



JPS

The Journal
of the
Polynesian Society

VOLUME 126 No.1 MARCH 2017

THE POLYNESIAN SOCIETY
THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

REFINING THE SOCIETY ISLANDS CULTURAL
SEQUENCE: COLONISATION PHASE AND
DEVELOPMENTAL PHASE COASTAL OCCUPATION
ON MO‘OREA ISLAND

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The Society Islands are critical to chronology building in East Polynesia, as the archipelago served as a potential first landfall for voyagers moving out of the West Polynesia homeland. Yet determining the particulars of migration sequences and settlement chronology in the Society Islands, like the rest of East Polynesia, has been challenging. Here, we report on a dating and re-dating program of four coastal sites on the island of Mo‘orea, Windward Society Islands, in an effort to refine the archipelago’s cultural chronology and its place within larger settlement trends for East Polynesia. We begin with a brief discussion of 1960s archaeological research in the Society Islands, and the archipelago’s role in the East Polynesian colonisation debate, before turning to a discussion of the newly dated and re-dated Mo‘orea coastal sites.

SOCIETY ISLANDS ARCHAEOLOGY IN THE 1960S

The early 1960s were an exciting time for Society Islands archaeology, as numerous researchers from international institutions turned their attention to survey and excavation programs in the archipelago. Kenneth Emory and Yoshihiko Sinoto of the Bishop Museum led coastal archaeological projects in an effort to develop regional cultural sequences and to determine the origins of the initial settlers of the Hawaiian Archipelago. Roger Green and colleagues began their own excavations at both inland and coastal sites on Mo‘orea. All of these archaeologists were influential in establishing the Pacific Area Archaeology Program (PAAP) developed at the 10th Annual Pacific Science Congress. Given that considerable work had been completed at the corners of the East Polynesia triangle (Hawai‘i, Easter Island and New Zealand), archaeologists attending this conference decided to collectively turn to Central East Polynesia (CEP: Societies, Australs, Tuamotus and Marquesas) as an area of interest. They agreed that the CEP archipelagos needed greater survey and excavation coverage, as they potentially represented “one of the earliest settled areas and the sources of some of the more marginal cultures” (Solheim 1961:74).

Sinoto's subsequent archaeological work at the Ana Paia Rockshelter on Mo'orea (M3) (Fig. 1) in 1960 was a part of this general research plan. The goals were strictly culture historical: to retrieve datable charcoal samples and artefacts that could be placed in relative sequences. Short reports of this work were published in French and English (Sinoto and Verin 1965; Verin 1960-61). Then, in 1962, the National Science Foundation funded a three-year program of East Polynesia site survey and excavation, headed by Emory and Sinoto. This led to Society Islands fieldwork, headed up by teams of American researchers from the Bishop Museum, French researchers from ORSTOM (Office de la Recherche Scientifique et Technique d'Outre-Mer) and researchers from other institutions. The research objectives were to determine the length of island occupation and to outline material culture phases from initial settlement onwards (Solheim 1961: 77), supporting the main principles of cultural historical archaeology as it was carried out in Polynesia. As part of this project, Yosihiko Sinoto, in collaboration with Pierre Verin, surveyed, surface collected and test excavated numerous sites on Mo'orea and its offshore islets (*motu*), including extensive excavations at the Afareaitu Fishing Village (M5). Aspects of the M5 excavations were discussed in an unpublished report (Emory and Sinoto 1965). Our discussion of the original M3 and M5 excavations draws from these sources, as well as archived field notes held by the Anthropology Department of the Bishop Museum in Honolulu.

