Garden Offerings in the Kona Field System, Hawai'i Island: A Fine-Grained Chronology and Its Implications

Mark D. McCoy, Hai Cheng, Mara A. Mulrooney, and Thegn N. Ladefoged

Identifying and explaining the end of long-lived practices is a major challenge for anthropological archaeology. We present a high-precision uranium series dating (^{230}Th/U) chronology of an undocumented aspect of Hawaiian religion: the use of corals as offerings in gardens. Our results from the upland gardens of Kealakekua (Kona District, Hawai`i Island) document the onset of religious offerings at the same time as farming in the area at around AD 1400, with no samples dating to after around AD 1635. There are similar conspicuous endings to coral offerings in temple sites on the small, isolated island of Nihoa and in the uplands of Maui. On Nihoa, the lack of coral offerings after AD 1606 can be reasonably linked to the abandonment of permanent settlement on the island. In upland Maui temple sites, as is the case in the upland gardens of Kealakekua, the end of coral offerings around AD 1600–1700 suggests a disruption to a long-lived ritual tradition at a time when other metrics point to the rise of state authority over religion.

Keywords: religious authority, agriculture, uranium series dating, the Hawaiian Islands

Identificar y explicar el fin de las prácticas longevas es un gran desafío para la arqueología antropológica. Presentamos una serie de uranio de alta precisión que data (^{230}Th/U) de un aspecto indocumentado de la religión Hawaiana: el uso de corales como ofrendas en jardines. Nuestros resultados de los jardines de las tierras altas de Kealakekua (distrito de Kona, isla de Hawai`i) documentan el inicio de las ofrendas religiosas al mismo tiempo que la agricultura en el área alrededor del 1400 dC, sin muestras que datan de alrededor del 1635 dC finales conspicuos a ofrendas de coral en sitios de templos en la pequeña y aislada isla de Nihoa y en las tierras altas de Maui. En Nihoa, la falta de ofrendas de coral después de 1606 dC puede estar razonablemente relacionada con el abandono del asentamiento permanente en la isla. En los sitios de templos de las tierras altas de Maui, como es el caso de los jardines de las tierras altas de Kealakekua, el final de las ofrendas de coral alrededor del 1600-1700 dC sugiere una interrupción de una tradición ritual de larga duración en un momento en que otras métricas apuntan al surgimiento de la autoridad estatal sobre la religión.

Palabras claves: autoridad religiosa, agricultura, datación en serie de uranio, Islas Hawaianas

Religious authority—defined as the power to influence the mode, location, and timing of worship—is inherently difficult to decipher from archaeological evidence. There is a strong preference among scholars to focus on the construction of religious architecture based on the notion that it reflects the capacity of a leader to direct labor and, by extension, to dictate what is orthodox religious practice (e.g., Trigger 1990). The Hawaiian Islands represent a textbook case of this approach (see Hommon 2013; Kirch 2010). In Hawai`i, oral histories and

Mark D. McCoy (mdmccoy@smu.edu) ■ Department of Anthropology, Southern Methodist University, Dallas, TX, USA
Hai Cheng ■ Institute of Global Environmental Change, Xi'an Jiaotong University, Xi'an, China; Department of Earth Sciences, University of Minnesota, Minneapolis, MN, USA
Mara A. Mulrooney ■ Pacific Legacy Inc., Kailua, HI, USA
Thegn N. Ladefoged ■ Anthropology, School of Social Sciences—Te Pokapū Pūtaiao Pāpori, University of Auckland; Te Pūnaha Matatini, Auckland, New Zealand

American Antiquity 87(3), 2022, pp. 591–600

doi:10.1017/aaq.2022.3

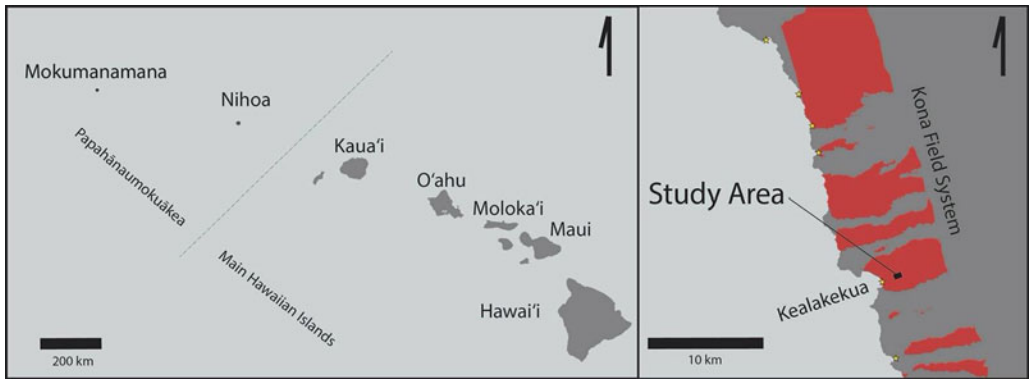

Figure 1. Location of the study area in Kealakekua, Kona District, Hawai`i Island. Kealakekua is one of six coastal royal centers in the Kona district and is shown here relative to the modeled extent of the Kona Field System (Ladefoged et al. 2009).

archaeological evidence document the emergence of four powerful kingdoms in the archipelago around AD 1600. An island's ruler was considered divine and acted as the head of a state religion. The clearest material signal of the rise of state-level authority over religion is a sharp increase in the number of temples (*heiau*) dated by uranium series (^{230}Th/U) to between AD 1550 and 1700 (Kirch and Sharp 2005; Kirch et al. 2015:222).

