in the Society Islands. Lying in the lee of 1,215-meter high Haleakalā, Kahikinui is a classically leeward, arid landscape, its lava flow-slopes barely modified by a few narrowly-incised, intermittent stream gulches.

La Pérouse's disappointment with southeast Maui may be taken as a metaphor for the post-contact history of Kahikinui District. Rapidly depopulated during the early nineteenth-century through the devastation of epidemics and the lure of out-migration to such centers as Lahaina, Kahikinui soon became a forgotten hinterland, famous only as the refuge of persecuted Catholics under the Protestant-dominated regimes of the successive *Kuhina Nui* Ka'ahumanu and Kīna'u. These converts to the Catholic faith gained notoriety in 1837 when—refusing to convert to Protestantism—they were *pa'a kaula* (tied with ropes) and marched to Wailuku via Hāna, a judicial action that backfired completely as a crowd of 2,000 joined their ranks along the course of the march (Matsuoka et al. 1995:III-127). In the Great Mahele of 1848, the entire *moku* or district of Kahikinui was surrendered to the Hawaiian Government by Lot Kamehameha (later King Kamehameha V) in lieu of commutation due on other lands received by this high chief and grandson of the great conqueror (Commissioner of Public Lands 1929:37). Being of little economic use to the Government, Kahikinui's lands were subsequently leased to *haole* cattle ranchers, a practice which continued throughout this century even after the passage of the Hawaiian Homes Act of 1920. The indigenous Hawaiian population of Kahikinui wholly abandoned its grassy slopes to the depredations of cattle by about 1865, when the little Catholic Church of St. Inez in Nakaohu *ahupua'a* was abandoned for lack of a congregation.

A cattle-ranching, unpopulated hinterland throughout the twentieth century, Kahikinui has also been largely bypassed by archaeologists. In 1929 Winslow Walker, a Yale-Bishop Museum Fellow assigned the task of surveying Maui archaeology (Buck 1945:57; Walker 1931), passed through the region on horseback recording a few *heiau* sites pointed out to him by his Hawaiian guide. Aside from a brief test excavation at a cave site in Mahamenui by K. P. Emory in 1961 (Chapman and Kirch 1979:19), Kahikinui received no attention in the renewed program of Hawaiian archaeology directed by Emory after 1950. In 1966, however, Kahikinui became the focus of a major archaeological survey effort directed by Peter S. Chapman, at the instigation of Emory (Kirch 1985:137–38). The Chapman team carried out intensive archaeological survey within two *ahupua'a* (Kīpapa and Nakaohu) as well as reconnaissance work throughout the district, and excavations at six sites within Kahikinui (Chapman and Kirch 1979). For reasons described below, most of this work was never completed or published, and Kahikinui once again was ignored in favor of other field settings.

Within the past two years, Kahikinui has again begun to attract attention, both from Native Hawaiians and from archaeologists. With the rise of a Sovereignty movement among Hawaiians, the vast, underutilized Kahikinui lands have become something of a political symbol, and the focus of a grassroots organization, Ka 'Ohana o Kahikinui. The Kahikinui Ohana proposes to reestablish a Hawaiian community within Kahikinui, which would include traditional land use practices. Responding to the likelihood that at least some Kahikinui lands would be released from cattle ranching to homesteading, the Hawaiian Homes Commission has engaged archaeologists to assess the extent of cultural resources, and to determine how these might be impacted by changes in land use (M. Kolb, pers. comm. 1994; Hammatt and Folk 1994). The possibility of a geothermal energy transmission line being routed across southeast Maui also prompted a cultural resources study of a narrow corridor from Huakini Bay to Ahiki (Erkelens 1995).

It was largely serendipitous that in this context of renewed interest in Kahikinui the senior author had decided in 1993 to begin a reanalysis of the Chapman survey data dating to 1966. Having been a member of the 1966 survey team, he had long harbored an interest in seeing that pioneering study brought to fruition. During 1995, we were able not only to rework and field check much of the 1966 survey data, but to extend the survey in Kīpapa and Nakaohu *ahupua'a* into areas not covered during the Chapman project. This article is a summary report of our progress to date.

Kahikinui: Environmental Background

Kahikinui District occupies the southwestern flanks of East Maui, surmounted by the 10,023-foot summit of Haleakalā. The land surface is dominantly undissected lava flow slopes of the Hāna Volcanic Series, derived from the southwest rift of Haleakalā, dotted in a few places with pyroclastic vents such as the Lualailua cinder cones (Stearns and Macdonald

1942; Macdonald and Abbott 1970:318–36). The young age of the Hāna lava is indicated by their lack of weathering, especially stream dissection. Stream gulches only become prominent towards the eastern edge of Kahikinui, where an older land surface of the Kula Volcanic Series was not buried under the late Pleistocene or Holocene Hāna series flows. Lithologically, the Hāna lavas include alkalic olivine basalts, basaltic hawaiites, and ankaramites. Within our Kīpapa-Nakaohu survey area, two or three ankaramite flows of different ages are suggested by lithology and degree of surface weathering. These flows vary locally in terms of a'a or pahoehoe morphology, a factor that has greatly influenced the degree of surface weathering, especially in the upland zones.

Because this landscape is geologically youthful, it has been only slightly modified by erosion. Within our survey area there are a few intermittent stream channels ranging from 2–8 m in width, with scoured and smoothed channel floors and small quantities of waterworn gravel indicative of water flow at times. None of these channels flow regularly now, although there may have been more frequent discharge in pre-contact times when the forest line was significantly lower, prior to the depredations of cattle and goats. These intermittent streams would have provided the only sources of surface water to the pre-contact Hawaiian population of Kahikinui. Slightly east of the Kīpapa-Nakaohu survey area is Kepuni Gulch, where the U.S.G.S. has a gauging station; from May 1963 to September 1965, the Kepuni stream had measurable discharge on only four days (U.S.G.S. 1971:363).

