in Oceania

Archaeology in Oceania, Vol. 0 (2024): 1–23
DOI: 10.1002/arco.5309

The pre-contact temple system of Hālawa Valley, Moloka‘i, Hawaiian Islands

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ABSTRACT

Building upon a pioneering 1909 survey of Moloka‘i Island heiau *(temples) by archaeologist John F. G. Stokes, the pre-contact temple system of Hālawa Valley is described and analysed. Ten* heiau *were relocated and mapped, with seven sites test excavated and radiocarbon dated. The majority of sites are terraces or terraced platforms in architectural form, ranging in size from 72 to 1300 square meters in basal area. Functionally, the temples include fishing shrines (*ko‘a*), agricultural or fertility temples (*heiau ho‘oulu‘ai*), and one* luakini *or temple of human sacrifice dedicated to the war god Kū. The orientations of the temple foundations appear to be deliberate (rather than dictated by topography). One group is slightly offset from cardinality and shows an eastward orientation, likely associated with the god Kāne. A second group exhibits an orientation to the ENE, which is the direction of the star cluster Makali‘i (Pleiades), whose achronycal rising determined the onset of the Makahiki season dedicated to the god Lono. The radiocarbon dates indicate that the temples were constructed during the seventeenth to eighteenth centuries, or the Archaic States Period of the Hawaiian cultural sequence.*

Keywords: monumental architecture, Polynesian religion, ritual sites, Polynesian archaeology, archaeoastronomy

RÉSUMÉ

S’appuyant sur une étude pionnière de 1909 sur les heiau *(temples) de l’île de Moloka’i réalisée par l’archéologue John F. G. Stokes, le système de temples pré-européens de la vallée de Hālawa est ici décrit et analysé. Dix* heiau *ont été relocalisés et cartographiés, et sept sites ont été fouillés et datés au radiocarbone. La majorité des sites sont des terrasses ou des plates-formes architecturales, dont la superficie au sol varie de 72 à 1300 mètres carrés. D’un point de vue fonctionnel, les temples comprennent des sanctuaires de pêche (*ko‘a*), des temples agricoles ou de fertilité (*heiau ho‘oulu‘ai*) et un* luakini *ou temple du sacrifice humain dédié au dieu de la guerre Kū. Les orientations des édifices semblent délibérées (plutôt que dictées par la topographie). Un groupe est légèrement décalé par rapport à la cardinalité et présente une orientation vers l’est, sans doute associée au dieu Kāne. Un deuxième groupe présente une orientation vers l’E-NE, c’est-à-dire la direction de l’amas d’étoiles Makali’i (Pléiades), dont le lever achronique déterminait le début de la saison Makahiki dédiée au dieu Lono. Les datations radiocarbone indiquent que les temples ont été construits entre le XVIIe et le XVIIIe siècle, soit la période des États Archaïques de la séquence culturelle hawaïenne.*

Mots-clés: architecture monumentale, religion polynésienne, sites rituels, archéologie polynésienne, archéoastronomie

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INTRODUCTION

During the three to four centuries after the population of the Hawaiian Islands became isolated from the rest of Eastern Polynesia—after roughly AD 1400—a distinctive and complex religious system developed, focused on the worship of four primary gods (Kāne, Kū, Lono and Kanaloa), along with a host of lesser deities and ancestral spirits (‘*aumakua*). Rituals addressed to these deities were performed at a variety of shrines and temples, which collectively are referred to as *heiau*, these rites being described in some detail by nineteenth century Hawaiian scholars (Malo 1951; Beckwith, ed., 1932; Kamakau, 1964, 1976). As Valeri observes, ‘the word *heiau* or *haiau* designates any place of worship and thus the places where sacrifices are offered’ (1985:173). *Heiau* sites vary enormously in size and architectural form, ranging from simple upright stones or small stone enclosures, to the massive stone platforms of the largest state temples of human sacrifice (*luakini heiau*).

Heiau sites have long been subjects of archaeological interest, particularly during the island-wide surface surveys conducted under the auspices of the Bishop Museum during the first half of the twentieth century (e.g. Bennett, 1931;

McAllister, 1933a, 1933b; Stokes, 1991; Walker Ms.). Archaeological studies of *heiau* later fell out of fashion, but beginning with Ladd's excavation of selected *heiau* on Hawai'i and O'ahu Islands (Ladd, 1969, 1973, 1985), there has been increasing interest in investigating the temporal development of Hawaiian ritual sites, and in studying their architectural and functional variation (e.g. Cachola-Abad, 1996; Kirch & Ruggles 2019; Kolb, 1991, 1992, 1994, 2006; McCoy et al., 2011; Ruggles, 1999, 2001; Thurman, 2015).

In this paper we examine the system of *heiau* in the Hālawa Valley of eastern Moloka'i Island, taking advantage of the unpublished 1909 survey of these ritual sites by pioneering Bishop Museum archaeologist John F. G. Stokes (Flexner et al., 2017). Stokes was taken by his Native Hawaiian collaborators to no less than 18 *heiau* in this valley, a major centre of irrigated taro cultivation. The sites range from two small shrines (*ko'a*), through mid-sized agricultural or fertility temples (*heiau ho'oulu'ai*), up to a major *luakini* temple of human sacrifice, thus providing a rare case where the full hierarchy of temples is evidenced within a single territorial unit (*ahupua'a*). Hālawa Valley was also the locus of an important settlement-pattern archaeological project in 1969–70, providing further insight into settlement, land use, and traditional practices throughout the valley (Kirch & Kelly 1975).

John F. G. Stokes's 1909 Heiau survey

Beginning in May of 1909, John F. G. Stokes, Curator of Polynesian Ethnology at the Bernice Pauahi Bishop Museum, spent ten weeks on the island of Moloka'i conducting a survey of the remains of ancient *heiau* or temple sites (Stokes, 1909a). This survey was a continuation of work that Stokes had begun several years earlier on the island of Hawai'i (Stokes, 1991). Stokes commenced his survey on the island's western end, in Kaluako'i, then moved to the southern shore (Mana'e), and then to Hālawa Valley. In an undated report, Stokes described his fieldwork in the valley:

> From Mapulehu to Halawa a number of smaller heiau were found, and in the latter place, in addition to innumerable small heiau, the remains of the large sacrificial heiau of Mana were found. About 1850 it had been planed [sic] to remove the stones of this place in order to build a church, but after work had progressed a little while, the natives began to fall sick and several died. The result was that the church was not completed, and most of the heiau yet remains. The natives are still very superstitious about destroying the heiau, although none hesitated about working on them on the many occasions it was necessary to clear away the thick vegetation which had accumulated on them since the abandonment of the tabu. (Stokes, 1909b: 2).

Hālawa was especially rich in the remains of *heiau*, with 18 sites being identified by the valley's Native Hawaiian people, although three of these were noted as having been destroyed prior to Stokes's visit.

Stokes's (1909a) Moloka'i *heiau* survey was never published, although his manuscript along with pencil-drawn plans of many of the sites and glass plate photographic images are preserved in Bishop Museum's Library and Archives (http://bishopmuseum.org/stokes/stokes). Stokes's descriptions of most of the *heiau* sites are minimal, often consisting of just one or two sentences. Moreover, Stokes only made survey plans of some of the sites, and did not photograph every site (Flexner et al., 2017). In spite of these shortcomings, Stokes collected information that would be impossible to obtain today.

Stokes determined the geographic position of the *heiau* by triangulation surveying from primary trigonometric stations originally established by the Hawaiian Government Survey (Flexner et al., 2017; Summers, 1971:iv). For the Hālawa Valley sites, the geographic positions were referenced to the Kalanikaula trig station in terms of bearings (azimuth) and distances. Using Stokes's bearings and distances, W. K. Kikuchi of Bishop Museum plotted the approximate positions of the Moloka'i *heiau*, including those in Hālawa, for Summers's *Sites of Molokai* volume (Summers, 1971, fig. 74). The locations of the *heiau* sites are shown in Figure 1.

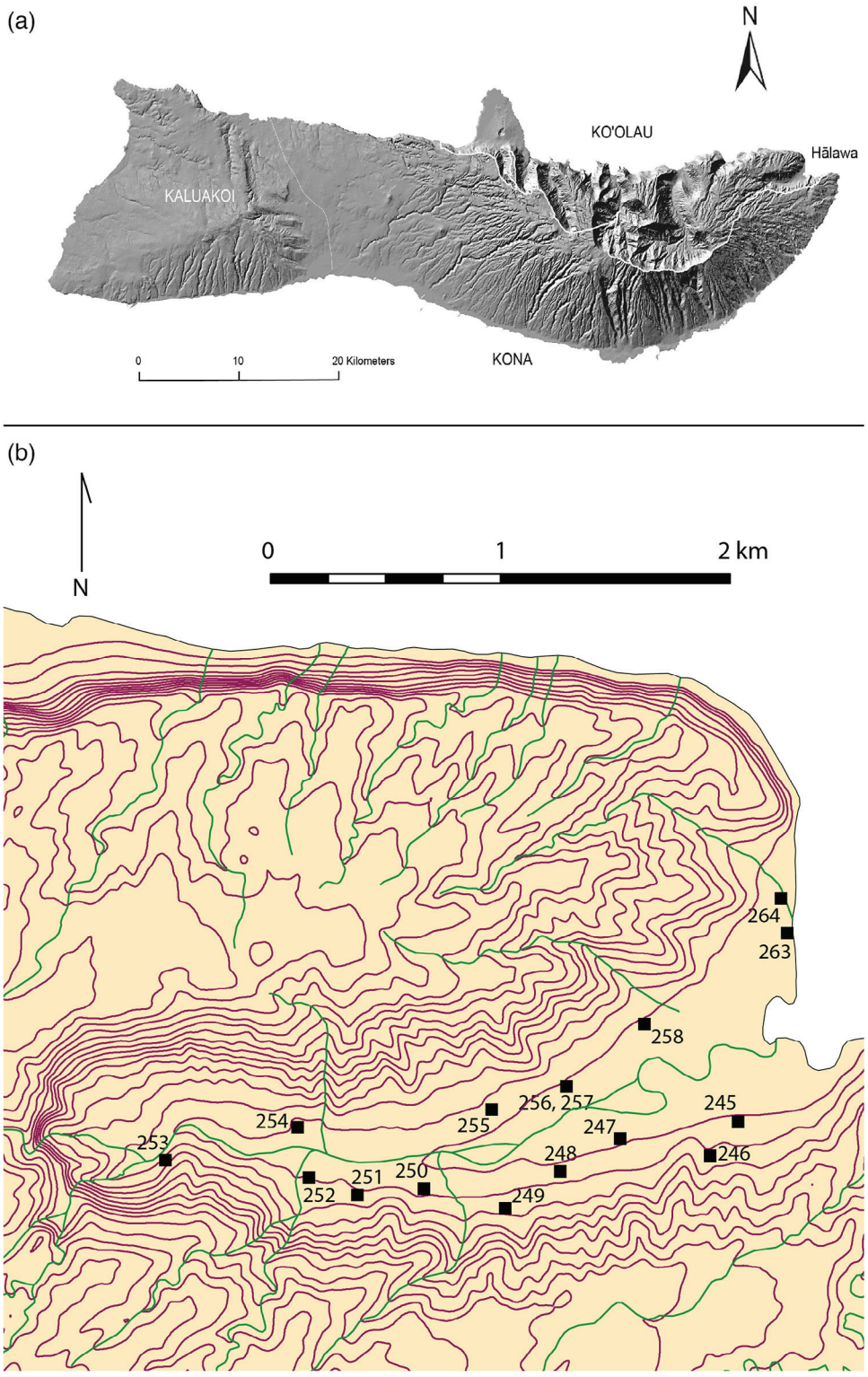
Re-survey and test excavations, 2019–2022

From April 22–29, 2019, Kirch and Ruggles relocated and recorded ten of the Hālawa Valley *heiau* identified by Stokes. In January 2020, Kirch and Swift initiated a multi-year research program in Hālawa, focused primarily on the valley's agricultural sites, but also including test excavations at selected temple sites in order to establish a chronology for the agricultural temples (*heiau ho'oulu'ai*). Five *heiau* on the south side of the valley were tested and radiocarbon dated. We also dated charcoal samples from Papa Heiau and from a fishing shrine (*ko'a*) that had been test excavated by Kirch in 1969, and subsequently curated in Bishop Museum. Of the 15 *heiau* extant at the time of Stokes's 1909 survey, we have been able to relocate and resurvey ten sites. The five sites that could not be relocated all have extremely brief descriptions by Stokes (typically just one sentence), and are lacking photos or maps that could be used to precisely identify the structures.

Our field methods followed previous work on the *heiau* of Kahikinui and Kaupō, Maui Island (Kirch & Ruggles, 2019). We re-mapped several sites, either with compass-and-tape or with plane table and alidade. For the large structures of Mana and Papa *heiau*, we also conducted precise theodolite surveys of structure orientation. On other sites, the orientation of walls and facings was recorded using compass and clinometer readings. As with our work on Maui *heiau*, we paid particular attention to evidence for the main 'axis of orientation' for each site (Kirch & Ruggles, 2019: 90-91). The locations of all sites were determined using a Trimble Juno GPS instrument (WGS84 datum). The site numbers used in this article are those given by Summers (1971).