To understand religious authority, however, we must look beyond the construction of monuments. As DeMarrais and coauthors (1996:16) note, the materialization of ideology involves "the transformation of ideas, values, stories, myths, and the like, into a physical reality—a ceremonial event, a symbolic object, a monument, or a writing system." These physical manifestations—events, objects, texts—offer another record of the way in which segments of a society can, in certain times and places, create and maintain religious authority.

One promising avenue of research in Hawai`i is religious activities linked to agriculture. Many but not all the rituals at temples were focused on agriculture. This preoccupation with food production is understandable, given that multiple lines of evidence suggest this was when the population—which had been growing rapidly since first colonization around AD 1000—peaked, and the threat of shortfall may have been more extreme than any ever before. At the same time, commoner households lost rights to hold land (Field et al. 2011), there was an increased capacity for extracting surplus food as offerings (Kolb 1999), and the collection of food surpluses and other goods as taxes was regularized as part of the annual harvest ceremony known as Makahiki (McCoy 2018). Through these processes, elites leveraged controls over land and subsistence wealth (i.e., surplus food) to create power and authority over nearly all aspects of social life.

We report here on a previously undocumented aspect of religious activity associated with food production in the Hawaiian Islands: corals left as garden offerings. Our excavations in a particularly well-preserved section of the Kona Field System, a rich upland agricultural zone, uncovered abundant small pieces of coral and waterworn stones that were likely to have been left as offerings in gardens (Figure 1). It is inherently difficult to associate a particular material type with religious ritual (e.g., Hawkes 1954), and both these kinds of items were used for other purposes—as paving stones (*'ili'ili*) and as coral abraders for shaping bone fishhooks. But it is well established that in Hawai`i coral was "used as dedicatory offerings" in temples and shrines (Kirch and Sharp 2005:103). Coral is found not only "on temple altars, on top of walls, or on pavements" but also was placed during construction in "wall fill . . . or . . . beneath the basal stones of walls" (Kirch et al. 2015:167). The historian David Malo (1903:229), writing in the nineteenth century, describes people carrying

https://doi.org/10.1017/aaq.2022.3 Published online by Cambridge University Press

"pieces of coral, which they piled outside the heiau [temple]."

We initially dated two coral samples with high-precision uranium series dating (^{230}Th/U) and found that the practice dated back to AD 1517–1547, immediately before an increase in temple construction elsewhere in the archipelago (McCoy et al. 2017). Our expanded sample of coral dates ($N = 20$) reported here allows us to discuss the practice of depositing coral in gardens within the broader context of the rise of state religious authority in the Hawaiian Islands. We find that the earliest samples date to around AD 1422–1459, a time before the transition to an archaic state society when farming first began in this zone (for discussions of the classification of Hawaiian society as an archaic state, see Bayman et al. 2021 and commentary; Hommon 2013; Kirch 2010). The practice ended in the early seventeenth century, with no evidence for coral offerings after AD 1635. We suggest this cessation indicates that a long-lived tradition, likely focused on productivity, was disrupted in AD 1600–1700 by a shift in religious authority.

We view this research as part of a growing sensitivity to recognizing and explaining the end of long-lived practices. It is inherently easier for archaeologists to identify materializations of generative acts, such as building a temple or leaving an offering. It is harder to recognize the end of traditions, because doing so requires the judicious use of negative evidence (Wallach 2019). We hope in the future that this discussion expands to also include the destruction of religious sites and iconography. This is rarely the subject of direct empirical study (e.g., Chapman 2018; Graves 2008), but it does tell us about the materialization of ideology, albeit expressed through damage and destruction (Latour and Weibel 2002).

Religious Offerings in the Hawaiian Islands: Ethnohistory and Archaeology

Rituals described in nineteenth-century ethnohistoric sources (e.g., Kamakau 1991; Malo 1903) have been the basis for much of the academic discourse on Hawaiian religion (e.g., Valeri 1985). At the time of European contact, the gods Kāne and Lono, often associated with irrigated and rainfed agriculture, respectively, were central to many of the rituals that took place. Formal locations for rituals included temples and shrines. Agricultural rituals commonly took place at modest temples (e.g., *hale o Lono*) or at small shrines (*pōhaku o Kāne*). In some cases, historical information passed down through oral histories gives us the names of temples or shrines and how they were used; in other cases, archaeologists have interpreted remnant architecture as agricultural temples or shrines based on their location within or near fields and the presence of distinctive characteristics in terms of layout, orientation, or the presence of upright stones as focal points of ritual practice (see Kirch 1985, 2004; Kirch and Ruggles 2019; McCoy et al. 2011; Mulrooney and Ladefoged 2005; Phillips et al. 2015). These agricultural ritual locations are distinct from other types of temples and shrines, such as those on mountaintops, near the coast, or located within households.