The rainfall gradient between the Haleakalā summit and the coast is steep. No good rainfall records exist, however, and rainfall is extrapolated from stations at 'Ulupalakua to the west and Waiopai Ranch to the east. The upland zone between about 2–4,000 feet elevation is estimated to receive 750–1,000 mm annually, mostly in the winter months; this is probably highly variable from year to year. This amount of rainfall has been sufficient to weather the older a'a lava flows. The coastal sectors are extremely arid, as indicated by the lack of weathering of their lavas.

The upland portions of Kahikinui District still support the remnants of a once-remarkable dryland forest, noted for its diversity of endemic trees and shrubs, but now sadly degraded through the effects of feral pigs, goats, and cattle (Medeiros, Loope, and Holt 1986). In our Kīpapa-Nakaohu study area, the uplands between ca. 365–740 m elevation are dominated by a mix of exotic grasses, lantana (*Lantana camara*), and *koa haole* (*Leucaena glauca*). However, significant numbers of such native species as *wiliwili* (*Erythrina sandwicensis*), *'ili-ahi* (*Santalum* spp.), and *a'ali'i* (*Dodonea eriocarpa*) also persist. The lower elevations and coastal region are more barren, although scattered *wiliwili* and *a'ali'i* grow to within a few hundred meters of the coast.

The littoral and marine resources available to the pre-contact and early historic inhabitants of Kahikinui were extremely restricted in comparison with other parts of Maui. The coastline is dominated by sea cliffs ranging from a few meters to 30–50 m high, making access difficult except in a few locations where there are small bays with cobble or gravel beaches; these bays are all marked by concentrations of archaeological sites. There is no fringing reef, and the 'Alenuihāhā Channel is noted for its strong currents and rough seas, making fishing from small canoes hazardous. Surge zone mollusks such as the prized *'opihi* (*Cellana exarata*), small cowries (*Cypraea caputserpentis*), and drupes (*Drupa ricinus*), and sea urchins were gathered from the sea cliffs and lava rock benches, and octopus are evidently common in the shallower waters immediately offshore (cowry-shell lures and "coffee-bean" type sinkers are among the most commonly found surface artifacts at Kahikinui sites).

The 1966–67 Chapman/Bishop Museum Survey

During the summer months of 1966 and in January 1967, an archaeological survey of portions of Kīpapa and Nakaohu *ahupua'a* was undertaken under the direction of Peter S. Chapman, then an anthropology graduate student at Stanford University. Officially under the auspices of the Bishop Museum, the survey was in large measure privately financed by Chapman. Tragically, Chapman became terminally ill a few years after the survey was carried out, and died before his intended dissertation or any final report could be prepared.

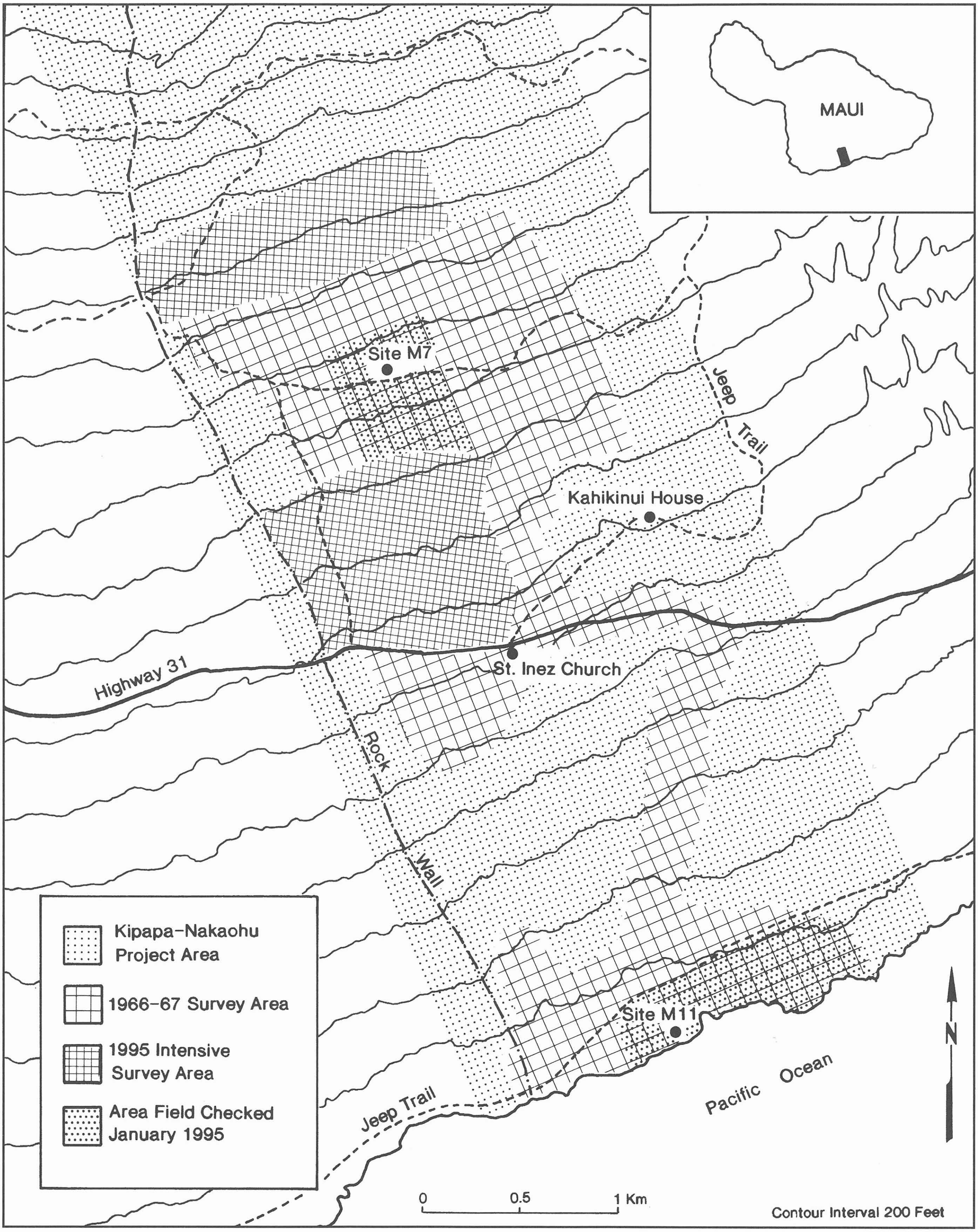
The 1966–67 survey was a pioneering effort in Hawaiian archaeology. Most prior survey work in Hawai'i had been highly selective, focused almost exclusively on monumental sites such as *heiau* and fishponds (such as the 1929 work of Winslow Walker [1931] on Maui.) Influenced by methodological and theoretical innovations taking place in the Americas and elsewhere, especially the emerging "settlement pattern" approach of Harvard archaeologist Gordon Willey and his students such as K. C. Chang and R. C. Green, Chapman decided to undertake an *intensive* or comprehensive archaeological survey of two *ahupua'a* units. The main theoretical inspirations to the 1966 Kahikinui survey were Green's work in the Society Islands and Samoa (Green 1967, 1970), and Ruppé's example from the American Southwest (Ruppé 1966). Chapman's aim was to record *all* archaeological remains visible on the surface, no matter how mundane, in order to gain a greater understanding of the patterns of traditional land use, settlement distribution, and sociopolitical organization. The 1966–67 Kahikinui survey was the first effort of this type in the Hawaiian Islands, although it would shortly be followed by similar settlement-pattern work in such areas as Mākaha, O'ahu (Green 1969), Halawa, Moloka'i (Kirch and Kelly 1975), and Lapakahi, Hawai'i (Pearson, ed. 1968; Tuggle and Griffin 1973; Rosendahl 1972).