Our test excavations were purposively limited in scale, but carefully positioned to abut standing architecture so that

FIGURE 1. (a) Map of Molokaʻi Island, showing the location of Hālawa Valley. (b) Map of Hālawa Valley, showing the locations of individual *heiau* sites.



subsurface deposits could be stratigraphically related to the stone foundations. Sixteen samples from our test excavations at seven *heiau* were radiocarbon dated using the AMS method at the Keck Carbon Facility at the University of California, Irvine. Sample details are reported in Table 1. Calibrations and, where appropriate, Bayesian modeling of these radiocarbon dates were performed using OxCal 4.4.4 (Bronk-Ramsey 2021).

Table 1. Radiocarbon dates from Hālawa Valley *heiau* sites..

Lab No. UCIAMS-	Site	Material	Conventional ^{14}C Age BP (1σ)	Calibrated age Range AD (2σ)*
233637	264 Papa	Carbonized *Aleurites* endocarp	165 ± 15	1666–1695 (17.8%) 1725–1784 (43.9%) 1795–1813 (10.3%)
233638	264 Papa	Carbonized *Aleurites* endocarp	210 ± 15	1651–1681 (34.1%) 1740–1753 (6.3%) 1762–1800 (52.3%)
233639	263 Koʻa	Carbonized *Aleurites* endocarp	115 ± 15	1691–1728 (23.4%) 1809–1921 (72.0%)
241380	250 Puaʻalaulau	*Styphelia tameiameiae* charcoal	190 ± 15	1661–1685 (21.7%) 1732–1805 (60.1%)
241381	250 Puaʻalaulau	*Osteomeles anthyllidifolia* charcoal	270 ± 15	1527–1554 (19.3%) 1632–1662 (76.2%)
241393	252 Kapana	cf. *Psychotria* sp. charcoal	120 ± 15	1687–1730 (23.1%) 1806–1925 (72.4%)
241394	252 Kapana	*Diospyros sandwicensis* charcoal	150 ± 15	1671–1699 (15.6%) 1721–1779 (28.8%) 1796–1815 (10.8%)
241395	252 Kapana	*Euphorbia* sp. charcoal	130 ± 15	1682–1737 (23.6%) 1802–1937 (71.9%)
268314	251 Haliʻi	Unidentified wood charcoal	135 ± 15	1680–1741 (24.5%) 1752–1764 (2.6%) 1799–1825 (10.1%)
268315	251 Haliʻi	Unidentified wood charcoal	330 ± 15	1494–1602 (76.2%) 1610–1637 (19.2%)
268316	251 Haliʻi	Carbonized *Aleurites* endocarp	360 ± 15	1461–1524 (50.7%) 1572–1630 (44.8%)
268320	245 Puʻupa	Carbonized *Aleurites* endocarp	320 ± 15	1501–1599 (77.9%) 1615–1641 (18.5%)
268321	245 Puʻupa	Unidentified wood charcoal	175 ± 15	1665–1690 (18.1%) 1728–1785 (48.1%) 1794–1809 (8.8%)
268322	246 Kiʻi	Unidentified wood charcoal	245 ± 15	1641–1666 (75.8%) 1783–1795 (19.6%)
268323	246 Kiʻi	Unidentified wood charcoal	290 ± 15	1521–1575 (62.6%) 1625–1652 (32.8%)
268324	246 Kiʻi	Unidentified wood charcoal	260 ± 15	1529–1540 (3.5%) 1635–1665 (86.3%) 1785–1795 (5.6%)

*Calibrations determined by OxCal v4.4.4 (Bronk-Ramsey 2021). Calibrated ranges post-dating 1819 are not listed, as there is no evidence for *heiau* use after the abolition of the religious system in 1819.

THE *HEIAU* OF HĀLAWA VALLEY

In the following section we systematically describe the valley's extant *heiau* using a standard format. The survey proceeds in a clockwise fashion from the eastern end of the south slope up-valley to the west, and then in reverse direction from west to east down the northern slope.

Site 245, Puʻupa Heiau

Location: UTM coordinates 734833E, 2340993N, at an elevation of 52 m asl. The site is located on the southern slope of the valley, almost directly up-slope from the ruins of the old Hālawa Congregational Church, on moderately sloping ground.

Architecture: Stokes's description is minimal: 'All that could be found was the remains of a terrace of stones, 37

FIGURE 2. Pu‘upa Heiau (site 245). (a) View of Pu‘upa Heiau from the northeast. (b) Detail of remnant facing along the north side of Pu‘upa Heiau (photos by P. V. Kirch).

feet long on its face, which was originally 6 to 9 feet high’ (1909a:15). Stokes did not make a plan map, nor did he take photos. Nonetheless, we are confident that we were able to identify the same structure that Stokes calls Pu‘upa Heiau. The structure consists of a single terrace built up of boulders and cobbles, roughly rectangular in plan, and originally faced on the downslope sides with two or more terraces. However, the structure has undergone significant collapse, and only remnant portions of the facings could be discerned (Figure 2). The terrain surrounding the structure consists mostly of earth with scattered boulders, so the site stands out on the landscape. Based on our GPS survey, the maximum dimensions of the structure’s remnants are approximately 14 m E-W and 10 m N-S.

Three basalt cores were observed on the surface of Pu‘upa Heiau. One is an adze fragment, with quadrangular cross-section, evident from traces of ground facets. The original adze evidently broke during use; the resulting core fragment may have been used as a hammerstone.

Orientation: An estimate of the orientation of this structure was obtained from a 3 m-long segment of intact facing on the upper terrace, which yielded an azimuth of approximately 95°/275° (magnetic), equivalent to 105°/285° (true). The alignment of two boulders that appear to mark the NW and NE corners, and may have marked the end points of a lower terrace, were consistent with this, yielding 106°/286° (true). This structure, we conclude, was cardinally oriented to within about 15°. Although collapsed, it is apparent that the E façade and the NE corner were much higher and more architecturally pronounced than the W façade, suggesting an axis or orientation toward the E.

Test Excavation and Dating: A test unit measuring 75 × 90 cm was laid out to abut the north (downslope) side of a remnant facing of Pu‘upa Heiau. The terrace itself is cobble-filled, so the unit was placed against a clear wall facing that extends just west of the dense fill and appears to be a continuation of the *heiau* construction itself. The *heiau* has experienced significant collapse; many large boulders found on the surface of the unit appear to be fall from previously constructed features. While excavating Level 1, just below the surface we uncovered a layer of flat, waterworn pebbles (*‘ili‘ili*) that likely made up an old pavement. Few materials were recovered from this context (a small piece of degraded non-human mammal bone, 1 piece of charcoal). Below the paving layer, we exposed a layer of angular vesicular basalt cobbles. On the west side of the unit, these were intermingled with some saprolitic rocks at the interface between the paving and an underlying layer of boulder-sized rocks, increasingly saprolitic in composition. We interpret this as a layer of construction fill underlying the paving. The unit extended to roughly 20 cmbs in depth. Our excavation revealed the bottommost boulder visible from surface in the wall facing, which was indeed the lowest layer of construction. Two samples of charcoal from below the paving layer were collected for radiocarbon dating.

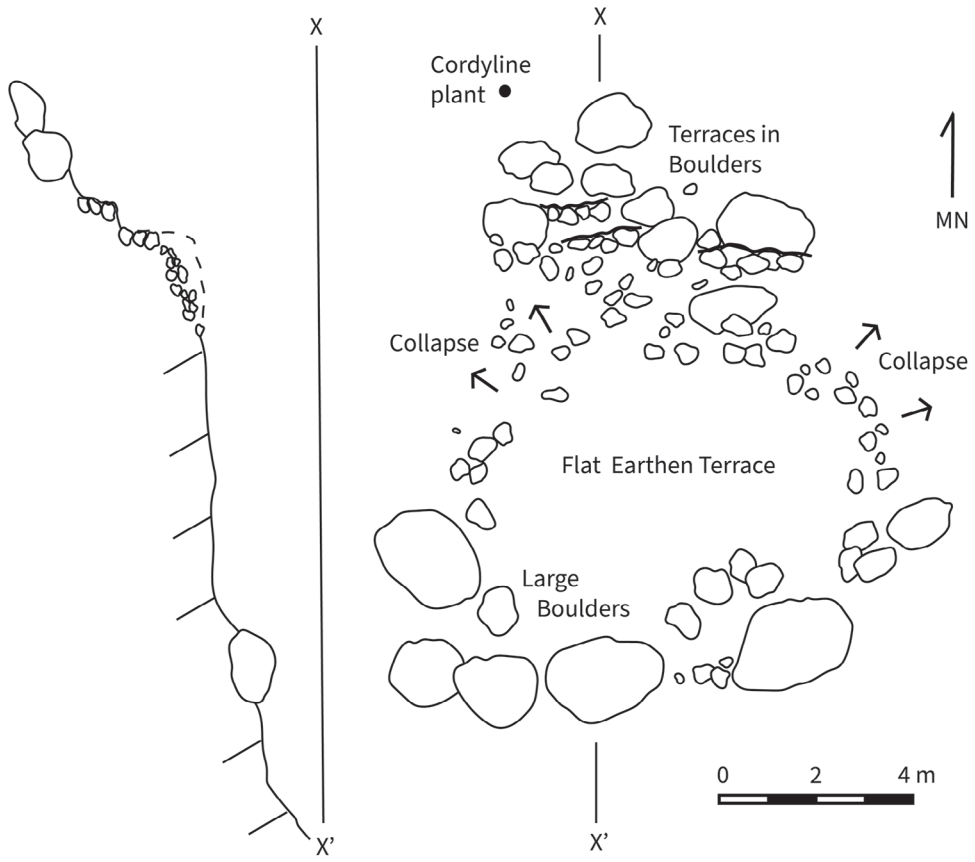
The stratigraphy of the test unit was described as follows: *Layer IA*: 10YR 3/3 Dark Brown. Fine loamy silt with some rounded gravel, a small number of sub-angular to sub-rounded cobbles, and a few large boulder inclusions. Layer I is bisected by the *‘ili‘ili* deposit, characterized by small, pebble-sized rounded and flat stones and loose sediment. *Layer IB*: 10YR 3/3 Dark Brown. This sediment has the same properties as the previous layer, and so was designated Layer IB. The only difference of note between Layer IA and IB is the size of inclusions. While Layer IA, above the paving, had primarily sub-rounded gravel inclusions with a small number of subangular cobbles, Layer IB contained a large number of angular and sub-angular vesicular basalt cobbles and boulders.

As noted above, two charcoal samples were recovered from below the pavement and submitted to the Keck Carbon Centre for AMS dating. The first of these (UCIAMS-268320) yielded a calibrated age range of AD 1501–1641 (2σ). The second sample (UCIAMS-268321) calibrated to AD 1665–1690 (18.1%), 1728–1785 (48.1%), 1794–1809 (8.8%) and 1922… (20.4%) (2σ); the last of these possible calibrated ranges can be rejected as there is no evidence of recent use of the site.

Site 246, Ki‘i or Pohakuloa Heiau

Location: UTM coordinates 734761E, 2340936N, with an elevation of 71 m asl. Stokes described this site as located

FIGURE 3. Plan and cross-section of Ki‘i Heiau (site 246).



on the southern slope of the valley, 50 ft N of the road, near the former Catholic Church (his reference to the ‘road’ is to the old horse or ox-cart road, not to the present road).

Architecture: Stokes’s description is terse: ‘originally there existed a series of terraces faced with stone and paved with stones and earth. The main terrace is the line of large boulders forming the southern boundary of the heiau’ (1909a:15). Thanks to the existence of two photographs taken by Stokes and preserved in the Bishop Museum archives, we were able to definitively identify Ki‘i Heiau.

The *heiau* was constructed within a talus rockfall, utilizing large natural boulders as well as smaller cobbles to construct the facings. The structure consists of a levelled terrace bounded on the up-slope side by several massive boulders, while supported on the down-slope side by a largely now-collapsed facing set atop three large boulders (Figures 3 and 4). The main terrace measures about 9 m E-W, and 8 m N-S. On the downslope side there were originally two facings, which have mostly collapsed. A venerable old *kī* plant (*Cordyline fruticosa*) was noted growing out of the talus boulders immediately below the heiau; *kī* are frequently associated with *heiau*, and can be long-lived.

Orientation: Intact segments of the facing on the downslope side of the main terrace yielded an azimuth of approximately 75°/255° (magnetic), equivalent to 85°/265° (true). An intact portion of the lower facing, towards the W end, also yielded 85°/265° (true). We conclude that this structure was cardinally oriented to within about 5°, but deviating from true cardinality in the opposite sense from Pu‘upa. The main axis of orientation is likely to have been toward the S, with a focus on the large boulders defining the upslope edge of the terrace.

Test Excavation and Dating: A test unit measuring 75 × 80 cm was placed against a large, prominent natural boulder forming part of the upslope, S wall of the rectangular structure. The unit was excavated in 10-cm levels to roughly 30 cmbs, with the downslope (N) side ending 10 cm lower in alignment with the natural terrain slope. At the end of level 4 (30-40 cmbs), we had reached the base of the cultural deposit. However, some small pockets of loose sediment remained and were excavated as a final level 5. Most of these were only a few centimetres in depth, however one pocket in the northwest corner of the test unit continued to ca. 60 cmbs. This was excavated separately as Feature 1, a small pocket of loose sediment rich in charcoal that gradually sloped down into what appeared to be a circular posthole feature. Near the bottom of this deposit, we uncovered a piece of degraded branch coral (a known ritual offering material). Within and surrounding the feature itself were several large angular and subangular cobbles, which may have been placed there as additional support for a post.