Te Rangi Hiroa [Sir Peter Buck] (1933:64), writing broadly about Polynesian religion, noted, "The gods were jealous gods and became inimical if neglected . . . [to ensure] success in any important enterprise, a particular god had to be placated by a ritualistic phrase or incantation, an offering, or even by an elaborate ritual." The long list of known emic categories of ritual offerings in Hawai`i varies based on the purpose and type of material used. The terms *mōhai* or *hai*, for example, refer to an offering or sacrifice and, when combined with other terms, specify what was being offered. They are so closely semantically linked to the term for temple (*heiau*; variant of *haiau*) that the act of making offerings is one of the behaviors that defines these sacred places (Pukui and Elbert 1986). Unlike many perishable materials that were used in offerings and degraded quickly, branch coral and small waterworn stones preserve well in the archaeological record. Because these materials only occur naturally along the coastline, they are highly visible at sites as manuports and have been well documented by archaeologists from the first archaeological excavations in the Hawaiian Islands (Kirch 1985).

There is an extraordinarily good chronology for the use of coral as offerings—at shrines or

https://doi.org/10.1017/aaq.2022.3 Published online by Cambridge University Press

in the dedication of temples—made possible by advances in ^{230}Th/U uranium series dating that often, but not always, yield a date an order of magnitude more precise than radiocarbon dating (for more examples of the application of this technique, see Hellstrom and Pickering 2015). Kirch and Sharp (2005) reported the first of these dates on fresh branch coral offerings left as dedications at the construction of a dozen temple sites in the Hawaiian Islands, mainly on Maui. Today the list of dates has grown to include more than 100 samples that demonstrate the use of fresh branch coral for offerings in different contexts from AD 1325 through AD 1794 (Kikiloi 2012; Kirch et al. 2015; McCoy et al. 2009, 2017; Weisler et al. 2006). This expanded sample—which occasionally includes older water-rolled corals collected on shore (e.g., Field et al. 2011; Kirch et al. 2015)—represents activities on four islands in the Main Hawaiian Islands: Maui ($n = 52$), Moloka`i ($n = 14$), Hawai`i ($n = 7$), and Lehua, a small island off the coast of Kaua`i ($n = 2$), with no dated samples from O`ahu, Lāna`i, Kaua`i, or Kaho`olawe. Dated samples have also been reported on Nihoa ($n = 36$) and Mokumanamana ($n = 1$) in Papahānaumokuākea, also known as the Northwestern Hawaiian Islands. These islands were reported in the logs of visiting ships as unoccupied at the time of European contact.

The earliest dated coral offerings associated with the construction of religious architecture date to the AD 1300s and 1400s. On Nihoa, a sharp rise in the number of dates in the early AD 1500s suggests an increase in ritual practices in Papahānaumokuākea during that time (see Kikiloi 2012). Coral samples dated to the late 1500s and 1600s indicate a massive increase in the frequency of monuments constructed on Maui (Kirch et al. 2015:222). The number of dates reported on coral offerings then decline, because fewer new temples were built in the 1700s. Within the current corpus of dated coral offerings, the last coral offering in the Hawaiian Islands dates to AD 1794, and although the practice may have continued past this time, the disappearance of the material evidence corresponds closely with the state abolition of Hawaiian religion by royal decree in AD 1819.

Methods

We conducted two seasons of excavations within the Amy Greenwell Ethnobotanical Gardens (AGEG) in Kealakekua Ahupua`a, South Kona District, Hawai`i Island (Figure 2). Located about 2 km from the coast, the AGEG are home to a series of upland-to-coast oriented field walls, or *kuaiwi*, that are the defining characteristic of the Kona Field System. Previous investigations yielded a remarkably early radiocarbon date (ca. AD 1000–1200; Allen 2001, 2004), but this date has been regarded as unreliable in recent evaluations of the chronology of Hawai`i Island.

In 2015, excavations were conducted to collect material for a more detailed chronology that conforms to current best practices (i.e., Rieth and Athens 2013). In that season, a 7 × 1 m trench (Trench #1) was excavated, exposing three major phases in the construction of the feature, Kuaiwi I, that yielded two key pieces of information: (1) agricultural infrastructure improvements began by AD 1400, and (2) infrastructure continued to be added in optimal farmland and elsewhere after AD 1700 (McCoy et al. 2017). No coral offerings were found in Kuaiwi I. Waterworn stones were common but isolated in the trench. We recorded a number of coral samples on the surface of another feature, Kuaiwi 0. Two surface-collected samples place the practice of leaving these offerings within a narrow temporal range: AD 1517–1547 (McCoy et al. 2017).