Since there was no precedent in Hawai'i for this kind of intensive survey, the 1966 field team had to develop its own data-recording protocols. The system developed by Chapman consisted of systematically walking the landscape, marking each archaeological feature or site as it was discovered and assigning these with sequential numbers. An instrument survey team (W. Kikuchi and P. Kirch) then mapped these sites using plane table and telescopic alidade at a scale of 1″ = 200′. The plane table survey sheets were later compiled by Kikuchi into a composite archaeological "settlement pattern" map of Kīpapa-Nakaohu. Meanwhile, a second team made individual sketch maps of the sites or features (using compass and tape, or sometimes by pacing), noting dimensions and making other observations. These sketches were mostly made on graph paper at various scales, although recording standards were by no means consistent; no verbal descriptions were made. Selected photographs were also taken by Chapman. In sum, the records of the 1966–67 survey consist of the plane table maps, and individual feature/site sketches augmented by selected photographs.

Although Chapman's original intention was to survey both Kīpapa and Nakaohu *ahupua'a* entirely, this proved beyond the resources of his 1966 project. As can be seen in Figure 1, his team succeeded in covering a large portion of the *mauka* zone (above the highway), as well as the coastal strip. A transect running along a *mauka–makai* jeep trail was also surveyed. In all, a total of 544 sites or features was recorded and assigned site numbers in 1966–67. Although Chapman's survey was highly innovative for its time, from our contemporary perspective the level of data recording was less than satisfactory. The individual site/feature sketches vary in quality and level of detail; no verbal descriptions were written; observations of architectural patterns, surface midden or artifacts were not always systematic; and, there is no comprehensive photo record. Nonetheless, the 1966–67 survey does provide a wealth of data, and forms the basis upon which a renewed program of intensive survey in Kahikinui can build.

The U. C. Berkeley Kahikinui Project: Background and Objectives

In 1994, with the assistance of Cynthia Van Gilder, we began to reanalyze the 1966 survey data by developing a systematic, computerized relational database. The 1966 field sketches were each scrutinized for data on feature type, architecture, dimensions, and other observations, which were then systematically coded into a data file using the Paradox 4.0 relational database software, running on a DOS-386 platform. As this work proceeded, problems and inconsistencies with the 1966 survey records became increasingly apparent. Often it was not possible to assign a feature to a particular architectural or formal class, or to make informed decisions about probable function. It became evident that if the 1966 survey data were to be properly utilized, renewed field checking would be essential. We therefore planned a 10-day fieldwork session in Kīpapa-Nakaohu for January, 1995, to re-evaluate the 1966 survey results.


MAUI
Site M7
Jeep Trail
Kahikinui House
Highway 31
St. Inez Church
Rock Wall
Kipapa-Nakaohu Project Area
1966-67 Survey Area
1995 Intensive Survey Area
Area Field Checked January 1995
Site M11
N
Pacific Ocean
Jeep Trail
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0.5
1 Km
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Our January 1995 survey was envisioned as a "trial run" to revisit and field-check as many of the 1966 sites as possible. We wanted to determine: (1) how readily the 1966 sites could be relocated, and how accurate the map locations were; (2) to check for the accuracy of the 1966 field sketches and dimensions; (3) to record systematically certain architectural and other observations not made in 1966; and (4) to photograph as many sites as possible. We were constrained by both the limited funds and the time available, and did not anticipate that it would be possible to recheck anywhere near the total of 544 sites. Our aim was more modest: to visit as many features as possible in both *mauka* and *makai* sample areas.

Between January 3–12, 1995, we spent seven days in the Kīpapa-Nakaohu area (two days were spent in the coastal sector, and five in the uplands). The field team consisted of the author, U. C. Berkeley graduate students Cynthia Van Gilder and Kathy Kawelu, and undergraduate student Greg Reuter. Our field strategy was to work in two teams, each assigned a particular mapped area from the 1966 survey. We used xerox reproductions of the 1966 plane table sheets to relocate sites, and had bound sets of the individual site sketches for rechecking. We made systematic architectural observations on a preprinted recording form, using a protocol originally developed for an intensive survey of the Kawela *ahupua'a,* Moloka'i (Weisler and Kirch 1985).