The stratigraphy of the unit was as follows: *Layer I*: 10 YR 2/2 Very Dark Brown. This is the primary cultural layer,

FIGURE 4. Ki‘i Heiau (site 246). (a) View of remnant facings set among large boulders forming the northern façade of K‘i Heiau. (b) Large boulders defining the southern edge of the main terrace at Ki‘i Heiau.

with little recent overburden. Sediment is tightly packed, silty clay forming large (up to 3–5 cm diameter) peds. Some organic and root matter persists in the top of Layer I. A few cobble-sized, angular to subangular vesicular basalt inclusions, many of which appear highly degraded or resemble saprolitic rock. Sparse charcoal was found across the entire unit, which was otherwise devoid of artifacts or other cultural materials. *Layer II*: 7.5 YR 3/2 Dark Brown. Sediment is very compact and consists primarily of highly degraded parent material. There is a visible reddish hue (5YR 3/3 Dark Reddish Brown), most prominently in the sediment in the east wall face, and less obvious throughout the rest of the unit (though also somewhat visible also in the west wall face). Many cobble-sized, mostly subangular inclusions of either highly degraded basalt or saprolitic rock are particularly visible in the west wall profile. These inclusions form a band on the west profile that demarcate the transition between Layer I and Layer II.

Two charcoal samples for AMS radiocarbon dating were recovered from the base of cultural Layer I, and a third sample from 50 cmbs within Feature 1. The calibrated age ranges show significant overlap, and we combined them in a Bayesian single-phase model. The lower boundary for this modelled phase is AD 1492–1658 (2σ), and the upper boundary is AD 1637–1768. Individual modelled age ranges are AD 1531–1659 (UCIAMS-268323), 1636–1661 (UCIAMS-268324) and 1639–1664 (UCIAMS-268322).

Site 247, Lalohana Heiau

This site was formerly situated on the southern slope near the bottom of the valley, but Stokes reported it as completely destroyed by the old road.

Site 248, Ka’opele or ‘O’opele Heiau

Stokes reports that this site was situated on a flat on the south side of the valley. He describes it as ‘A small platform or terrace with a front 30 feet wide facing southeast. The pavement is 37 feet deep. The east corner is 6 feet high’ (1909a:16). Stokes did not make a plan map, nor did he take photos.

Location. A small stone-faced terrace that is probably Ka‘opele Heiau is situated at 733956E and 2340892N, at an elevation of 25 m above sea level. At the time we visited the site, it was partly obscured by Java plum tree branches that had been cut and piled on the terrace.

Architecture. As best as could be discerned, the site consists of a terrace approximately 30 m long and 10 m wide, with the long axis perpendicular to the slope, which rises steeply behind the terrace. The S and E faces consist of large boulders and cobbles; the greatest height is at the SE corner, at approximately 1.5 m. The terrace fill is made up of stone cobbles and earth. Several basalt flakes were noted on the surface.

Orientation. The S face of the terrace has an orientation of 71°/251° (true) as determined by our Trimble GPS. The SE corner is the architecturally most pronounced and the E façade more elaborated than the W. As with Pu‘upa Heiau, this suggests an orientation toward the E.

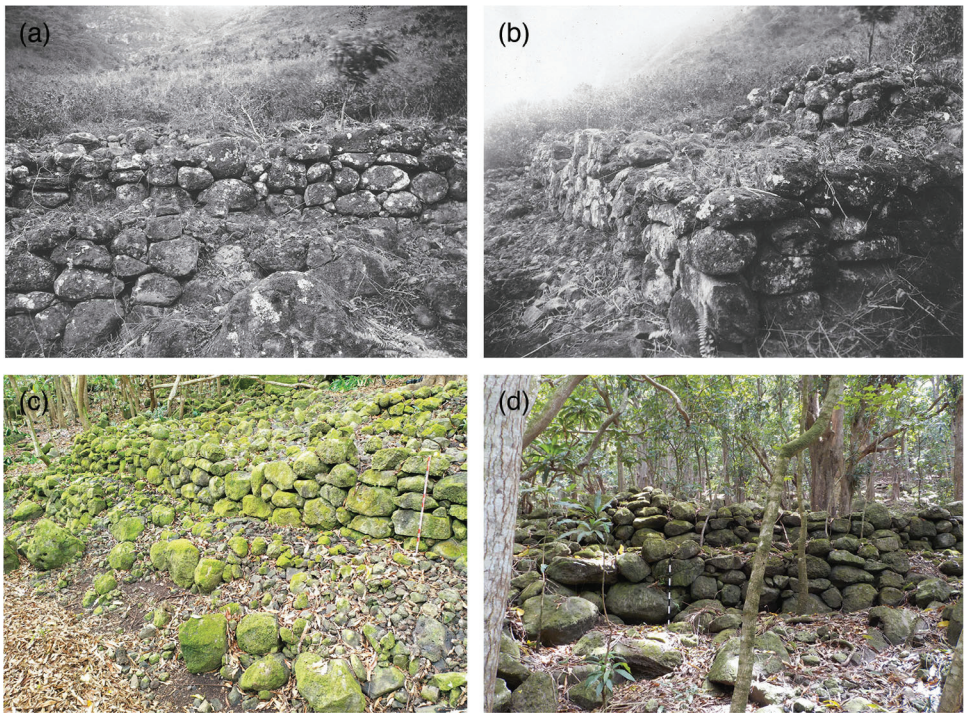
Site 249, Wai‘oli Heiau

Wai‘oli Heiau is reported by Stokes to lie at the mouth of a large side valley on the south. ‘The foundations are very small and consist of two adjoining stone terraces. The terrace on the south is 30 feet, west to east and 18 feet, south to north. The terrace on the north is a foot higher than the southern one. It measures 30 feet, west to east, and 8 feet south to north. The ground on which the structure is located declines to the south. On the south side, the structure is 5 feet high, on the north, one foot’ (Stokes, 1909a:16). Unfortunately, Stokes did not take photos, rendering re-identification of the site problematic. We searched the area to the east of Pua‘alaulau Stream extensively, finding two sites that are likely to be *heiau*, labelling these as Wai‘oli 1 and Wai‘oli 2. Neither one exactly matches Stokes’s description (in neither case does the terrain ‘decline to the south’), but Wai‘oli 2 is more likely to be the *heiau* seen by Stokes in 1909.

Wai‘oli 1

Location: UTM coordinates 733777 E, 2340728 N, elevation 80 m asl.

FIGURE 5. Pua‘alaulau Heiau (site 250). (a) Stokes’s photo of the front (north) façade of Pua‘alaulau Heiau (Bishop Museum Negative No. 1095). (b) Stokes’s photo of the northwest corner of Pua‘alaulau Heiau (Bishop Museum Negative No. 1097). (c) View of the northern façade of Pua‘alaulau Heiau in 2020 (photo by P. V. Kirch). (d) View of the northeast corner of Pua’alaulau Heiau in 2020 (photo by P. V. Kirch).



Architecture: The site consists of a single terrace built up around several large boulders; the terrace measures 9 m E-W. One especially large boulder is situated in the SE corner of the terrace, and has a height of 1.6 m. There is an intact stone alignment on the W side of the terrace, and remnant facing on the N, although most of the N facing has collapsed. Part of a battered adze was noted on the ground adjacent to the NE corner of the site.

Orientation: The intact alignment on the W side has an orientation of 165°/345° (magnetic), equivalent to 175°/355° (true), and representing a deviation from true cardinality of about 5° in a counter-clockwise sense. Our best estimate of the orientation of the N facing, given the extensive collapse, was 68°/248° (magnetic) = 78°/258° (true), which represents a larger deviation from cardinality, of some 12°. This latter estimate is less reliable, but cannot be dismissed as is it not safe to assume that the W and N sides of the terrace were perpendicular. The presence of the large boulder in the SE corner suggests a possible S or E orientation.

Wai‘oli 2

Location: The UTM coordinates are 733719 E, 2340767 N, with an elevation of 55 m asl. The site lies on a moderately steep slope a short distance to the south of Pua‘alaulau Stream, and better fits Stokes’s description of being at the mouth of a large side valley.

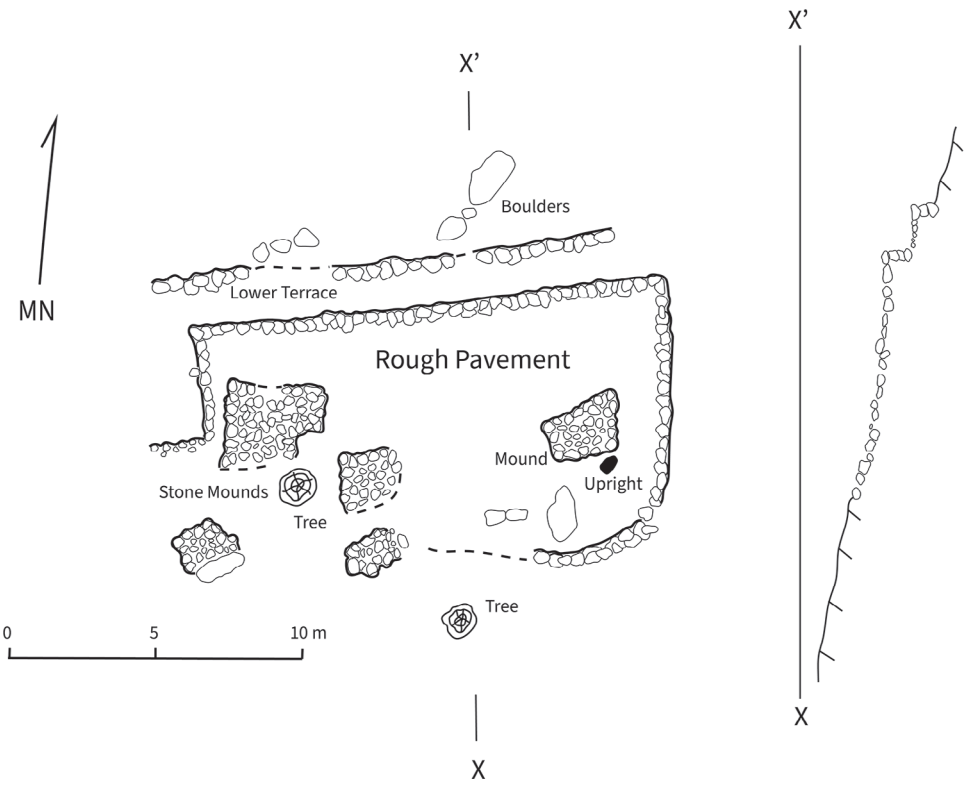
Architecture: The site consists of an elongated, rectangular terrace, well faced on the N (down-slope) side. The terrace is about 24 m long, and has a width of 5–6 m; the up-slope edge of the terrace is marked by a steep increase in the slope angle. The main face along the N is well constructed of large cobbles and small boulders with between five and six courses. The terrace is divided into two sections by a low stone wall and possible low platform.

Orientation: The two sections of the main N face have slightly different orientations, 82°/262° (magnetic) for the western section and 86°/266° (magnetic) for the eastern section. The corner-to-corner alignment was determined as 83° (magnetic) west to east but 258° east to west, indicating a possible magnetic anomaly close to the NE corner. Ignoring this latter figure and applying the mean magnetic correction of 10°, our best estimate of the orientation is 93°/273° (true). The axis of orientation is not certain, but may have been toward the S (upslope).

Site 250, Pua‘alaulau or Lawea Heiau

Stokes located Pua‘alaulau Heiau at the mouth of one of the side valleys, describing it as follows: ‘This foundation consists of a terrace with a stone bench along its northern face and continuing along the western end’ (1909a:16). Stokes made a plan map (reproduced in Summers [1971: fig. 75]), and took two photos (Figure 5), allowing us to definitively relocate the site. We re-mapped the site with plane table and alidade in 2020 (Figure 6). Stokes noted that

FIGURE 6. Plan and cross-section of Pua‘alaulau Heiau (site 250).



‘the heiau is said to have been built by Lawea, the son of Kaenakilolani, the prophet’ (1909a:16).

Location: UTM coordinates 733602 E, 2340761 E, elevation 54 m above sea level. The *heiau* lies a short distance to the west of Pua‘alaulau Stream (note that the position of Pua‘alaulau Stream is wrongly shown on the State of Hawai’i GIS shapefile, seeming to indicate that the *heiau* is east of the stream, which is not the case). The terrain in this locality is gently sloping, with large boulders scattered about.

Architecture: The *heiau* consists of a large, well-constructed terrace, about 20 m E-W by 14 m N-S. Along the N, down-slope side the terrace is well faced with a secondary buttressing terrace. The W and E sides are also well faced, although the E façade is more pronounced, while on the S (up-slope) side the terrace grades into the hillside. The surface of the main terrace is uneven, and shows signs of having been disturbed, probably due to the removal of some of the paving stones to form five small, roughly rectangular platforms or mounds that are almost certainly post-contact burials. The use of *heiau* as burial sites following the end of the traditional religious system is a pattern that has been noted elsewhere (e.g. Kirch & Ruggles 2019: 287, 328).

Orientation: The measured orientations of the facings, after making the conversion from magnetic to true azimuths by adding 10°, were as follows: main terrace N wall 91°/271°, secondary terrace N wall 90°/270°, W side 0°/180°, and E side 6°/186°. In other words, the N and W sides of this *heiau* were almost perfectly cardinally oriented, while the E side is slightly skewed. The pronounced NE corner and well-constructed E façade may indicate an orientation of the main platform towards the E.