In 2016, excavations were conducted to collect material for a more detailed chronology of coral offerings (Figure 3). In that season a 6 × 1 m trench (Trench #2) was excavated across Kuaiwi 0, exposing three major phases: (1) a possible clearing burn prior to the construction of the field wall, (2) construction and use of the main field wall when it was about 3 m wide, and (3) a widening of the field wall to 6 m, with an additional 2 m along the south edge and 1 m on the north edge. Fragments of coral and small waterworn stones were encountered throughout the excavation. The coral was not worked and does not appear waterworn, making it unlikely it was raw material for creating abraders or was used as floor paving. Waterworn

https://doi.org/10.1017/aaq.2022.3 Published online by Cambridge University Press

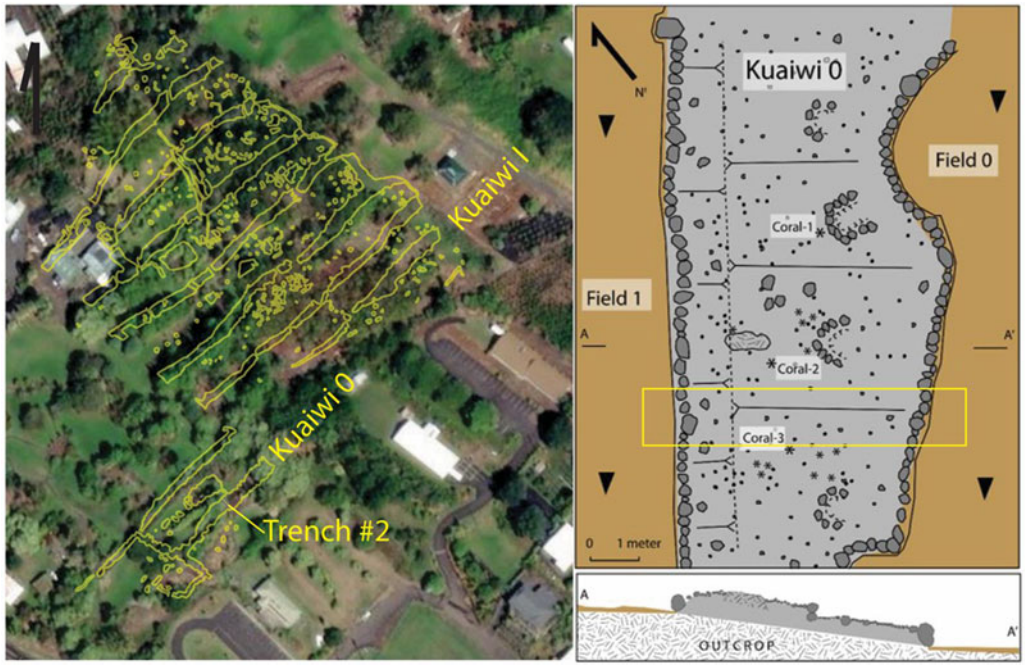

Figure 2. Excavations of an agricultural field wall (*kuaiwi*) in the Amy Greenwell Ethnobotanical Gardens. Figure by Mark D. McCoy. (Color online)

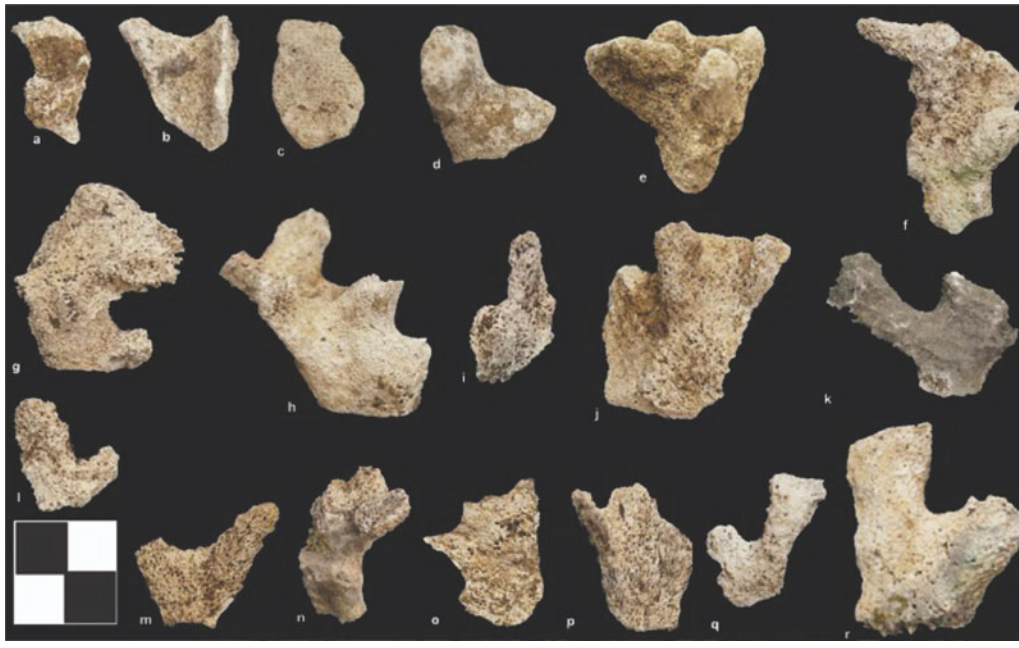

Figure 3. Small offerings of branch coral found in excavations selected for dating. Sample identifications (AGEG-2016): (a) -21, (b) -48, (c) 39, (d) -55, (e) -58, (f) -22, (g) -38, (h) -20, (i) -24, (j) -25, (k) -13, (l) -40, (m) -45, (n) -33, (o) -44, (p) -27, (q) -19, and (r) -7. See Table 1 for dating results. Photographs by Mark D. McCoy.

https://doi.org/10.1017/aaq.2022.3 Published online by Cambridge University Press

stones were found at a remarkably high density (137 per m^3), and the density of coral fragments (19 per m^3) was high compared with all other previous excavations in this upland setting (Allen 2001). We note that it was common practice to use waterworn stones in floor paving (*ʻiliʻili*), as slingstones, and to mark trails. However, both the waterworn pebbles and corals were not concentrated in any one part of the excavation, suggesting to us that they each could have arrived in the gardens as a separate offering. We focused dating on branch coral (*Acropora* sp.) that had little or no signs of weathering or wear on the surface to try and avoid dating coral that had been naturally broken, rolled in the surf, and found on the shoreline. An additional 18 samples from Kuaiwi 0 were dated by the uranium series (^{230}Th/U) method at the Xi'an Jiaotong University lab. Complete lab protocols, standardization, and half-lives are described in Cheng and colleagues (2013).