The January pilot study showed that the 1966–67 sites could readily be relocated, and that with systematic cross-checking the original data could be more readily interpreted. We were thus encouraged to lay plans for a longer-term restudy of the Kīpapa-Nakaohu area with the ultimate goal of realizing Peter Chapman's initial vision of a comprehensive settlement-pattern study of these two *ahupua'a.* The second phase of this restudy was carried out from 29 June through 5 August, 1995 by the U. C. Berkeley team, assisted by staff of the State of Hawai'i Historic Preservation Division. Rather than continue to focus on rechecking 1966–67 sites, we decided to concentrate on the survey and recording of sites in areas not covered by the Chapman team. In particular, we chose to survey a large block of approximately 1 km^2, *mauka* of Highway 31 and extending east from a rock boundary wall through Kīpapa and into Nakaohu *ahupua'a.* In addition, we also extended the survey into a higher-altitude zone (above the pipeline which marked the upper boundary of the 1966–67 survey area). By the close of the 1995 field season, we had recorded 462 new sites, bringing the total for Kīpapa-Nakaohu to 1,006 sites.

Figure 1. Topographic map of a portion of Kahikinui District, showing the Kīpapa-Nakaohu survey area, and the extent of archaeological survey coverage (1966 and 1995 seasons). Topography based on U.S.G.S. Lualailua quadrangle.

Field and Laboratory Methods: 1995 Survey

The field and laboratory methods which we devised for the 1995 survey, and which will be used in our continuing efforts in Kīpapa-Nakaohu, are designed to take advantage of the best aspects of traditional archaeological field survey, combined with modern technological advances in data capture, storage, and analysis. A significant pre-fieldwork innovation consisted of scanning and digitizing a series of enlarged, color infrared aerial photographs. The photos had been taken for the State of Hawai'i Division of Forestry, and the enlargements made for us by Air Survey Hawai'i were at a scale of approximately 1:8,000. Once scanned and digitized, it was a simple task to delineate any area of interest on the computer screen, enlarge this to any desired scale, and to process and enhance the digitized image using several filtering or edge-enhancing features of the imaging software. Many archaeological sites, especially free-standing walls and larger structures, could readily be identified, as could distinctive vegetation patterns and other environmental features. Figure 2 depicts a cluster of historic-period house enclosures situated *mauka* of St. Inez Church, as revealed by a digitized and edge-filtered image. Before departing for the field, we prepared a comprehensive set of such digitized images which proved to be of great use during the field survey.

In the field, a reconnaissance team walked close transects, flagging structures for mapping and recording (no easy feat in some parts of the survey area with dense, head-high lantana). Several low-level heli-

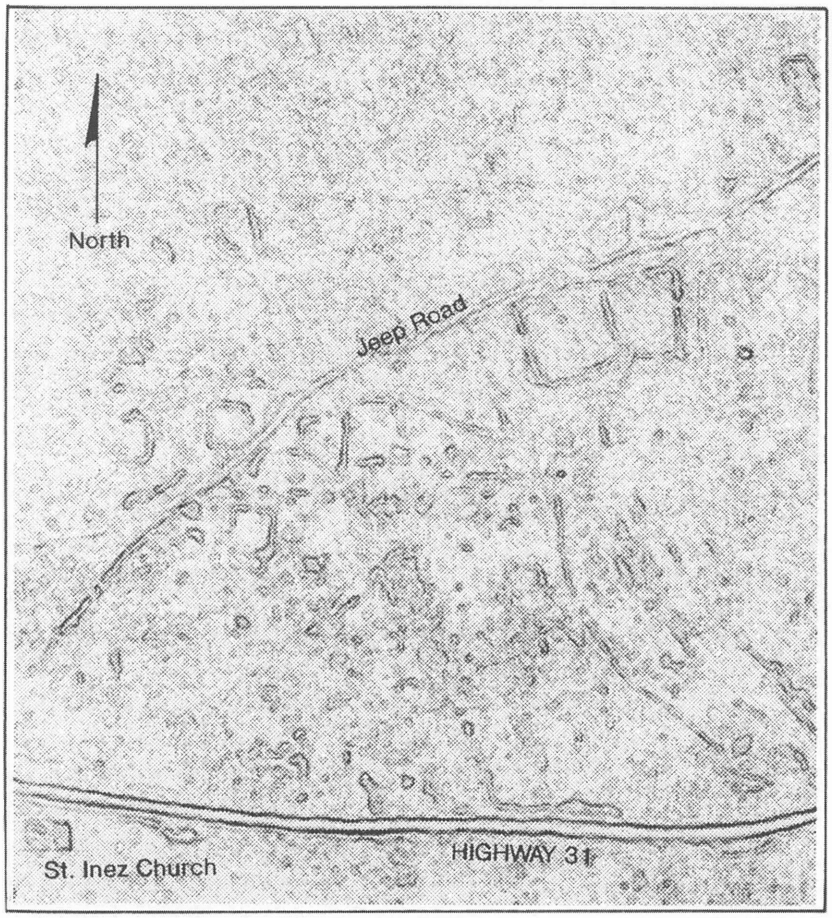

Figure 2. Example of an enlarged digitized, edge-filtered aerial photo of an historic village complex in Nakaohu *ahupua'a.* The image area is approximately 200 x 200 m.

copter flights over the survey area allowed us to obtain oblique photographs of sites and terrain. Reconnaissance was followed by the mapping team which, as in 1966–67, used a Gurley telescopic alidade and plane table to plot all sites at 1:1,000. The decision to map site locations by optical instrument was based both on a desire to maintain consistency with the 1966–67 maps, but also because plane table mapping allows one to make detailed and extensive observations on topography, geological substrate, and vegetation cover. Thus our 1:1,000 survey maps provide a basis for interpretations of remote-sensing data to be entered into our GIS (geographic information system) database for this region (see below). For most sites, moreover, we also electronically recorded site locations using a Trimble Global Positioning System instrument, with differential correction of coordinates supplied by the State Historic Preservation Office. GPS positions were also taken on all plane table mapping stations.