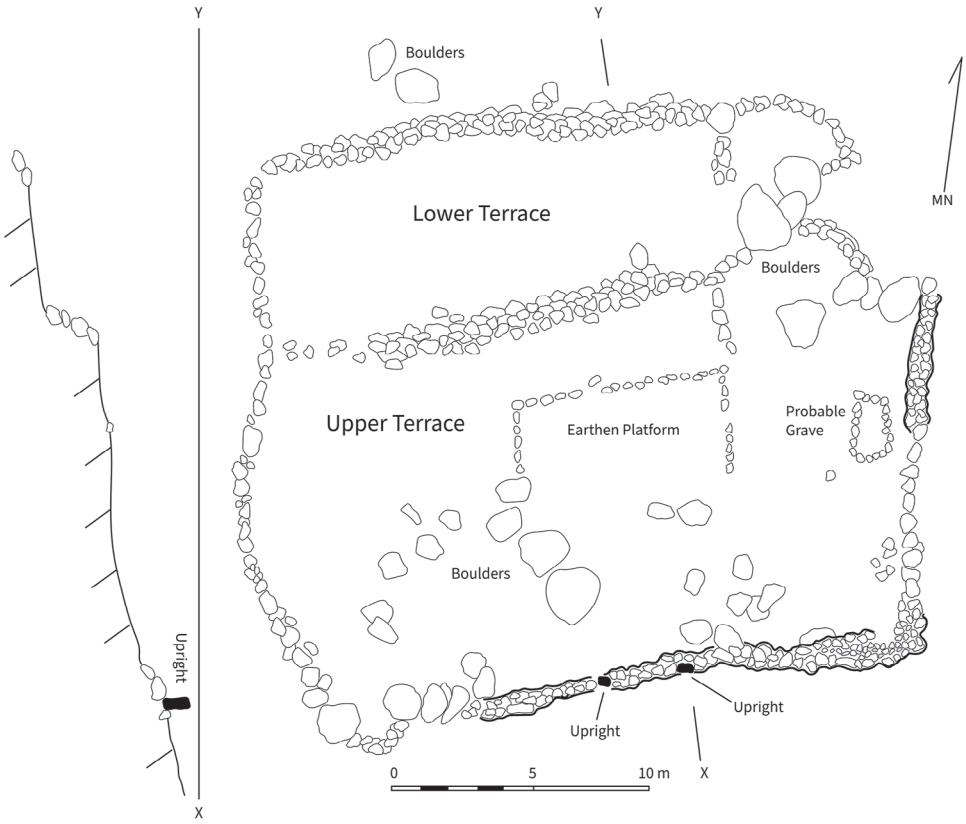
Test Excavation and Dating: A 50 × 50 cm unit was excavated on the west side of Pua‘alaulau Heiau, abutting the outside wall of the *heiau*, in an area where a stone alignment runs east-west into, and possibly underneath, the *heiau* platform. The unit was placed at the ‘corner’ of where this alignment and the heiau wall intersect. Under about 20 cm of dark brown loamy overburden the excavation exposed a pavement of larger cobbles with smaller stones chinked in between them; charcoal was recovered from both between and below the paving stones.

Two samples of identified wood charcoal were submitted for AMS radiocarbon dating. The first consisted of a piece of *Styphelia tameiameiae (pukiawe)* wood charcoal from between the paving stones (UCIAMS-241380), which yielded calibrated age ranges (2σ) of AD 1661–1685 (21.7%), 1732–1805 (60.1%) and 1927… (13.6%). The second sample, from beneath the pavement, of *Osteomeles anthyllidifolia (’ulei)* wood charcoal, produced calibrated age ranges of 1527–1554 (19.3%) and 1632–1662 (76.2%).

Site 251, Hali‘i Heiau

Location: The UTM coordinates are 733208 E, 2340815 N, with an elevation of 50 m asl. Stokes gives the location of Hali‘i Heiau as on the flat, near the south side of the stream. It is accessed after rounding a steep, prominent ridge that

FIGURE 7. Plan and cross section of Hali‘i Heiau (site 251).



defines the E boundary of Kapana ‘*ili*. The *heiau* lies on gently sloping ground. The site is depicted on the settlement pattern map of Kapana published in Kirch and Kelly (1975, fig. 31), where it is identified as site Mo-A1-29. We mapped the site with plane table and alidade in 2021.

Architecture: Stokes described Hali‘i Heiau as ‘a series of stone terraces facing the north’ (1909a:16). Stokes’s plan map was reproduced by Summers (1971, fig. 76); he took no photos. Although we are confident that we correctly relocated Hali‘i Heiau, there is some discrepancy between Stokes’s plan and our observations, in particular the absence on Stokes’s plan of the southern rock wall that bounds the upper terrace. Other features, including the ‘pavement’ and the large rock, however, do correspond with our observations.

Hali‘i Heiau is one of the more impressive sites in Hālawa Valley, with overall dimensions of approximately 27 m E-W by 23 m N-S. It consists of two large terraces, enclosed by a stacked stone wall (Figure 7). On the S (up-slope) side, the wall incorporates several upright stones, one of them a prismatic slab about 1 m high, as shown in Figure 8. The upper terrace has a large curbstone foundation, presumably for a thatched structure, which corresponds to what is labelled the ‘pavement’ on Stokes’s map. To the E of this is a smaller rectangular stone outline that may be a post-contact grave; interment of individuals on *heiau* sites following the abolition of the *kapu* system was not uncommon. The facing that separates the upper and lower terraces is roughly constructed of large cobbles and boulders, and ranges between 1 and 1.4 m in height. This wall ends on the E side in a cluster of massive boulders; a small enclosed space was constructed on the N side of the boulders.

Orientation: Orientation measurements were obtained on the *heiau* walls as follows (true azimuths, converted from the measured magnetic azimuths by adding 10°): S wall 92.5°/262.5°; E wall (best fit) 2°/182°; W wall (northern part) 1.5°/181.5°; N wall 85.5°/265.5°. The S, E and W walls are therefore rectangular, oriented within 2° of perfect cardinality, while the N wall is skewed by about 7°, although still within 5° of cardinality. The southern few meters of the W wall (162.5°/342.5°) are skewed by a greater amount, somewhat reducing the sharpness of the SW corner. The presence of the two prominent uprights in the S wall is indicative of an orientation to the S (upslope). However, the incorporation of several massive boulders in the E side of the structure may also be significant.

Test Excavation and Dating: In 2021 we excavated two small tests at Hali‘i Heiau. TU-27, measuring 100 × 75 cm, was laid out on the upslope side of a low, single-course stone faced terrace within the upper part of the *heiau* enclosure. At about 20 cmbs, a rough pavement of basalt cobbles was exposed. Numerous basalt flakes, a pig tooth, a fragment of unidentified non-human mammal bone, and small pieces of wood charcoal were recovered from between these paving stones. TU-28, measuring 75 × 75

FIGURE 8. Hali‘i Heiau (site 251). (a) View of the rear (southern) wall with large prismatic basalt upright stone. (b) View of the stone façade separating the upper and lower terraces (photos by P. V. Kirch).

cm, was positioned along the outside enclosing wall on the upslope, south side of the *heiau*, adjacent to the large stone upright. Excavation proceeded to the base of the upright at 45 cmbs, encountering a few basalt flakes; some carbonized candlenut endocarp was recovered from screening the 10–13 cm level.

Two samples of wood charcoal recovered from between the paving stones in TU-27, and thus associated with initial construction of Hali‘i Heiau, were submitted for AMS radiocarbon dating, yielding consistent corrected 14C ages of 360 ± 15 BP (UCIAMS-268316) and 330 ± 15 BP (UCIAMS-268315). The piece of carbonized candlenut endocarp from TU-28, derived from post-construction fill abutting the upright stone, gave a corrected age of 135 ± 15 BP (UCIAMS-268314). We combined these three dates into a two-phase Bayesian model, with the two dates from TU-27 representing an initial construction phase, and the TU-28 date representing post-construction use. The lower boundary for the early phase has a modelled age range of AD 1167–1631 (2σ) with a transition boundary to the later phase of AD 1508–1839. The two earlier dates have modelled ages of AD 1474–1632 and 1498–1638. The later phase date from TU-28 has a modelled age of 1672–1936, although there is no reason to believe that the heiau was in use after the end of the *kapu* system in 1819.

Site 252, Kapana Heiau

Stokes’s description of Kapana Heiau was more detailed than his usual terse notes: ‘A foundation consisting of stone terraces on the north and earth floors on the south. The stone terraces are somewhat unusual for the valley; angular, flat stones have been selected, while in all the other heiaus in this valley, a preponderance of rounded, water-worn stones have been used. The eastern boundary of Kapana consists of a line of large, naturally placed boulders’ (1909a:16). Stokes made a plan of the site (see Summers [1971:fig. 77]), and took two photographs–one of the north face, and a detail of the stonework that clearly impressed him (Figure 9).

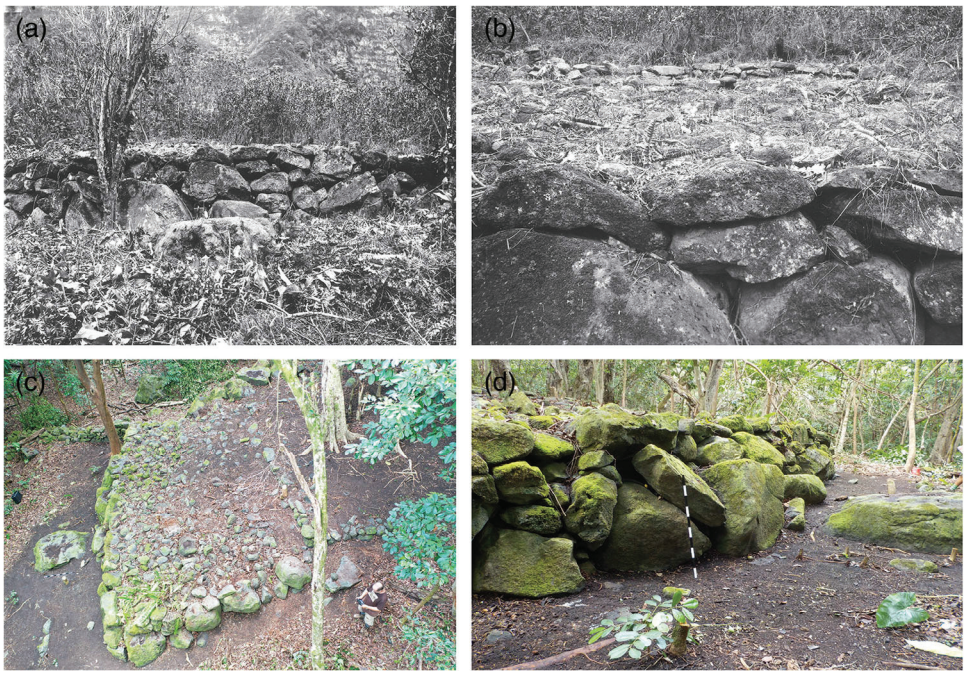
Location: The UTM coordinates are 732960 E and 2340823 N, with an elevation of 65 m asl. The site is centrally located within the *‘ili* (subsection of an *ahupua‘a*) of Kapana, on the eastern bank of Maka‘ele‘ele Stream.

Architecture: In addition to Stokes’s 1909 map, Kapana Heiau was mapped in detail by Paul Rosendahl as part of the 1969–70 Hālawa Valley Project (Rosendahl, 1975:153-160). The site consists of a stepped platform with overall dimensions of 11 m E-W by 10.5 m N-S. On the E side this platform is built up to a group of massive natural boulders, as is also seen at Hali‘i Heiau. The well-constructed front face (on the N side) stands about 1.3 m high, with large boulders at the base. The stone-paved main terrace is divided into three levels by the presence of two low facing alignments, each one-to-two stone courses high. At the southern end of the pavement there is a low, rectangular earthen platform, defined around the perimeter by curbstones. A test excavation conducted by Rosendahl in 1970 showed that this earthen platform was a post-contact period addition, when the site was used as a residence, most likely by someone who was the *kahu* (keeper) of the *heiau*. A volcanic glass flake from the pre-contact deposit underlying the historic period residence was dated by the hydration-rim method to AD 1476–1532 (Rosendahl, 1975:159).

Orientation: The front (N) face of the platform curves round from approximately 88°/268° (true) at its west end to 97°/277° (true) at its east end, for an average of 92.5°/272.5° (true). The W side of the main terrace, which splays out slightly towards the N, has true azimuth 352°/172°, but the W side of the earthen platform is oriented almost exactly north-south (true azimuth 359°/179°). The stepping up of the low stone terraces suggests an orientation to the S (upslope). However, as at Hali‘i Heiau, Kapana Heiau was constructed so as to incorporate a cluster of massive boulders on the E side, and these hint that E may also have been important in the structure’s orientation.

Test Excavation and Dating: During the 2020 field season a 70 × 75 cm unit (TU-22) was positioned abutting the front façade or north side of Kapana Heiau. The unit

FIGURE 9. Kapana Heiau (site 252). (a) Stokes's photo of the northern façade (Bishop Museum Negative No. 1093). (b) Stokes's photo showing a detail of the northern façade stonework (Bishop Museum Negative No. 1096). (c) Drone photo of Kapana Heiau from the west, after clearing in 2020 (photo by P. V. Kirch). (d) View of the northern façade of Kapana Heiau in 2020, from the northeast corner (photo by P. V. Kirch).



was relatively shallow (c. 30 cm deep) and stratigraphy followed the gentle downward slope to the north that was already visible from the surface. The simple stratigraphy was as follows: *Layer I*: Black reddish brown (5 YR 2.5/1), loose, fine silty clay with some ped structure and considerable organic matter. Appears to be recent overburden. *Layer II*: Very dark brown (7.5 YR 2.5/1). This deposit (20–25 cm thick) is significantly more clayey and compact than Layer I, very rich in charcoal, with charcoal concentrations becoming more evident in the deeper part of the deposit. The few rocky inclusions consisted of waterworn pebbles and angular basalt pebbles or cobbles. Near the bottom of Layer II (levels 3 and 4) we found dense quantities of charcoal across the entire unit, but especially in the southern half, closest to the structure wall. Many pieces of charcoal were visible in the profile of the unit after the excavation. Layer II included abundant charcoal, mammal (pig and/or dog) bone, fish bone, shell, coral, basalt flakes, polished adz flakes, and volcanic glass flakes. *Layer III*. Dark reddish brown (5 YR 3/3). Very compact sediment with rocky inclusions that look to be saprolitic. The boundary between Layers II and III is somewhat diffuse, as the Layer III surface undulates with pockets of Layer II soil and charcoal.