Table 1. Summary of ^{230}Th/U Dates from Coral Offerings

Sample ID	^{230}Th	Age (yr BP)
AGEG-2016-21	889*	±38
AGEG-2016-48	819*	±26
AGEG-2016-39	664*	±46
AGEG-2016-55	509	±19
AGEG-2016-58	442	±37
AGEG-2016-22	439	±31
AGEG-2016-38	439	±35
AGEG-2016-20	424	±30
CORAL-1	418	±11
AGEG-2016-24	413	±25
CORAL-3	402	±15
AGEG-2016-25	384	±44
AGEG-2016-13	382	±45
AGEG-2016-40	374	±28
AGEG-2016-45	367	±27
AGEG-2016-33	366	±28
AGEG-2016-44	360	±34
AGEG-2016-27	360	±29
AGEG-2016-19	354	±31
AGEG-2016-7	315	±40

Note: Error is 2σ.
* Coral likely dead when collected for offering.

Results

A fine-grained chronology of rituals in gardens is now possible based on high-precision dates on coral offerings in the Kealakekua section of the Kona Field System (Table 1; Supplemental Table 1). In this context, we found that the practice of leaving coral offerings in the Kona Field System began around AD 1400 and coincides with the beginning of a continuous record of anthropogenic burning marking the earliest upland farming (McCoy et al. 2017). Offerings continued into the AD 1600s, with the last securely dated offering in this section of the field system around AD 1635 (± 40), although the practice continued elsewhere in the Hawaiian archipelago until at least AD 1794 (± 4) (Kirch et al. 2015).

A conspicuous lack of coral offerings dating to after AD 1600 has been found elsewhere. Dye (2016:7) notes that "branch coral harvesting was regularly practiced—from the mid sixteenth century to the turn of the eighteenth century" and goes on to suggest that coral offerings at temples declined after this time. In Figure 4 we summarize the results of major studies of coral offerings in three settings: an isolated island (Nihoa), upland agricultural fields, and the coastal habitation zone. Dates are normalized by 25-year periods, and we note the last date from each study area.

The dates from coastal Maui sites show a continuous use of coral offerings from the early AD 1500s until state abolition of Hawaiian religion in AD 1819. In this context, the average rate of offerings was greatest from AD 1600 to 1700. In the upland agricultural fields of Maui and Hawai`i Island, the period of most intense offerings is earlier—about AD 1500–1600—and the last dated offerings are staggered across the period from around AD 1600 to 1700. A similar pattern is found on isolated Nihoa. Due to potential sampling and preservation biases, we cannot say for certain that the period from AD 1600 to 1700 saw a complete cessation of coral offerings on Nihoa and in upland agricultural settings of other islands. However, given that coral offerings were made in coastal Maui throughout this century and for a century beyond, the lack of coral offerings in upland locations is notable.

Discussion and Conclusion

At the time of the first written accounts of the islands of Papahānaumokuākea in the nineteenth

https://doi.org/10.1017/aaq.2022.3 Published online by Cambridge University Press

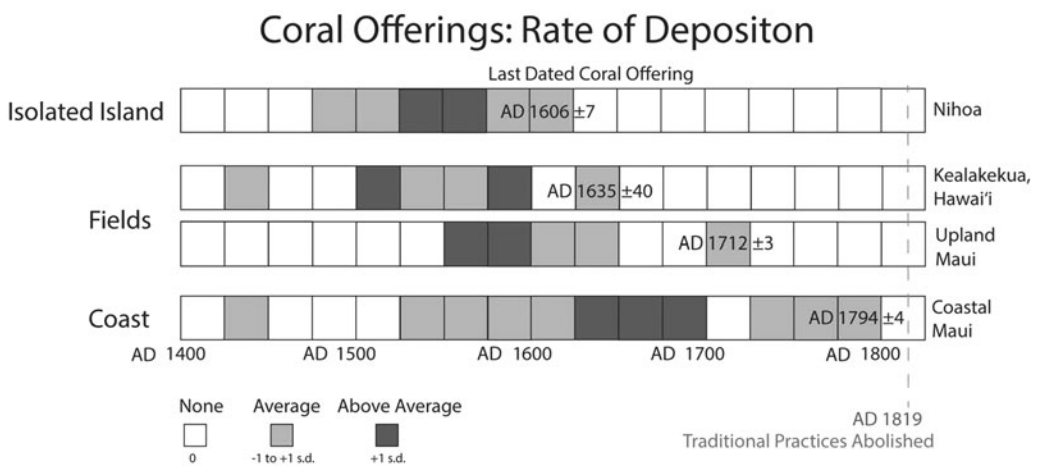

Figure 4. Rate of deposition of corals used as offerings in religious ritual. These timelines represent variation in the rate of offerings of branch coral on an isolated island (Nihoa), in upland fields on the islands of Maui and Hawai`i, and the coastal zone on Maui. The latest date reported for each area is shown. Sources: Kikiloi (2012), Kirch et al. (2015), and this study.