Once sites were mapped, plotted, and numbers assigned, they were recorded in detail by a third team, using standardized, pre-printed recording forms. The four-page form (printed on a single, folded sheet of stiff, green, non-reflective paper) incorporates a metric grid for plan and two cross-sections (usually drawn at 1:100), a check-list of 27 architectural, artifactual, and environmental features, and space for a verbal description. Use of such a pre-printed format greatly enhances the quality of data capture, and comparability of results between individual recorders, a problem also addressed by regularly conferring between field team members. A few large, architecturally-complex sites were also mapped in detail with plane table and alidade at 1:100 or 1:200.

In the post-field laboratory analysis phase, our survey data are entered into a relational database using Paradox, running in Windows 2.0 on a DOS-386 platform. The 1995 Paradox survey file is a slightly modified version of that developed for the 1966 survey data, incorporating all observations made on the pre-printed recording forms. We are also digitizing the site location maps (using AUTOCAD and an IBM 5084-3 digitizer as the input device), as the first phase of developing a GIS database for the Kīpapa-Nakaohu area. Our objective is to create a GIS database which combines the archaeological survey map with infra-red images from aerial photography, a digital elevation model, and additional information "layers" on geology, soils, vegetation, and other variables.

The Kīpapa-Nakaohu Survey: Results to Date

Architectural Variation and Problems of Site Classification

As in other leeward regions of Hawai'i, the archaeological landscape of Kīpapa-Nakaohu exhibits an initially bewildering array of stacked-stone architectural features, highly variable in morphology, ranging in

Figure 3. Helicopter aerial photo of a settlement cluster in the coastal zone. The smaller of the two rectangular enclosures (closer to the shoreline) is site M11, excavated in 1966.

size from 50-cm high stone mounds up to complex, walled, multi-component structures enclosing as much as 1,600 m². The effects of a century and a half of cattle ranching—resulting in collapse and heaping of many wall segments—further complicates architectural description. Having no precedents to inform him, Chapman struggled in 1966 with this architectural variation, defining such site types as "buttressed half-circles" (later to be called "C-shaped shelters" by most archaeologists), "walled rectangles," and "limited clearings." The problems of describing and classifying Hawaiian stone structural variation have continued in Hawaiian archaeology (e.g., Hommon 1970; Weisler and Kirch 1985; Ladefoged et al. 1987). In our 1995 fieldwork, we adopted a strict morphological system (modified from the 1980 Kawela survey on Moloka'i), noting probable functional attributions separately. In this brief summary paper, however, we cannot describe the range of morphological variation in detail, and our remarks on sites follow several very broad functional classes.

Patterns of Site Distribution

An exhaustive analysis of site distribution patterns must await the completion of the *ahupua'a*-wide survey and the GIS database. Yet several significant patterns are already evident. First, in broad areal terms three major zones of site distribution can be defined: (1) a coastal zone about 200–350 m wide, of relatively high site density; (2) an intermediate zone of low site density extending from the inland edge of the coastal zone to an elevation of about 340 m above sea level (about 2 km inland); and (3) an upland zone of very dense site concentration from about 340–750 m elevation. About 4.5 km from the coast, at 800 m elevation, site density drops off rapidly. The precise upper boundary of archaeological sites in the study area remains to be determined, in part due to the presence of a dense kikuyu grass (*Pennisetum clandestinum*) blanket that hinders site visibility at this altitude. However, our reconnaissance transects combined with low-level helicopter overflights suggest that relatively few sites will be found above 800 m elevation.

There can be no doubt that this zonal pattern is largely controlled by a few key environmental variables, especially rainfall and degree of surface weathering (and hence, soil development). The narrow zone of coastal sites is clearly related to marine-exploitation activities (Fig. 3), and most of these sites appear to have been only intermittently utilized. Sites in the intermediate zone are generally small and inconsequential (such as small shelters and *ahu*). It is in the dense upland zone that the majority of residential and ritual features are located, and here also that rainfall and soil development would have been adequate to support intensive cultivation of dryland crops such as sweet potato and taro. An unanswered question concerns the approximate location of the forest line in pre-contact times, and whether this correlated with the decrease in site density at about 800 m elevation. Today the remnant *Acacia koa* forest does not extend below about 1,300 m; it is well known, however, that there was significant forest retreat in the past two centuries owing to the effects of cattle-ranching and other introduced animals (Medeiros et al. 1986:22–29).

Within the densely settled upland zone we have also been able to detect significant variation in site distribution and density. Tentatively, we believe that areas of high stone structure density correlate strongly with pahoehoe substrates, whereas areas with older and more deeply weathered a'a substrates are characterized by relatively low stone structure density. The weathered a'a substrates are also those dominated by grasses, and as noted below, in the Mahele records for Kahikinui we have some indication of grasslands being preferred areas for cultivation. It is entirely likely that residential activities were being purposively situated on areas of pahoehoe with low agricultural productivity (and high availability of loose building stone), leaving the more fertile soil areas free for intensive cultivation. This distribution pattern is of considerable interest archaeologically, for the a'a and pahoehoe substrates can be readily detected on our digitized infra-red images (due to differential reflectivity of vegetation covers), and may potentially provide the basis for predictive modeling of site density in other leeward areas of Maui or other islands using a GIS approach.