At the interface of Layers II and III we uncovered a small pocket of sediment that remained loose and soft, and resembled Layer II sediment rather than Layer III. We excavated this separately as Feature 1 to a depth of roughly 20 cm below the bottom of the unit. This sediment was screened and the small quantity of recovered charcoal from Feature 1 was bagged separately. Feature 1 likely represents a posthole.

Three samples of identified, short-lived species of wood charcoal from the cultural deposit Layer II were submitted for AMS radiocarbon dating, all returning relatively consistent ages (Table 1). The samples all have multiple calibrated ranges, as is typical of such young radiocarbon dates. However, as Layer II did not contain any post-contact artifacts, we disregard those calibration ranges that post-date 1819, when the *ʻai kapu* system was overthrown. Using 1819 as a *terminus ante quem*, Bayesian modelling of the three dates yields the following modelled ages: AD 1675–1819 (Beta-241394); AD 1684–1819 (Beta-241395); and AD 1688–1819 (Beta-241393).

Site 253, Koʻa of Hoʻomilianuhe

According to Stokes, this site was located on the southern border of the stream, not far from Moaula (or Moʻoula) Falls. It was a fishing shrine for *ʻoʻopu* (*Lentipes concolor*, the native Hawaiian goby) built to the god Hoʻomilianuhe. 'There is a small wall, enclosing a space about 6 feet in diameter, and as in many of the ocean fishing temples, the walls are built up to a large stone' (Stokes, 1909a:17). Kirch searched for this site in 1969, but concluded that the topography of the stream had changed drastically due to numerous floods, and that the site was most likely destroyed.

Site 254, Hopuhewa Heiau

According to Stokes's map this site, located at the foot of a ridge on the northern side of the valley, consists of a foundation of two paved terraces, the northern one 37 feet E

to W and 13 feet N to S. The southern terrace is 5 feet lower than the northern one, and is 42 feet east to west, and 15 feet north to south. Stokes reports that informants identified the site as a *ko‘a ho‘oulu‘ai*, or agricultural shrine.

Location. We identified what appears to be Hopuhewa Heiau at 732916E and 2341058N, at an altitude of 81 m asl.

Architecture. The site is in poor condition, with the trunk and branches of a recently fallen, large candlenut tree obscuring much of it from view. It appeared to be a low stone platform, internally divided into two levels. One intact facing was visible on the W, made up of an alignment of basalt cobbles 30–40 cm high. A large basalt flake was noted near the SE corner.

Orientation. The intact W facing has a bearing of 160°/340° (true), while the N edge of the platform has a bearing of 75°/255° (true). The axis of orientation may have been to the N (upslope), but this cannot be determined with certainty.

Site 255, ‘Elelu Heiau

According to Stokes, this *heiau* lies at the foot of a ridge on the northern slope of the valley. Stokes’s description is minimal: ‘A combination of large and small terraces facing south’ (1909a:17). He notes that the site was known to his Hālawa informants as a *ko‘a ho‘oulu‘ai*. Stokes made a plan of the site (see Summers [1971:fig. 78]) but took no photos. We searched the locality indicated by Stokes’s coordinates without being able to accurately discern which of the many terraces in this area made up this site. The area where the site is presumably situated consists of a talus fan with many large boulders and extensive agricultural terracing. Several large, old *hala* (*Pandanus*) trees grow in this area.

Sites 256–257, Pu‘u O‘ahu or Hiwa Heiau, and Kaenakilolani or Mo‘oiki Heiau

According to Stokes, these were two ‘adjacent terraces’ located at the base of the northern slope of the valley. ‘[Pu‘u O‘ahu] has an earth platform measuring 86 feet west to east and 23 feet south to north, and on the south a 7-foot high retaining wall’ (Stokes, 1909a:17). Of Kaenakilolani heiau Stokes says: ‘The terrace has an earth and stone pavement measuring 92 feet west to east and 24 feet south to north’ (1909a:17). After considerable searching, we identified a structure matching Stokes’s description of Hiwa Heiau. We partially cleared the site of obscuring vegetation, and prepared a compass-and-tape map at a scale of 1:100, shown here in Figure 10. We were not able to identify the remains of Kaenakilolani Heiau, despite intensive searching.

Location: The UTM coordinates in the center of the terrace are 734100 E and 2341232 N, at an elevation of 27 m asl. Hiwa Heiau lies on a gently sloping ridge spur on the northern side of the valley, about 450 m southwest from Mana heiau, and a few meters north of the trail leading to Hālawa Falls.

Architecture: The site consists of a rectangular terrace, about 25 m long (E-W) and 9–10 m wide (N-S), faced with boulders and cobbles on the south (down-slope) side. Part of the facing has collapsed, but it is still largely intact on the eastern end, where there is a buttressed face (Figure 11). The facing at the E end reaches a maximum height of 2 m from ground surface to the terrace floor (which corresponds to Stokes’s description of a ‘7-foot high retaining wall’). The E side of the structure incorporates a number of massive boulders, as also seen at Hali‘i and Kapana Heiau.The terrace itself is of earth, and the up-slope edge is defined simply by the presence of scattered boulders and a change in slope. A low stone wall (ca. 0.3 m high) divides the terrace into W and E parts. A low stone platform in the western part of the terrace is likely to be a post-contact grave.

Orientation: Compass measurements showed the corner-to-corner alignment along the SSE wall of the terrace to be 57°/237° (magnetic), equivalent to 67°/247° (true). This was confirmed by measurements of the intact ENE facing, which yielded 158°/338° (true). It is interesting, and potentially significant, that the azimuth of 67° is very close to the rising position of the star cluster Pleiades (Makali‘i) during the time period when this *heiau* was likely built. That the structure’s axis of orientation was to the ENE is also suggested by the incorporation of the large boulders into that end of the *heiau*.

Site 258, Mana Heiau

Mana Heiau is without doubt the most impressive temple site in Hālawa Valley. Stokes comments that ‘its history has been as poorly preserved as its appearance is striking. The account [told to him by his Hālawa informants] is that it was built in the time of Alapa‘inui of Molokai by, it was thought, the Menehune. It was for human sacrifice’ (Stokes, 1909a:17). In 1969, Kirch interviewed Rose Kamanao, then in her 80s, who was born and raised in the valley. She spoke of the considerable respect, even fear, that the people had for Mana Heiau, noting that during certain nights of the lunar calendar (Pō Kāne nights) the beat of the *pahu* drums could be heard emanating from the *heiau*, and people remained indoors.

Stokes described Mana Heiau as follows: ‘The main portion is part platform and part terrace, facing south-southeast. The retaining wall is 13 feet high in places and is constructed of water-worn stones; it has a slope of about 1 horizontal to 3 $\frac{1}{2}$ vertical. The pavement is also of ‘ala stones, except for two small rectangular sections in the eastern half. These are paved with earth and shore pebbles, and are probably sites of some of the temple houses’ (Stokes, 1909a:17-18). Stokes also notes irregular terraces south of the main platform. Stokes made a detailed map of Mana Heiau, reproduced in Summers (1971, fig. 79). Obviously impressed with Mana Heiau, Stokes also took five photographs of the site, of which we reproduce two (Figure 12).

Location: The UTM coordinates in the centre of the main platform are 734505 E and 2341521 N, at an elevation of 25 m asl. Mana Heiau is located on the northern side of the valley, at the mouth of a lateral side valley. As Stokes

FIGURE 10. Plan of Hiwa Heiau (site 256).

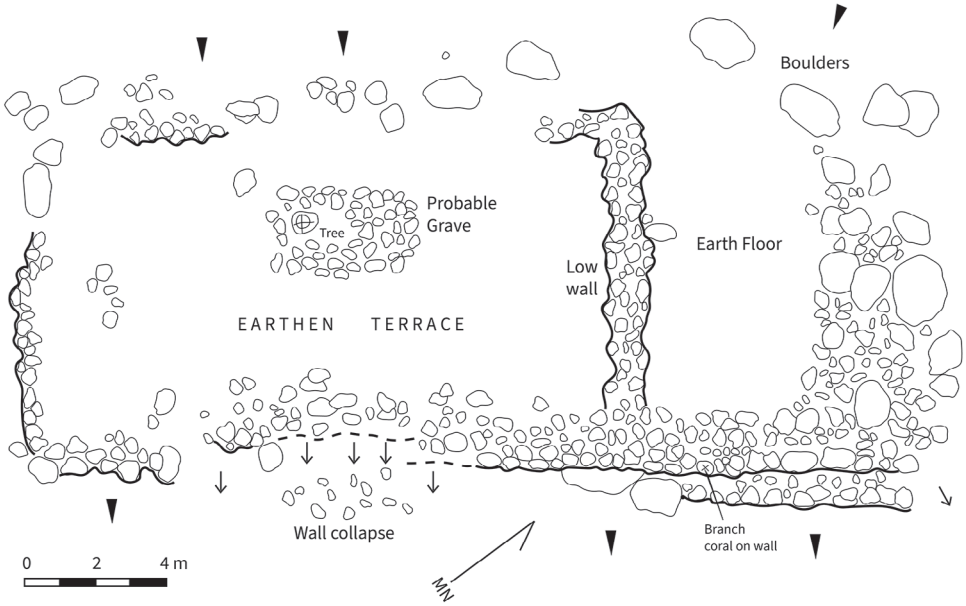
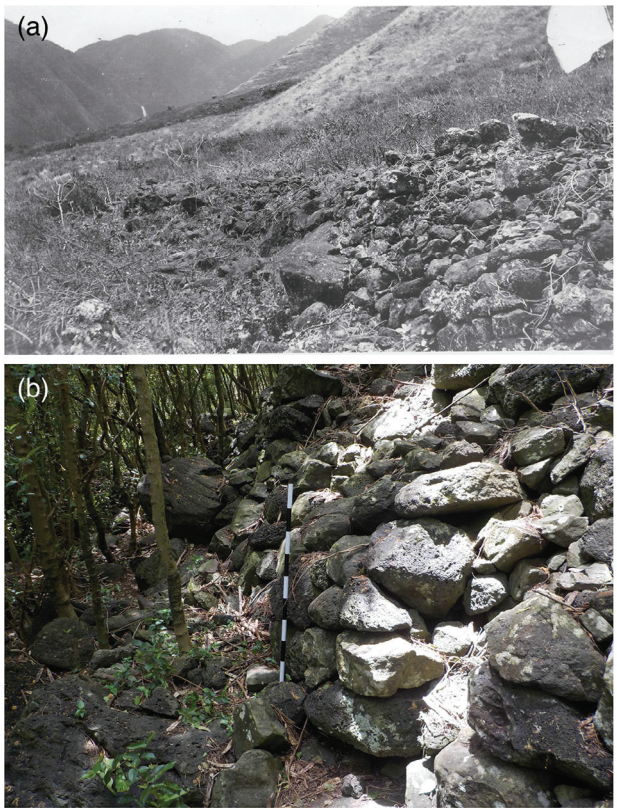


FIGURE 11. Hiwa Heiau (site 256). (a) Stokes's photo of the front (south) façade of Hiwa Heiau, from the southeast corner (Bishop Museum Negative No. 1248). (b) View along the front (south) façade of Hiwa Heiau in 2019 (photo by P. V. Kirch). Note the large boulder with a notch appearing in both photos.



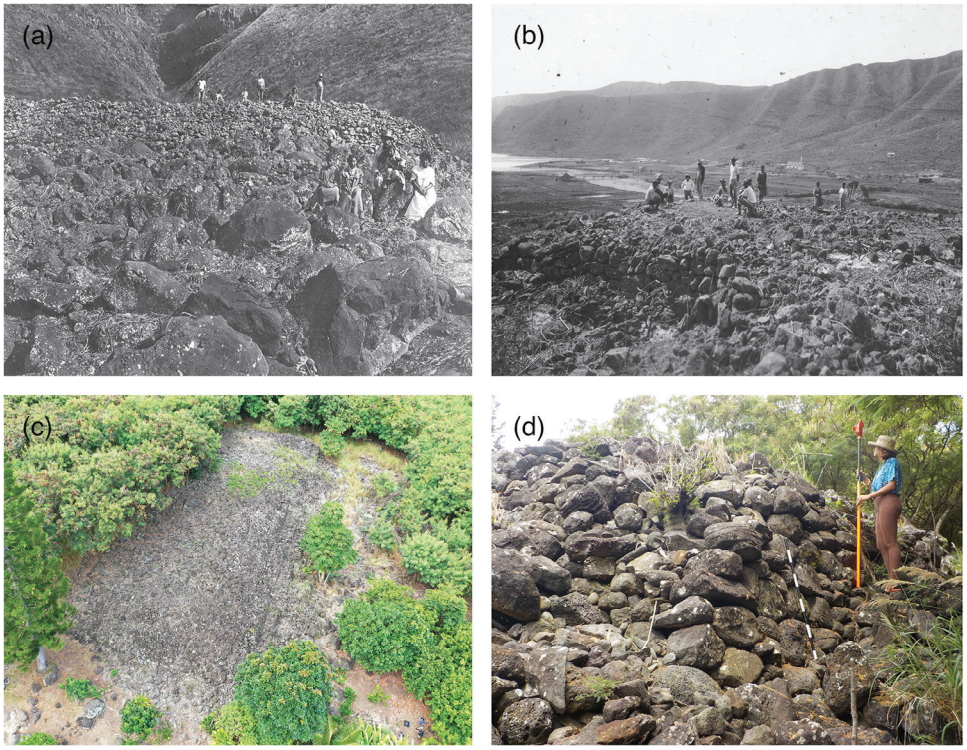
observed, from this location 'this heiau would have controlled not only the valley, but also the bay' (1909a:18).