century, the small, isolated island of Nihoa was not occupied. It likely acted as a waystation for voyages from the Main Hawaiian Islands to Mokumanamana, which based on archaeological evidence, never supported a permanent settlement. The last reported date on a coral offering on Nihoa is AD 1606 (± 7), although radiocarbon dating, which is less precise, points to continued visits to Mokumanamana after this date (Kikiloi 2012). It seems likely that permanent settlements on Nihoa were abandoned as voyages became less frequent, thus explaining the lack of coral offerings in either the seventeenth or eighteenth centuries AD. Abandonment, however, does not explain the apparent end of coral offerings on Maui and Hawai`i Island. Both the uplands of Kahikinui and Kona continued to be central places for agricultural production well into the nineteenth century AD.

We interpret the cessation of coral offerings in the upland garden features of Kona and in the dedication of new upland temples in Kahikinui as the result of a disruption of individual religious activities directed toward successful subsistence production. Prior to the state-imposed control of religion, where and when to make offerings in the fields or at temples within fields would have been at the discretion of individuals, presumably farmers. With increased levels of political control and demands for surplus, there was an increase in offerings from AD 1500 to 1600. After the transition to an archaic state, in AD 1600–1700, religious practices to ensure agricultural fecundity appear to have been refocused away from gardens. The lack of new temple construction in upland areas while there were continued coral offerings at coastal temples suggests that religious practices were more focused on those temples along the coast.

Religious reform is not unknown in Hawaiian history. In AD 1810, King Kamehameha became the first to rule the entire archipelago. After Kamehameha's death in AD 1819, his son, Liholiho (King Kamehameha II) immediately used his power to break with tradition and prohibit many Hawaiian religious practices. In the following weeks many temples were destroyed, there was a brief insurrection, and the priestly class was disbanded (Sissons 2014). This is just one of many historical examples of rulers enacting sweeping religious reforms (Freeman 2009; Trigger 1993). The lack of coral offerings in Hawai`i dated to the nineteenth century is undoubtedly associated with the 1819 prohibitions, which was immediately followed by the arrival of Christian missionaries and additional legal barriers to public displays of Hawaiian religious practices, such as chanting.

https://doi.org/10.1017/aaq.2022.3 Published online by Cambridge University Press

Our suggestion that the absence of coral offerings in upland fields after AD 1600–1700 is not just a byproduct of sampling and uneven preservation but also of religious reform is inherently founded on negative evidence. We recognize the weakness of negative evidence. It is nonetheless a commonplace and, to some degree, a necessary part of interpreting the archaeological record (Wallach 2019). Further, if we accept that the lack of samples dated to the nineteenth century is associated with state prohibitions on religious practices, then we must at least entertain the possibility that the absence of coral offerings in upland fields after AD 1600–1700 is not just a byproduct of sampling and uneven preservation but may also be an expression of religious authority.

The discovery of a shift in religious practices in agricultural fields has several implications for future research in the Hawaiian Islands. First, and most obviously, a larger sample of dates on coral offerings is necessary to determine whether there was a single end to the practice, as is often assumed to have occurred in AD 1819, or if, as we have hypothesized, it ended earlier in certain settings. Second, more research is needed to determine whether the apparent earlier end of the practice of making coral offerings signifies only the end of one practice or whether it is also the rise of a new practice, such as offerings made of different materials, or a shift in the context of rituals. For example, in the leeward North Kohala Field System on Hawai`i Island, we have suggested that the introduction of the notched-styled temple (*heiau*) to the Kohala region dates to AD 1600–1700 (McCoy et al. 2011). Bayesian models have been applied to the problem of refining the date of this tradition (Dye 2012), but they yield wildly different and misleading results depending on the "end" date selected (i.e., 1778, 1819; McCoy et al. 2012: Figure 1). We would also add the complication that changes may have occurred at different rates in more rural areas (Ladefoged et al. 2020). Finally, given the fact that radiocarbon dating places the onset of construction of monumental architecture in coastal Kealakekua at AD 1640 (McCoy et al. 2021), we need to entertain the possibility that there was a broader shift away from rituals within fields to the coast. Each of these possibilities has its own particular challenges that will be necessary to address if archaeology is going to contribute to our long-term understanding of Hawaiian religion.

Acknowledgments. This research was carried out with permission and support from Bishop Museum and funded by the University Research Fund at Southern Methodist University and the Faculty Research Development Fund at the University of Auckland. Our research benefited from parallel collaborative research on remote sensing with Jesse Casana, Austin Chad Hill, and Elise Jakoby Laugier. Special thanks to Scott Belluomini, Bobby Camara, Christina Carolus, Veerle de Ridder, Ann Horsburgh, Hayley Glover, Jen Huebert, David Ingleman, Adam Johnson, Ben Jones, Patrick Kirch, Gordon Leslie, Sarina Pearson, Hannah Springer, Tracy Tam-Sing, Neil J. Tabor, Ben Teele, Ryan Terry, Peter Van Dyke, Charmaine Wong, Rose Young, and Martha Yent. We thank the reviewers and copyeditor for their attention to detail and suggestions for improving this article.