Agricultural Features

When intensive archaeological surveys of leeward parts of the Hawaiian archipelago commenced in the late 1960s, investigators were struck by the extent to which agricultural features often dominated the landscape (e.g., Newman n.d.; Green 1969). In particular, the leeward field systems of Hawai'i Island have attracted much attention (Kirch 1984:181–92, 1994:251–68; Kelly 1983; Rosendahl 1984). Given that Kahikinui is also a leeward, undissected, flowslope landscape it is all the more surprising that none of the regularized, linear field walls or terraces so typical of leeward Kohala or Kona are to be found in Kahikinui. Small stone mounds or heaps (ca. 0.5–2 m diameter) are, however, ubiquitous in the upland settlement zone in Kīpapa-Nakaohu. While settlement in parts of upland Kahikinui was unquestionably as dense as in leeward Hawai'i, there was evidently no effort to construct reticulate, stone-walled field systems.

What then, were the agronomic practices associated with what one can only assume must have been a system of fairly intensive cultivation, given the density of upland residential features? Our working hypothesis focuses on the likelihood that intensive field cultivation was practiced in two microenvironments of the uplands: (1) in areas of more deeply-weathered a'a, enriched in places with light ash fall, and marked in historic times by grassland vegetation; and (2) in the swale-like depressions found between undulating lava ridges. As noted below, the weathered a'a slopes have a significantly lower density of residential features; one such extensive area in the eastern part of Nakaohu is almost devoid of surface stone structures. There is some historic-period indication that such grassland-covered, weathered a'a substrates were preferred microenvironments for cultivation. In the adjoining and environmentally-similar district of Honua'ula, several Mahele claimants in 1847–48 explicitly counted "grasslands" among their core holdings. For example, Kala of Waipao submitted before the Land Commission his claim for "3 sections of grassland," noting that "2 have taro growing on them," and observing also that "the *haole*" had taken control of some of this acreage (Archives of Hawai'i, L.C.A. 2405, Native Testimony, 12/26/1847).

The swales which are typical of this undulating lava flowslope would also have provided suitable areas for cultivation. These vary in size, but are generally no more than about 50–75 m across, and about 3–10 m deep. They form natural sediment catchments, and we observed that lantana thickets growing in them today are more lush, and remain green even during the dry summer months. An objective for future research will be to stratigraphically section these swales for sedimentological and archaeobotanical indications of prior cultivation.

The most likely field crops cultivated in the Kīpapa-Nakaohu uplands would have been sweet potato (*Ipomoea batatas*) and taro (*Colocasia esculenta*), with bananas also a candidate in the protected swales. Douglas Yen, who visited the field site and consulted on possible prehistoric agricultural practices, has suggested that the early, pioneering stages of settlement and cultivation in Kahikinui may have been based on a "swidden-in-forest" system with taro as

Figure 4. A rectangular enclosure (site 44) in the uplands of Kīpapa.

the dominant crop (Yen, pers. comm., 21 Sept. 1995). As settlement became more intensive, however, one might anticipate the need to adapt this originally extensive system to changes in the degree of forest cover, wind exposure, and local moisture regimes. These are all matters that will require considerable study in the future phases of our project.

Residential Features

Features putatively associated with residential function exhibit the greatest range of architectural variability in the survey corpus, and are also the most numerous; they are therefore the most difficult to synopsize in a brief report such as this. Morphologically, they range from stone-faced terraces, to a variety of stone-walled windbreak shelters (linear, L-shaped, U-shaped, and C-shaped), to rectangular or square enclosures. Many incorporate natural outcrops and lava ridges in their construction, making it partly a subjective decision as to how to describe or classify them architecturally. In size, they are more consistent, generally falling within a maximum dimension of 4–8 m (16–64 m^2). The results of test excavations in six residential features are described separately, below.

Numerically, the most ubiquitous forms are clearly the windbreak shelters and the enclosures (both rectangular and square in plan view). Both of these classes are constructed of stacked lava cobbles, with frequent use of a "core-filled" construction method in which stacked outer and inner facings are in-filled with smaller a'a clinker. In the coastal zone, water-worn basalt gravel (*'ili'ili*) was used for paving interior surfaces, while in the uplands paved surfaces are of closely-fitted field stone. The shelters, whether they consist of a single linear wall segment, or of two or three walls, invariably have the longest and highest wall oriented perpendicular to the prevailing easterly wind. The protected or partially-enclosed living surface is then open to the west. Walled enclosures, only a relative few of which have formal entryways, also tend to have the highest or strongest wall to the east (Fig. 4). Walled enclosures in which wall heights reach approximately 1 m, and which are usually associated with larger enclosed spaces appear to us to be post-contact or historic period features, evidenced by surface finds of ceramics, bottle-glass, and clay pipe stem fragments. One large cluster of high-walled enclosures lies immediately NE of St. Inez Church, and may represent an early nineteenth-century settlement (Fig. 2).

There is some tendency towards clustering or aggregation of residential features, although in the uplands site density is so high that discrimination of discrete spatial clusters of features is at times difficult; on the coast more discrete clusters are apparent. One pattern that we have tentatively observed is a repeated group of three main features, which may on future investigation prove to be of some sociological significance.

Three major problems beset settlement-pattern analysis of residential structures: (1) chronology; (2) feature-use duration; and (3) function. Chronology is essentially the problem of establishing whether a series of features on the landscape were contemporary in their construction and use-lives. Feature-use duration is the problem of determining the use-life of a particular feature, and whether that use-life was continuous or temporary (intermittent). Function refers to the problem of ascertaining specific activities performed within or adjacent to a feature, a complex issue given the ethnohistoric record of con-