Architecture: In 1969, as part of the Hālawa Valley Project, Kirch mapped the site with plane table and alidade (Figure 13); this map more accurately shows the five terraced steps along the west, south and east faces of the main platform than Stokes's 1909 plan. The site consists of an elongated, rectangular platform approximately 42 m long and 19 m wide. The five sets of descending terraces are fairly closely spaced, with their façades ranging from 0.4 up to 1 m in height. These facings have partially collapsed in places. There are two areas with traces of *'ili'ili* paving on the eastern part of the main platform that were probably the floors of thatched structures. One possible image hole was noted in the western part of the platform. We did not attempt to map the irregular terraces observed by Stokes to the south of the main platform, as this area is densely overgrown with vegetation.

Orientation: We were able to determine the relevant structural orientations accurately at Mana using a total station and surveying all intact terrace facing segments. The best-fit orientations (true azimuths) for the long, SSE faces of the uppermost four terraces (in order from top to bottom) in the ENE direction are 58.8°, 60.3°, 60.3° and 58.6°. Those for the shorter ENE faces in the SSE direction are 146.3°, 145.7°, 146.5° and 142.2° while those for the WSW faces are 157.1, 152.5 and 155.5 (no data for the lower terrace).

Taking the average of the four terraces on the SSE side, we would conclude that the platform faces an azimuth of 59.5° to the ENE. On the other hand, the corner-to-corner alignment on the NNW side of the platform is 62.2°, suggesting that the intended azimuth was closer to 61°.

FIGURE 12. Mana Heiau (site 258). (a) Stokes's photo of the main (south) façade from the south (Bishop Museum Negative No. 1038). (b) Stokes's photo of the northeast side of Mana Heiau, looking out over the valley (Bishop Museum Negative No. 1039). (c) Drone photo of Mana Heiau looking toward the east, in 2020 (photo by P. V. Kirch). (d) View of the eastern façade and partially collapsed southeast corner, in 2019 (photo by P. V. Kirch).



No excavations have been conducted at Mana Heiau, and no radiocarbon dates are available. However, the information given to Stokes in 1909 that Mana Heiau was dedicated (or rededicated) by the Hawai'i Island ruling chief Alapa'inui as part of his invasion of Moloka'i in support of the island's chiefs against the oppression by the O'ahu king Kapi'iohookalani (Fornander, 1996:136-37; Kamakau, 1961:71; Kirch, 2010:107) gives us some basis for estimating when the temple was built (at least the phase represented by the extant architecture). Alapa'inui ruled roughly between AD 1710–1730, based on his position in the genealogy of ruling chiefs of Hawai'i Island (Kirch, 2010, table 3.1).

Site 261, Makaohalawa Heiau

Stokes located this site on the western shore of the 'small harbor', but stated that the *heiau* was entirely destroyed at the time of his visit (1909a:18).

Site 262, Kauhuhu Heiau

Stokes describes this site as being near the beach, 'north of the former landing' (1909a:18). As with site 261, Stokes says that the site was entirely destroyed.

Site 263, Ko'a

This *ko'a* or fishing shrine is located near the boulder beach south of Papa Heiau. Stokes describes the site as 'a small enclosure with its walls joining up with a large rock' (1909a:18). Stokes's photograph is reproduced as Figure 14a. Kirch mapped the structure with compass-and-tape in 1969.

Architecture: The structure consists of a low, roughly stacked semi-circular stone enclosure of two to four courses, built up against the large natural boulder. The enclosure has maximum exterior dimensions of 5 × 2.5 m; the interior floor is roughly paved with basalt cobbles. The natural boulder that was probably the focus of veneration measures 4 m E-W by 2.5 m N-S, and has a height of about 2 m on the S side.

Test Excavation and Dating: In July 1969 during the initial Hālawa Valley Project, Kirch excavated a 1 × 2 m trench across the interior of the enclosure. A layer of dark brown silty clay had accumulated against the stone wall and larger boulder; at the base of this fill was a thin lens of charcoal flecking and decomposed candlenut endocarps that apparently marks the floor at the time that the shrine was in use. This lens lay directly on top of the natural subsoil. A sample of charcoal taken from this lens, where it abutted the base of the large boulder, was curated in the Bishop Museum. In 2019 a piece of carbonized candlenut endocarp was selected from the larger sample and submitted to the Keck Carbon Facility for AMS dating, returning an age of 115 ± 15 BP (UCIAMS-233639). The calibrated ages at 95% probability are AD 1691–1728 (23.4%) and 1809–1921 (72.0%).

FIGURE 13. Plan map of Mana Heiau (site 258), based on plane table survey by P. V. Kirch in 1969.

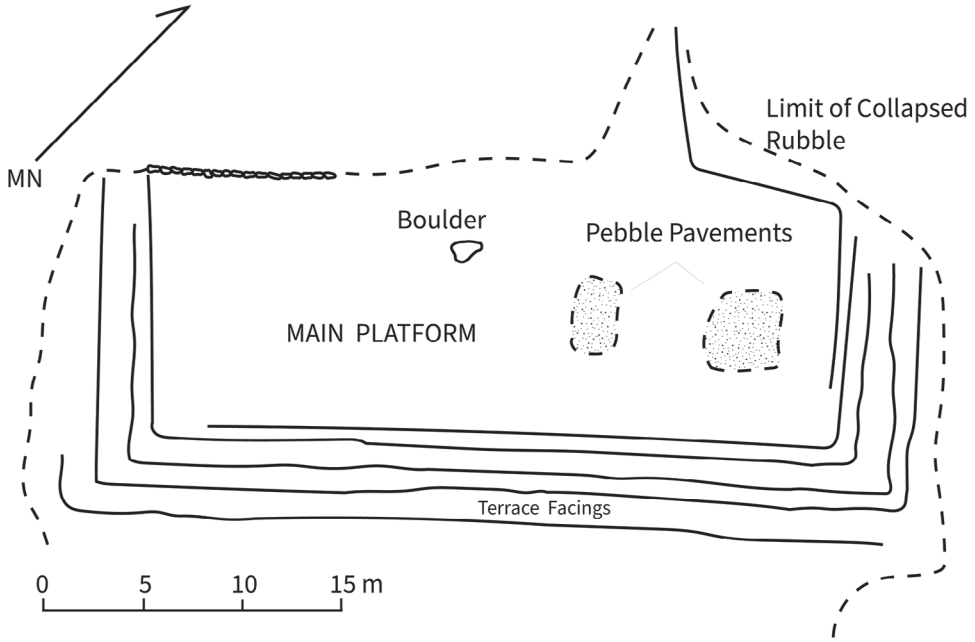
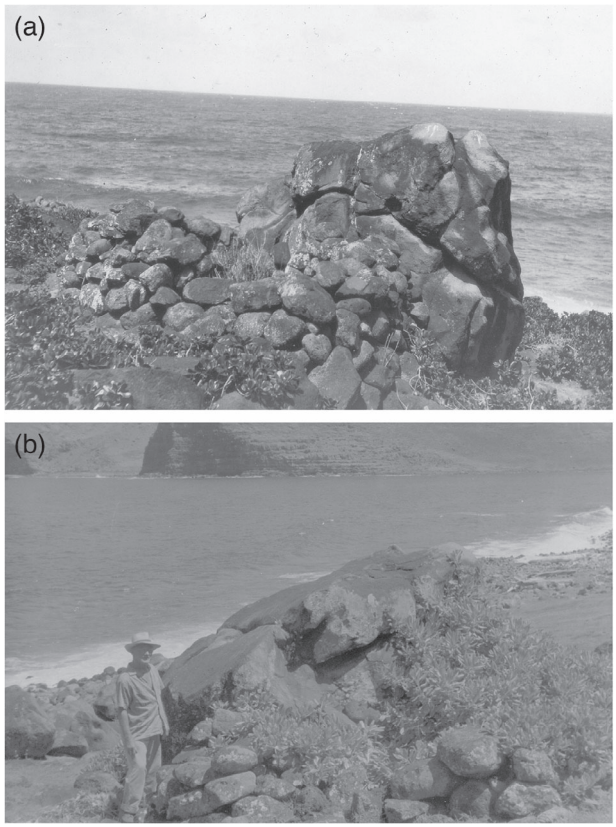


FIGURE 14. Fishing shrine (*ko'a*, site 263). (a) Stokes's photo of site 263 in 1909, from the west (Bishop Museum Negative No. 1307). (b) View of site 263 in 1964, from the northwest (photo by P. V. Kirch).



Site 264, Papa or Kakau Heiau, Hālawaiki

Situated at the mouth of Hālawaiki Gulch, this fairly extensive and complex structure was described by Stokes as follows:

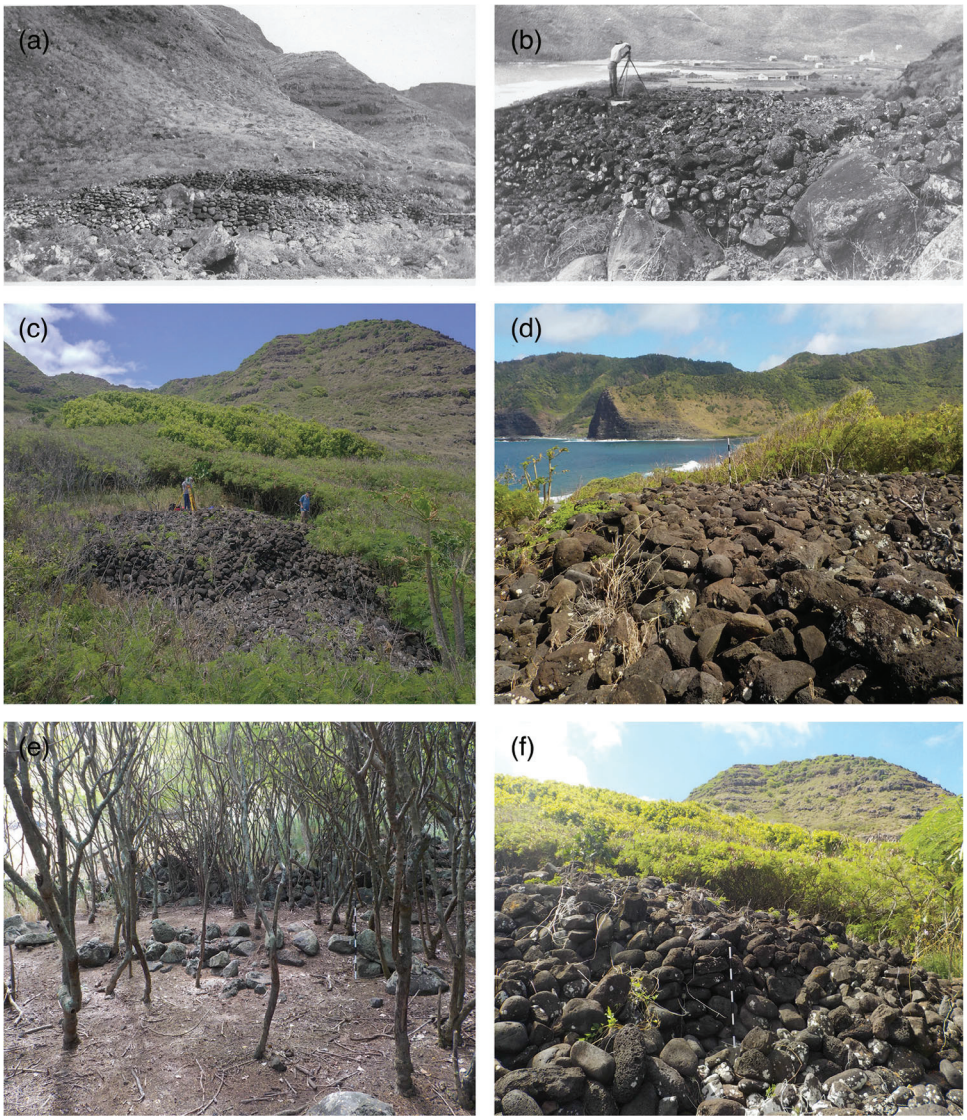
> A collection of small platforms, terraces, and walls, suggesting more the site of a college of priests than a heiau. It is said to have been a heiau, built by Alapai, dedicated to Kaili and to have included a lele [offering stand] in its construction. It is not known if the heiau were used for human sacrifice, though the connection of the name of the war god [Ku-ka'ili-moku] and the presence of a lele would indicate this use. (Stokes, 1909a:18-19)

Stokes made a detailed map of the site, reproduced by Summers (1971:fig. 80), and took two photographs (Figure 15a, b).

Location: The UTM coordinates on the main platform are 734982 E and 2342108 N, at an elevation of 25 m asl. Papa or Kakau Heiau lies on a moderate slope at the mouth of Halawaiki Gulch, just south of the small stream flowing out of this side valley.