Data Availability. Primary field and survey data are on file with the Bishop Museum and State of Hawai'i, Department of Land and Natural Resources, State Historic Preservation Division.

Supplemental Material. For supplemental material accompanying this article, visit https://doi.org/10.1017/aaq.2022.3.
Supplemental Table 1. Full results of ^{230}Th/U Series Dating.

Competing Interests. The authors declare none.

References Cited

Allen, Melinda S.
2004 Bet-Hedging Strategies, Agricultural Change, and Unpredictable Environments: Historical Development of Dryland Agriculture in Kona, Hawaii. *Journal of Anthropological Archaeology* 23:196–224.

Allen, Melinda S. (editor)
2001 *Gardens of Lono: Archaeological Investigations at the Amy B. H. Greenwell Ethnobotanical Garden, Kealakekua, Hawai'i*. Bishop Museum Press, Honolulu.

Bayman, James M., Thomas S. Dye, and Timothy M. Rieth
2021 States without Archaeological Correlates? A Report from Hawai'i. *Journal of Pacific Archaeology* 12(1):47–71.

Chapman, Henry
2018 *Iconoclasm and Later Prehistory*. Routledge, London.

Cheng, Hai, R. Lawrence Edwards, Chuan-Chou Shen, Victor J. Polyak, Yemane Asmerom, Jon Woodhead, John Hellstrom, et al.
2013 Improvements in ^{230}Th Dating, ^{230}Th and ^{234}U Half-Life Values, and U–Th Isotopic Measurements by Multi-Collector Inductively Coupled Plasma Mass Spectrometry. *Earth and Planetary Science Letters* 371/372: 82–91.

DeMarrais, Elizabeth, L. J. Castillo, and Timothy Earle
1996 Ideology, Materialization, and Power Strategies. *Current Anthropology* 37:15–31.

Dye, Thomas S.
2012 Hawaiian Temples and Bayesian Chronology. *Antiquity* 86:1202–1206.

2016 Long-Term Rhythms in the Development of Hawaiian Social Stratification. *Journal of Archaeological Science* 71:1–9.

Field, Julie S., Thegn N. Ladefoged, Warren D. Sharp, and Patrick V. Kirch
2011 Residential Chronology, Household Subsistence, and the Emergence of Socioeconomic Territories in Leeward Kohala, Hawai'i Island. *Radiocarbon* 53: 605–627.

Freeman, Charles
2009 *A.D. 381 Heretics, Pagans, and the Dawn of the Monotheistic State*. Overlook Press, New York.

Graves, Pamela
2008 From an Archaeology of Iconoclasm to an Anthropology of the Body: Images, Punishment, and Personhood in England, 1500–1660. *Current Anthropology* 49:35–60.

Hawkes, Charles Francis Christopher
1954 Archaeological Theory and Method: Some Suggestions from the Old World. *American Anthropologist* 56:155–168.

Hellstrom, John, and Robyn Pickering
2015 Recent Advances and Future Prospects of the U–Th and U–Pb Chronometers Applicable to Archaeology. *Journal of Archaeological Science* 56:32–40.

Hiroa, Te Rangi (P. H. Buck)
1933 Polynesian Religion. *Thurm's Hawaiian Annual* pp. 64–67.

Hommon, Robert J.
2013 *The Ancient Hawaiian State: Origins of a Political Society*. Oxford University Press, Oxford.

Kamakau, Samuel
1991 *Ka Po'e Kahiko: The People of Old*. Bernice P. Bishop Special Publications 51. Bishop Museum Press, Honolulu.

Kikiloi, S. Kekuewa
2012 Kūkulu Manamana: Ritual Power and Religious Expansion in Hawai`i: The Ethno-Historical and Archaeological Study of Mokumanamana and Nihoa Islands. PhD dissertation, Department of Anthropology, University of Hawai`i at Manoa.

Kirch, Patrick V.
1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. University of Hawai`i Press, Honolulu.
2004 Temple Sites in Kahikinui, Maui, Hawaiian Islands: Their Orientations Decoded. *Antiquity* 78:102–114.
2010 *How Chiefs Became Kings: Divine Kingship and the Rise of Archaic States in Ancient Hawai`i*. University of California Press, Berkeley.

Kirch, Patrick V., Regina Mertz-Kraus, and Warren D. Sharp
2015 Precise Chronology of Polynesian Temple Construction and Use for Southeastern Maui, Hawaiian Islands Determined by ^{230}Th Dating of Corals. *Journal of Archaeological Science* 53:166–177.

Kirch, Patrick V., and Clive Ruggles
2019 *Heiau, 'Āina, Lani: The Hawaiian Temple System in Ancient Kahikinui and Kaupō, Maui*. University of Hawai`i Press, Honolulu.