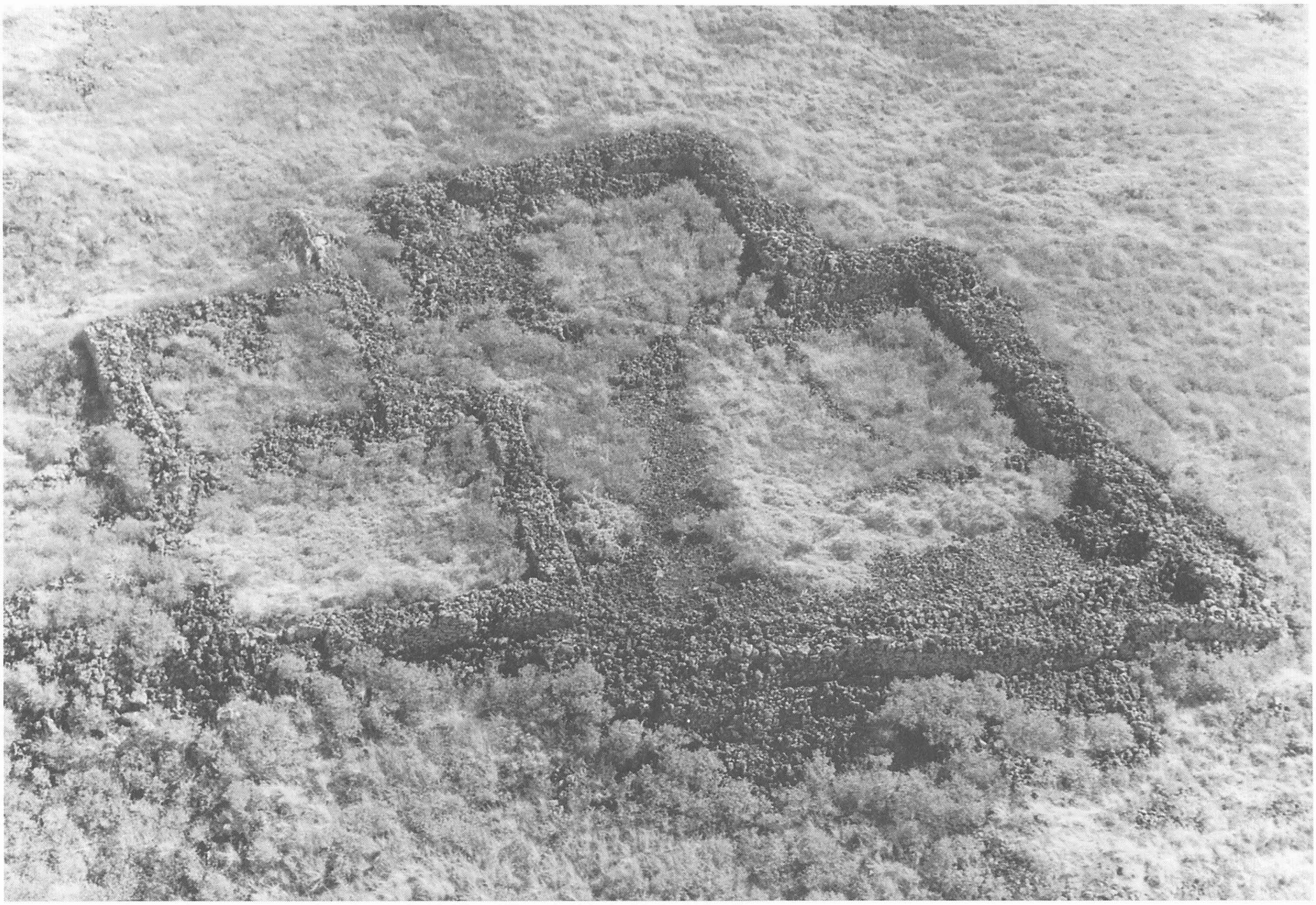

Figure 5. Helicopter aerial photo of the largest *heiau* within the Kīpapa-Nakaohu survey area (site 1010). The eastern portion of the structure (to the right in the photo) has the highest and most massive wall construction. Note that in plan the site consists of two "notched" enclosures, and may represent a two-phase construction sequence.

tact-period Hawaiian society in which the built environment was highly influenced by the *kapu* system. These are problems that we hope to tackle in earnest during subsequent phases of our project.

Ritual Features (*Heiau*)

Typically, religious or ritual sites (*heiau*) in Hawai'i are identified either through traditional or ethnohistoric sources, or by identification of architectural features thought to be characteristic of such sites (Kirch 1985:257–65). In Kahikinui, only a few sites were identified by Walker's Hawaiian guides in 1930 as being *heiau;* two of these lie within our survey area. On architectural criteria as well as size, however, at least another 15 structures within the Kīpapa-Nakaohu probably functioned as ritual sites. These range from a very large, architecturally-complex structure (ca. 1600 m^2) near the eastern boundary of Nakaohu *ahupua'a* (Fig. 5) which may well have been a district-level *heiau,* through intermediate-sized walled structures (ca. 200–800 m^2) often of "notched" form (see Kolb 1994), down to small structures (ca. 75–150 m^2) that were probably either household shrines (*mua*) or—on the coast—fishing shrines (*ko'a*). A full analysis of the architectural variability within these structures will be presented elsewhere; here we confine ourselves to a few observations of note.

The mid-to-large sized *heiau* structures are all concentrated in the upland zone of dense site distribution (approximately 340–800 m elevation). With two exceptions, these are all stone-walled enclosures, usually having a six-sided ("notched") plan which has been noted by other archaeologists as typical of Maui Island *heiau* (Kolb 1994); the exceptions are terraced sites. Notably, all *heiau* sites exhibit a preferred orientation to the east, with the highest and best-constructed walls and facings at their eastern ends. Such an eastwards orientation was also noted by Weisler and Kirch (1985) as typical of ritual sites in Kawela *ahupua'a* on Moloka'i, and may represent a widely shared cultural ideology. Almost without exception, all ritual sites in Kīpapa-Nakaohu also have offerings of branch coral placed on them, or buried within wall fill; these coral offerings are exclusively of branch (not brain or block type) coral that was clearly gathered live from the sea. In the upland sites, these offerings usually consist of single branches, but on the coastal fishing shrines (*ko'a*) they are more numerous and include whole coral heads.