Architecture: This is certainly the most complex structure of all of the *heiau* in Hālawa, which may be what prompted Stokes to regard it as 'more the site of a college of priests' (1909a:18) as it did not conform to other typical *heiau* plans. The core of the site consists of two substantial stone terraces, the upper one of which is capped by a low stone platform (what Stokes labelled the 'new pavement' in his plan). These two stone terraces are separated by an approximately 1.2–1.5 m high facing. Figure 15d is a view across the low stone platform that caps the upper stone terrace (this is also the platform shown in Stokes's 1909 photo reproduced in Figure 15b). Figure 15f shows an intact segment of the facing separating the upper and lower main stone terraces. Upslope from the stone terraces are a

FIGURE 15. Papa Heiau (site 264). (a) Stokes's photo of Papa Heiau from the southeast (Bishop Museum Negative No. 1249a). (b) Stokes's photo of the main platform of Papa Heiau from the northwest (Bishop Museum Negative No. 1250). (c) Drone photo of the main platform in 2019 (photo by G. McCleary). (d) Detail of the main platform from the northwest, in 2019 (photo by P. V. Kirch). (e) View of stone-faced earthen terraces situated northwest of the main platform (photo by P. V. Kirch). (f) Partially intact façade of the main platform, in 2019 (photo by P. V. Kirch).



succession of three earthen terraces retained by low, fairly rough stone facings (Figure 15e). The entire complex is bounded by a sinuous, low wall of cobbles and boulders. The entire complex measures approximately 50 m along the NW-SE axis, and between 22 and 30 m along the SW to NE axis.

Orientation: The main structural orientations at Papa as determined from our total station survey are provided in Table 2. The orientation of this *heiau* is as anomalous as its design: it faces ESE, broadly facing azimuth 123° to judge by the NE and SW sides, or perhaps around 132° as deduced from the direction perpendicular to the long terrace facings on the SE side.

Test Excavation and Dating: During the 1969 Hālawa Valley Project, Kirch excavated two 1 × 3 m trenches at Papa Heiau. Unit 1 abutted the main stone platform on the upslope side, while Unit 2 was situated on the first stone-faced earthen terrace, abutting the stone retaining wall. Unit 2 exposed a stone pavement beneath 8–10 cm of overburden; although some small flecks of charcoal were noted, none was collected. In Unit 1, a pavement of waterworn and subangular cobbles was exposed at 30 cm below surface, along with charcoal, some decomposing marine shell, fishbone, and one piece of volcanic glass. Two samples of carbonized candlenut endocarp that were curated in the Bishop Museum, both associated with the Unit 1 pavement, were submitted in 2019 for AMS dating. The first sample produced an age of 165 ± 15 BP (UCIAMS-233637), which has multiple calibrated age ranges of AD 1666–1695 (17.8%), 1725–1784 (43.9%),

Table 2. Structural orientations for Papa Heiau (all values are true azimuths)..

Feature	NE side	SE side	SW side	NW side
Top platform	123.4°/303.4°	40.8°/220.8°	121.5°/301.5°*	19.9°/199.9°
Upper main terrace	125.5°/305.5°	42.9°/222.9°*		
Lower main terrace		41.3°/221.3°*		

*Denotes a best-fit orientation determined from three or more points along an intact facing.

Table 3. Hālawa *heiau* architectural form, size, and probable function..

Site	Name	Architectural form	Basal area (m2)	Probable Function
245	Pu‘upa	Terraced platform	140	*ho‘oulu‘ai*
246	Ki‘i	Terrace incorporating natural boulders	72	*ho‘oulu‘ai*
248	Ka‘opele	Terraced platform	300	*ho‘oulu‘ai*
249	Wai‘oli 1	Terrace	81	*ho‘oulu‘ai*
249	Wai‘oli 2	Terrace	144	*ho‘oulu‘ai*
250	Pua‘alaulau	Terraced platform	280	*ho‘oulu‘ai*
251	Hali‘i	Enclosure with terraces	621	*ho‘oulu‘ai*
252	Kapana	Terraced platform	115	*ho‘oulu‘ai*
254	Hopuhewa	Terraced platform	108	*ho‘oulu‘ai*
256	Hiwa	Terraced platform	250	*ho‘oulu‘ai*
258	Mana	Terraced platform	798	*luakini*
263	Ko‘a	Enclosure adjacent to large boulder	12	*ko‘a*
264	Papa	Terraced platform, earthen terraces, enclosing wall	1,300	uncertain

1795–1813 (10.3%), and more recent ranges that we reject as they are after the end of the traditional religious system in 1819. The second sample produced an age of 210 ± 15 BP (UCIAMS-233638), with calibrated ages of AD 1651–1681 (34.1%), 1740–1753 (6.3%) and 1762–1800 (52.3%).

DISCUSSION AND CONCLUSIONS

Heiau architecture, size and function

Table 3 provides a summary of architecture, size, and probable function of the thirteen structures for which we have such data, including the two structures at Wai‘oli that may or may not correspond to Stokes’s site 249, but which are both likely to be *heiau*. The dominant architectural form in the valley is the terraced platform (elevated on four sides), or the terrace (elevated on three sides). The three exceptions are the small *ko‘a* enclosure (site 263), Hali‘i Heiau (site 251), consisting of terraces enclosed by a perimeter wall, and the unusually complex Papa Heiau (site 264) with its combination of multiple platforms and terraces all enclosed within a perimeter wall. In some cases, such as Pua‘alaulau Heiau (site 250) and especially Mana Heiau (site 258), the main platform has been buttressed on the downslope side by additional terrace facings. The dominance of this terrace or terraced platform architectural form is in striking contrast to the situation on Maui, where the so-called ‘notched *heiau*’ consisting of a six-sided enclosure is the most common form (Kirch & Ruggles 2019:53-54; Kolb, 1992; Walker MS [1930]). Notched *heiau* are also common on Hawai‘i Island (McCoy et al., 2011; Phillips et al., 2015; Stokes . The absence of this notched form in Hālawa may be a reflection of a conservative trend on Moloka‘i, in which older *heiau* forms were preserved. As the hegemonic Hawai‘i and Maui Island polities expanded their reach through territorial conquests in the Archaic States Period, they were wont to impose aspects of their ritual systems including *heiau* architecture on subjugated territories. Moloka‘i has a noted tradition of resisting such attempts at subjugation, in particular with the use of sorcery (Kamakau, 1964:128); to this day the island has a reputation as Moloka‘i Pule ‘O‘o, ‘Moloka‘i of Powerful Prayer’.

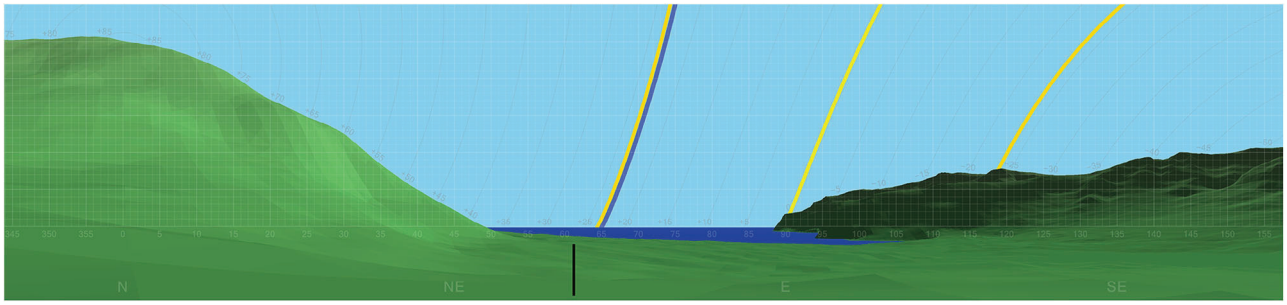
The sizes of *heiau* in Hālawa, as measured by basal area, range from a mere 12 m^2 in the case of the coastal fishing shrine (site 263) up to 1300 m^2 in the case of Papa Heiau. The majority of *heiau*, however, fall in the range between 72 and 300 m^2, a range consistent with the majority of temple sites in Kahikinui and Kaupō districts of Maui (Kirch & Ruggles 2019:44, fig. 3.3). We believe that *heiau* with basal areas of less than 300 m^2 likely served as *heiau ho‘oulu‘ai* or agricultural fertility temples for respective sectors of the valley, in keeping with the generally smaller sizes of such agricultural temples as documented elsewhere in the archipelago. The three exceptions in terms of size are Hali‘i, Mana and Papa, with basal areas of 621, 798 and 1300 m^2, respectively. That Mana Heiau falls into this larger size range is consistent with its known status as a *luakini*, or temple of human sacrifice. Stokes was told that Hali‘i Heiau was used for human sacrifice, but this is doubtful, as his

Table 4. Measured orientations of Hālawa *heiau*..

Site	Deviation from cardinality*	Azimuth of *heiau* in downhill direction	Azimuth of downhill direction	Difference from downhill direction*	Azimuth of *heiau* in facing direction	…or possibly
245, Pu'upa	+15°	15°	0°	+15°	105°	
246, Ki'i	−5°	355°	340°	+15°	175°	
248, Ka'opele	−19°	341°	355°	−14°	71°	
(249), Wai'oli 1	−12° to −5°	348° to 355°	0°	−12° to −5°	?	
249, Wai'oli 2	+3°	3°	355°	+8°	?	
250, Lawea (N, S and W walls)	0°	0°	0°	0°	90°	
250, Lawea (skewed E wall)	+6°	6°	0°	+6°	96°	
251, Hali'i (S, E and W walls)	+2°	2°	10°	−8°	182°	92°
51, Hali'i (skewed N wall)	−5°	355°	10°	−15°	175°	85°
252, Kapana	−2° to +7°	358° to 7°	20°	−22° to −13°	178° to 187°	88° to 97°
254, Hopuhewa	−20° to −15°	160° to 165°	155°	+5° to +10°	?	
256, Hiwa	−23°	157°	140°	17°	67°	
258, Mana	−29°	151°	150°	1°	61°	
264, Papa (NE and SW sides)	+33°	123°			123°	
264, Papa (SE side)	+42°	132°			132°	

*+ indicates clockwise; – indicates counter-clockwise

FIGURE 16. Computer-generated easterly viewshed as seen from Mana Heiau (site 258), from 345° to 155°. The solid black line at 61° indicates the main axis of orientation of the *heiau* platform. The yellow line indicates the Sun's path at the equinox, the orange lines indicate the Sun's solstice paths, and the dark blue line indicates the achronycal rising of the Pleiades. (Viewshed image courtesy of Andrew Smith).



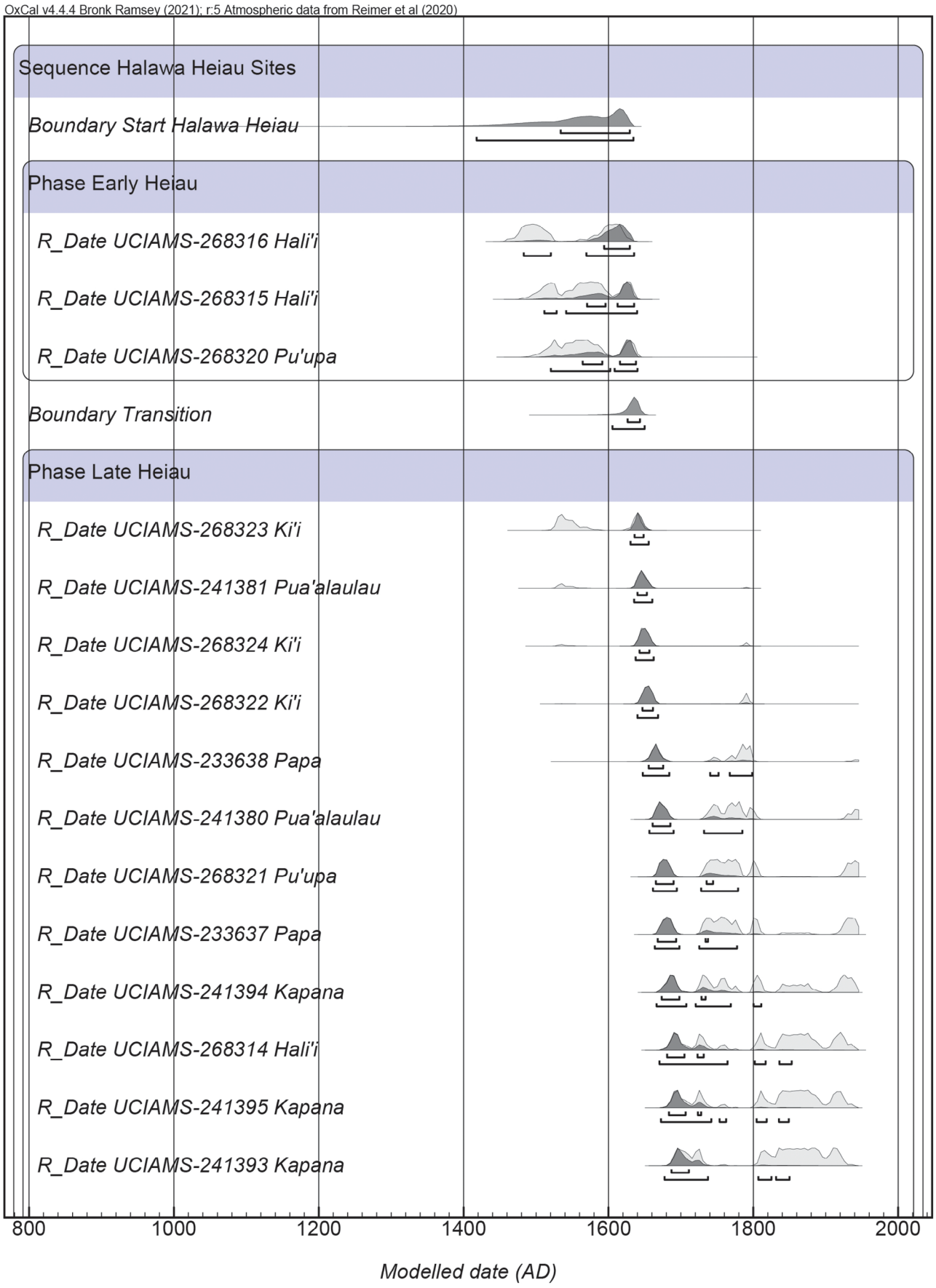
informants said the same thing about several much smaller structures (such as Ki'i and Kapana Heiau); it seems more likely that Hali'i was a *heiau ho'oulu'ai* or fertility temple. (That Stokes's 1909 informants attributed human sacrifice to several sites might reflect the influence of missionary views regarding *heiau* as places of 'heathen' practices.)