Kirch, Patrick V., and Warren D. Sharp
2005 Coral ^{230}Th Dating of the Imposition of a Ritual Control Hierarchy in Precontact Hawaii. *Science* 307:102–104.

Kolb, Michael J.
1999 Staple Finance, Ritual Pig Sacrifice, and Ideological Power in Ancient Hawai`i. In *Complex Polities in the Ancient Tropical World*, edited by Elisabeth A. Bacus and Lisa J. Lucero, pp. 89–107. Archaeological Papers 9. American Anthropological Association, Washington, DC.

Ladefoged, Thegn N., Patrick V. Kirch, Samuel M. Gon, Oliver A. Chadwick, Anthony S. Hartshorn, and Peter M. Vitousek
2009 Opportunities and Constraints for Intensive Agriculture in the Hawaiian Archipelago prior to European Contact. *Journal of Archaeological Science* 36: 2374–2383.

Ladefoged, Thegn N., Mark D. McCoy, and Michael W. Graves
2020 Collective Action and Political Agency in the Leeward Kohala Hinterlands, Hawai`i Island. *Journal of Pacific Archaeology* 11(1):10–20.

Latour, Bruno, and Peter Weibel (editors)
2002 *Iconoclash: Beyond the Image Wars in Science, Religion and Art*. MIT Press, Cambridge, Massachusetts.

Malo, David
1903. *Hawaiian Antiquities (Moolelo Hawaii)*. Hawaii Gazette Co., Honolulu.

McCoy, Mark D.
2018 Celebration as a Source of Power in Archaic States: Archaeological and Historical Evidence for the Makahiki Festival in the Hawaiian Islands. *World Archaeology* 50:242–270.

McCoy, Mark D., Jesse Casana, A. Chad Hill, Elise J. Laugier, Mara A. Mulrooney, and Thegn N. Ladefoged
2021 Unpiloted Aerial Vehicle Acquired Lidar for Mapping Monumental Architecture: A Case Study from the Hawaiian Islands. *Advances in Archaeological Practice* 9:160–174.

McCoy, Mark D., Thegn N. Ladefoged, Simon H. Bickler, Jesse W. Stephen, and Michael W. Graves
2012 The Value of an "Eclectic and Pragmatic" Approach to Statistics in Chronology Building: A Reply to T. S. Dye. *Antiquity* 86:1206–1209.

McCoy, Mark D., Thegn N. Ladefoged, Michael W. Graves, and Jesse W. Stephens
2011 Strategies for Constructing Religious Authority in Ancient Hawai`i. *Antiquity* 85:1–15.

McCoy, Mark D., Mara A. Mulrooney, Mark Horrocks, Hai Cheng, and Thegn N. Ladefoged
2017 Evaluating Agricultural Bet-Hedging Strategies in the Kona Field System: New High-Precision ^{230}Th/U and ^{14}C Dates and Plant Microfossil Data from Kealakekua, Hawai`i Island. *Archaeology in Oceania* 52:70–80.

McCoy, Patrick C., Marshall I. Weisler, Jian-xin Zhao, and Yue-xing Feng
2009 ^{230}Th Dates for Dedicatory Corals from a Remote Alpine Desert Adze Quarry on Mauna Kea, Hawai`i. *Antiquity* 83:445–457.

Mulrooney, Mara A., and Thegn N. Ladefoged
2005 Hawaiian Heiau and Agricultural Production in the Kohala Dryland Field System. *Journal of the Polynesian Society* 114(1):45–67.

Phillips, Natasha, Thegn Ladefoged, Blair W. McPhee, and Gregory P. Asner
2015 Location, Location, Location: A Viewshed Analysis of Heiau Spatial and Temporal Relationships in Leeward Kohala, Hawai'i. *Journal of Pacific Archaeology* 6 (2):21–40.

Pukui, Mary K., and Samuel Elbert
1986 *Hawaiian-English Dictionary*. University of Hawai'i Press, Honolulu.

Rieth, Timothy, and J. Stephen Athens
2013 Suggested Best Practices for the Application of

https://doi.org/10.1017/aaq.2022.3 Published online by Cambridge University Press

Radiocarbon Dating to Hawaiian Archaeology. *Hawaiian Archaeology* 13:3–29.

Sissons, Jeffrey
2014 *The Polynesian Iconoclasm: Religious Revolution and the Seasonality of Power*. Berghahn Books, Oxford.

Trigger, Bruce G.
1990 Monumental Architecture: A Thermodynamic Explanation of Symbolic Behaviour. *World Archaeology* 22:119–132.
1993 *Early Civilizations: Ancient Egypt in Context*. American University in Cairo Press, Cairo.

Valeri, Valerio
1985 *Kingship and Sacrifice: Ritual and Society in Ancient Hawaii*. University of Chicago Press, Chicago.

Wallach, Efraim
2019 Inference from Absence: The Case of Archaeology. *Palgrave Communications* 5(94):1–10.

Weisler, Marshall I., Kenneth D. Collerson, Yue-xing Feng, Jian-Xin Zhao, and Ke-Fu Yu
2006 Thorium-230 Coral Chronology of a Late Prehistoric Hawaiian Chiefdom. *Journal of Archaeological Science* 33:273–282.

Submitted August 18, 2021; Revised October 15, 2021; Accepted January 1, 2022