The distribution of *heiau* sites in the upland settlement zone is of particular interest. A number of smaller-sized notched enclosures are closely associated with clusters of residential features (linear, L-, and C-shaped structures) and may well have functioned as residential shrines or men's eating houses (*mua*). The intermediate-sized structures, however, are typically somewhat isolated from these residential clusters, suggesting that they may have been associated with stricter ritual prohibitions (*kapu*). Moreover, some six of these structures form a distinct *mauka–makai* cluster stretched out along a high a'a lava ridge in the middle of the survey area, immediately west of one of the most extensive tracts of deeply-weathered (and in part, ash-covered), arable soil. Our working hypothesis is that these intermediate-level *heiau* were each associated with individual *'ili*-level subdivisions of the *ahupua'a*.

Test Excavations

Test units were excavated in six sites in Kīpapa *ahupua'a,* four in the upland zone and two in the coastal area (Table 1), with the following goals in mind: (1) to obtain samples for radiocarbon dating; (2) to determine the state of preservation of subsurface materials; (3) to test for potential taphonomic differences between the coastal and upland zones; and (4) to provide an informed basis for planning more extensive excavations in future field seasons.

The six sites tested were chosen on the basis of several criteria. Only three sites (M7, M10, M11) had previously been tested in the survey area as part of the 1966 research (Chapman and Kirch 1979). In the upland zone, which has the densest concentration of sites, we chose two linear shelters (sites 742 and 440), a C-shaped shelter (site 37), and a rectangular enclosure (site 44, Fig. 4). In the coastal zone we sampled one L-shaped shelter (site 331) and a rectangular enclosure (site 335). We also selected sites with obvious surface scatters of midden and artifacts (such as 742) and those with no visible surface remains (such as 44). In two cases, the sites were chosen as pairs (sites 37 and 44; and sites 331 and 335, respectively) because they were in close enough proximity that it was felt they might represent structural elements of the same household cluster. In all sites, units were positioned against an interior wall with little or no structural tumble, allowing us to observe the stratigraphic relationships between wall and subsurface cultural deposit. The tests were purposefully limited in area (see Table 1). All excavated sediment was screened through 0.25-inch as well as 0.125-inch mesh.

The sediment at both the coastal and upland sites was a fine, dry, powdery, aeolian silt. Unless there was a concentration of ash, the cultural layers were marked not by a change in sediment texture, but rather by a slight darkening of sediment color. Two sites did contain ashy deposits, 37 and 742. In site 37, we noted a small (approximately 7 cm in diameter) concentration of ash with charcoal inclusions, but no artifactual associations. In site 742, one half of a stone-lined hearth was exposed in the test unit at approximately 23 cm below surface. We chose not to excavate the interior of the hearth at that time, but rather to cover the feature with the intention of

Table 1. Results of Kīpapa-Nakaohu Test Excavations (1995)

Category	Site 37	Site 44	Site 440	Site 742	Site 331	Site 335
Location	Upland	Upland	Upland	Upland	Coastal	Coastal
Site Type	C-shape shelter	Rectangular enclosure	Linear shelter	Linear shelter	L-shape shelter	Rectangular enclosure
Test Area (m^2)	0.5	0.5	1	0.5	0.25	0.25
Thickness of Cultural Deposit (cm)	5	7	7	7+	4	Disturbed
Charcoal (g)	13.4	60.7	148.3	28.1	0	0
Bone (g)	0.1	0.2	0	0	0	0.6
Bone (NISP)	6	8	0	0	0	1
Marine Mollusk (g)	0.5	0	0.5	4.6	9.1	6.3
Land Snail (g)	0.1	0	0	0	0	0
Waterworn Coral (g)	0	0	23.1	0	10.4	1.3
Waterworn Basalt (g)	0	0	0	7.4	0	0
Basalt Flakes (#)	0	0	0	14	6	3
Aleurites Endocarp (g)	0	0	7.4	21.3	0	0

returning in the future when a more extensive exposure can be made.

In the other two upland sites, 44 and 440, the cultural layer was marked by a high concentration of charcoal, much of which is so well preserved that it will be possible to identify wood species. In contrast, the two coastal sites had little or no discernible cultural deposit. Site 331 had a very thin midden deposit contained with the top 10 cm of the site. At site 335 the excavation team noted the presence of modern goat feces throughout the first 20 cm of the test unit mixed with cultural materials; no intact cultural layer could be identified.

Only three of the sites excavated produced basalt lithics; in every case these were unretouched flakes. During surface survey, however, a small reworked adz was found at site 742. Another portion of a basalt adz was found on the surface of site 331, as well as a basalt awl. The highest concentration of marine shell was found at the two coastal sites, 331 and 335, and included the following species: *Drupa ricinus, Nerita picea, Cellana exarata, Thais* sp., *Cypraea* sp., and *Littorina* sp. In addition, two individuals of the land snail genus *Succinea* sp. were found at site 37. Faunal remains recovered included rat bones, among them an incisor of *Rattus exulans,* and two fishbones, including a fragment of the pharyngeal grinding plate of a labrid. Significantly, both of the fishbones were found at upland sites (37 and 44).

Summary

Building upon a pioneering settlement-pattern survey initiated by Peter Chapman in 1966, we have now completed an intensive survey of significant portions of two *ahupuaʻa* (Kīpapa and Nakaohu) in the little-studied Kahikinui District, Maui. More than 1,000 archaeological sites have been recorded and mapped, and systematic observations on architecture and other features recorded in a computerized, relational database. These survey data are being combined with digitized aerial photographs, a digital elevation model, and other geographic information to form a GIS database for the survey area. We are now in the process of seeking grant funds to enable further field seasons, in order to complete the intensive ground survey throughout the project area, and to carry out extensive excavations in a variety of architectural features. Excavations will be essential to address problems of chronology, use-duration, function, and other matters. Although it has long been neglected by both historians and archaeologists, Kahikinui was once the setting for a large and vibrant Hawaiian population. It is our long-term goal to see that Kahikinui takes its rightful place in Hawaiian archaeology; in the process, we hope to add some new insights to our understanding of the historical development of Hawaiian culture and society.

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