Given its size, architectural complexity and anomolous orientation, Papa Heiau poses something of an enigma as to its function within the Hawaiian *heiau* system. Stokes wrote that the *heiau* was said to have been built by Alapa'inui and dedicated to Ka'ili (the war god Kūka'ilimoku), which would suggest a *luakini* function (1909a:18-19). Stokes opined that the 'collection of small platforms, terraces and walls' suggested 'more the site of a college of priests than a heiau' (1909a:18). Unfortunately, Stokes did not elaborate further on his reasons for suggesting that Papa Heiau may have served as some kind of 'college' or teaching temple; while this speculation is intruiguing, we find no real basis for accepting it.

Hali'i Heiau is of particular interest in its combination of two large terraces (separated by a stone façade) with an enclosing stone wall. Also notable at this site are the two substantial uprights incorporated into the S wall (the upslope rear wall, and thus likely the focus of ritual activity, given Polynesian asssociations between height and sacredness). In other parts of Eastern Polynesia such the Society Islands (Emory, 1933), stone uprights are ubiquitous on ritual sites (*marae*) and were regarded as receptacles for the deities or spirits of deceased ancestors during ceremonies. Hali'i Heiau is the oldest of the dated *heiau* in the valley, and may be reflective of an earlier form of ritual architecture dating to the early Expansion Period.

Mana Heiau, which Stokes's informants told him had been dedicated by the Hawai'i Island ruling chief Alapa'inui and was a *luakini*, or war temple where human sacrifice was performed, is strikingly similar in architectural form to the much larger 'Ili'ili'opae Heiau at Mapulehu on the island's southeastern coast (see Summers,

FIGURE 17. Two-phase Bayesian calibration model of all radiocarbon dates from Hālawa Valley *heiau* sites.



1971:130-134, fig. 63 for a description and plan of this temple, the largest on Molokaʻi Island). Although Mana is considerably smaller in scale, its architectural features such as the multi-terrace reinforcing of the S and E faces mimick those of ʻIliʻiliʻopae. Moreover, both sites appear to have an orientation to the rising position of Makaliʻi (Pleiades). Although oral traditions collected by Stokes attribute ʻIliʻiliʻopae to ʻthe Menehune', it seems entirely plausible that both temples were constructed (or rebuilt) and dedicated by Alapaʻinui during his sojourn on Molokaʻi, during the early eigtheenth century (Kamakau, 1961:70-71).

Spatial distribution of Heiau

As can be seen in Figure 1, the *heiau* of Hālawa Valley are fairly regularly spaced out on both the south and north sides, situated on the higher colluvial slopes where they overlook the agricultural terraces and house sites on lower slopes descending toward the stream. More importantly, most of the *heiau* appear to correspond to individual land sections known as ʻ*ili*. In the traditional Hawaiian system of land divisions, ʻ*ili* were the sections into which an *ahupuaʻa* territory (one controlled by a chief and managed by the *konohiki* or resident overseer) was subdivided (Chinen, 1958). Dye (2021) argues that the ʻ*ili* (or *ʻili ʻāina*) was a fundamental unit of land management in the traditional Hawaiian land tenure system. The entire valley of Hālawa and its watershed comprised an extensive *ahupuaʻa* of the same name, awarded in the Great Māhele or land division of 1846–54 to the high chiefess Victoria Kamamalu. The records of the Māhele also inform us about the smaller land holdings of the resident farming population, who typically referenced their land claims in terms of the ʻ*ili* in which they were situated.

In Hālawa, the ʻ*ili* were narrow strips of land that commenced at the stream and ran in a north-south orientation across the irrigated taro fields and then up to the higher colluvial slopes designated in Hawaiian land terminology as *kula* or dry-farming lands, terminating at the base of the cliffs. On the south side of the valley, the ʻ*ili* thus started at the stream and continued southwards to the cliffs, while on the north side the ʻ*ili* started at the stream and continued northwards to the cliffs. The Māhele records indicate the presence of 17 ʻ*ili* on the south side and 15 ʻ*ili* on the north side of the valley (see Anderson 2001:98, fig. 4.1 for a map of the ʻ*ili* in Hālawa Valley.)

Ten of the *heiau* have names provided to Stokes that are identical to the ʻ*ili* names in which the sites are situated, strongly suggesting that these functioned as agricultural or fertility temples (*heiau hoʻouluʻai*) for the resident farmers of those ʻ*ili*. Two of these *heiau*, Hopuhewa and ʻElelu, were specifically described by Stokes's informants as being of *hoʻouluʻai* function. However, since there are a total of 32 named ʻ*ili* in the valley, the question arises as to whether some ʻ*ili* lacked such *heiau hoʻouluʻai*, or whether Stokes's informants in 1909 chose to show him only some of these sites. If the latter is true, then there are likely to be other smaller *heiau* that have not been recorded. We are inclined to believe that this is indeed the case, and we have at least one indication of this, in a small terraced platform with a pronounced upright situated in the ʻ*ili* of Keauhou, on the north side of the valley, a site not shown to Stokes but with architectural features that would indicate ritual use (in particular the upright).

Heiau orientations

The measured orientations of the Hālawa *heiau* are provided in Table 4. All figures are true azimuths corrected, where necessary, from magnetic bearings. Table 4 includes the approximate azimuths of the downhill direction, as determined to the nearest 5° from topographic data and on-site inspection (cf. Figure 1). The fact that the orientations of Puʻupa, Kiʻi, Kaʻopele, Kapana and Hiwa are all skewed round from the uphill-downhill direction (and the level ground perpendicular to this) by some 15° or more is sufficient to demonstrate that the orientations—at least in these cases—are not simply being constrained by the local topography. Added to this, the precise locations of *heiau* such Lawea and Mana, whose orientations largely fit with the topography, may well have been chosen to optimise the topographic constraints given that a particular orientation was desirable for independent reasons. (The gentle slope at the location of Papa Heiau placed no significant constraints on its orientation). The final columns of Table 4 show the azimuth in the direction each *heiau* appears to have been facing.

The orientations form a general pattern falling into two groups. Kiʻi, Waiʻoli (1 and 2), Lawea, Haliʻi, and Kapana—the first group—are approximately cardinally oriented, their deviations from cardinality being no more than about 5°. Puʻupa is an outlier, oriented some 15° clockwise. Kiʻi was evidently south-facing, while Puʻupa and Lawea faced east; at Haliʻi and Kapana the architecture suggests a southerly orientation but that the easterly direction was also significant. Which way Waiʻoli 1 and 2 faced is unclear, although Waiʻoli 1 may have a SE or E orientation. Amongst the first group, all but Kiʻi appear to attach significance to the easterly direction.

The second group comprises Mana, Hiwa and Kaʻopele. These *heiau* are oriented NNW–ENE–SSE–WSW, facing ENE, with true azimuths of 61°, 67° and 71° respectively. Hopuhewa has a similiar orientation, with an azimuth in the ENE direction of 70° to 75°, although the direction it faced is unclear. This pattern conforms to that found in the Kahikinui and Kaupō *heiau* as described in Kirch and Ruggles (2019: 133), i.e. broadly cardinal orientations (E- or N-facing, which we reason to be associated with the gods Kāne and Kū respectively), and a distinct ENE-facing group, which we argue to be associated with the the god Lono and the rising of Makaliʻi (Pleiades), whose achronycal rising determined the onset of the Makahiki season dedicated to Lono. The apparent E orientation of a number of the Hālawa *heiau*, and thus an association with Kāne, would be in keeping with the valley's emphasis on the irrigated cultivation of taro, as Kāne is the deity associated with both flowing waters and with the taro plant (Valeri, 1985:15, 16:n12).

From Mana Heiau there is an open view in the ENE direction (Figure 16). This is now obscured by trees but in their absence would be towards the sea horizon in the mouth of the valley, framed by the ridges to the N and S. At the time of construction, Makali‘i would have risen from the sea horizon at an azimuth of about 66°, a few degrees to the right of the direction faced by the temple, implying that the *heiau* could have had an association with Makali‘i. However, the alignment is not precise, unlike (for example) at Lo‘alo‘a Heiau in Kaupō (Kirch & Ruggles 2019, 325–326). Another point of interest at this *heiau* is that the foot of the cliffs where the southern ridgeline of the valley meets the sea has an azimuth of 88.9°, very close to due east or the equinox sunrise. There was also a clear view of the Pleiades rise from Hiwa Heiau, which is oriented almost exactly on the direction concerned, and from Ka‘opele, oriented about 5° to the right of this.

Papa Heiau falls outside both orientation groups and poses something of an enigma. It faces an azimuth around 123° to 132°, towards land across the valley to the right of the cliffs that, from here, rise from the sea horizon at azimuth 103°. While this is broadly the direction of the rising of Ka Nuku o Ka Puahi (Maui’s big fishhook, or the tail of Scorpius), there is no strong reason to believe that the alignment intentionally related to this asterism. An orientation of 132°, however, does point to the summit of the hill named Koali‘i (‘Chiefly Warrior’) along the southern ridgeline; directly below this hill is the sacred *kukui* (candlenut tree) grove where the famous sorcerer priest Lanikaula resided in the late seventeenth or early eighteenth century (Kamakau, 1961:57; Kamakau, 1964:7). Recalling that Stokes had the impression that Papa Heiau may have been a ‘college of priests’, an association with Lanikaula is entirely plausible, and an orientation toward the priest’s *kapu* abode is a reasonable hypothesis.

Heiau chronology

The 16 AMS radiocarbon dates from seven *heiau* sites in Hālawa Valley (Table 1) provide the basis for developing a chronology of temple construction and use. We have already discussed the dates from individual sites in the main body of the paper. While most of the dates range across the seventeenth to eighteenth centuries, those from Hali‘i and Pu‘upa indicate slightly earlier construction, in the sixteenth century. We therefore constructed a two phase Bayesian model for the corpus of *heiau* dates from Hālawa, with Hali‘i and Pu‘upa in an early phase, and the other sites in a later phase, with the result shown in Figure 17. The model shows excellent overall agreement ($A_{model} = 98.9$). At 95% confidence (2σ), the start boundary (α parameter) for the early phase is cal AD 1418–1634, with a transition boundary to the late phase of cal AD 1605–1650. The end boundary (β parameter) for the late phase is cal AD 1690–1884, although we assume that *heiau* use ended with the abolition of the ‘*ai kapu* system in 1819, or very soon thereafter. In terms of the periods of the Hawaiian cultural sequence recently defined by Kirch and McCoy (2023), initial *heiau* construction in the valley began during the later part of the Expansion Period, with most of the *heiau* constructed and in use during the Archaic States Period.

To sum up, the *heiau* of Hālawa Valley, Moloka‘i, offer an unusually clear picture of an integrated system of ritual places within a single territorial unit or *ahupua‘a*, ranging from small fishing shrines, to a series of agricultural or fertility temples associated with the different ‘*ili* land sectors of the valley, and culiminating in a major *luakini* or state temple of human sacrifice dedicated to the war god Kū. We are fortunate that the Native Hawaiian residents of Hālawa were willing in 1909 to share their knowledge of these *wahi kupuna* (sacred places) with pioneering archaeologists John F. G. Stokes, whose record provided the basis for our own continued study of the archaeological manifestation of the ancient ritual system.

ACKNOWLEDGEMENTS

Archaeological investigations in Hālawa Valley from 2020 to 2022 were funded by U.S. National Science Foundation collaborative grants BCS-1939516 to the University of Hawai’i and BCS-1939790 to Bishop Museum. We thank Pu‘u o Hoku Ranch for granting access to their lands in Hālawa Valley, and for facilitating our work in numerous ways. Galen McCleary and Ranch manager Rudi Hunke were especially helpful in this regard. Savannah Forti ably assisted us throughout the field survey and she is due a special mahalo piha. The late Pilipo Solatorio and his son Greg Solatorio–true *kupa o ka ’aina* of Hālawa –welcomed us once again to their home and shared their deep knowledge of the valley and its history. Catherine Aki assisted in survey and excavation work, Pūlama Lima assisted in the survey of Papa Heiau, and Malia Waits helped with the survey of Mana Heiau. Elizabeth Lindsey and Amy Gore volunteered to help with the clearing and survey of Hiwa Heiau. Andrew Smith provided the computer-generated viewshed from Mana Heiau. During the 2020 and 2021 test excavations we were assisted by Kylie Tuitavuki and Kepa Lyman. Permission to reproduce Stokes’s 1909 photographs was provided by the Bishop Museum Library and Archives.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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