At the same time as these Bishop Museum projects were being carried out, Roger Green and Ann and Roy Rappaport were completing survey and excavations along the Papeto'ai coast of Mo'orea. A total of eight sites were surface collected or excavated (ScMt-1, ScMf-1 to 6). Two of these sites were dated and basic analyses of the faunal remains and portable artefacts were discussed in their monograph publication (Green *et al.* 1967). The Green and Rappaport analyses of the portable artefacts, notably the fishing gear, attempted to integrate analysis of manufacturing stages, similar to Suggs's (1961a) study of Marquesan adzes. Yet many of their larger interpretations centred on classic cultural historical questions, such as which archipelagos had portable artefacts closely resembling those found in the Society Islands. Our re-analysis focuses on sites ScMf-2 and -5 where the densest midden deposits were recovered (Fig. 1). We utilise notes from the 1967 monograph, in addition to unpublished field notes held by the American Museum of Natural History in New York, to contextualise the sites' deposits.

Utilising data from the early 1960s culture historical work in the Society Islands, archaeologists began to postulate about differences in regional East Polynesian material culture, notably the paucity of coral files, urchin files and bone fishhooks in the Societies, and differences in the form of octopus lures and fishhook manufacture between the Societies, Hawai'i, the Marquesas and

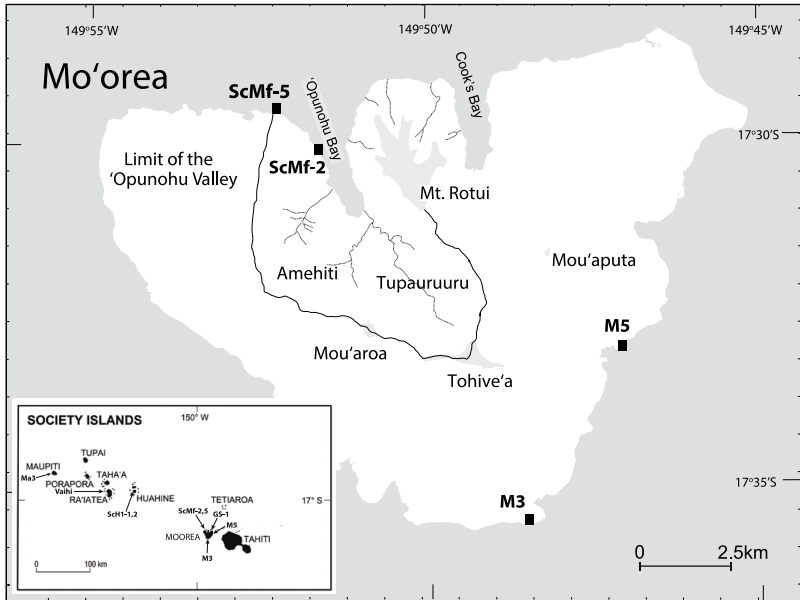


Figure 1. The Society Islands with sites discussed in the text and inset of Mo'orea Island with location of sites investigated.

Mangareva (Emory and Sinoto 1965; Green *et al.* 1967). Others discussed how artefacts excavated from Society Islands sites differed from assemblages held in museums, hinting at the perhaps significant role of change through time (Green *et al.* 1967).

Despite the fact that many Society Islands sites excavated in the 1960s were rich in artefact content, many were never published in any detail and numerous sites were not dated via the newly developed ^{14}C methodology. This is all the more damaging given that the Society Islands remain one of the greatest lacuna in terms of establishing the settlement sequence for Central East Polynesia (Allen 2014; Kahn 2012; Kirch 2011). Following this, we decided to re-date archived charcoal samples originally excavated from sites M3, M5, ScMf-2 and ScMf-5 in the 1960s. These re-dating efforts are part of larger goals of refining the 1,000-year settlement history of the Society Islands (Anderson *et al.* 2000; Anderson and Sinoto 2002; Kahn 2006, 2010, 2011) and for outlining the substantial geomorphological changes wrought upon its coastal shores, which leave its early settlement sites so difficult to discover (Kahn *et al.* 2015a, 2015b).

SOCIETY ISLANDS AND THE EAST POLYNESIA CHRONOLOGY DEBATE

The development of a robust, reliable chronology for East Polynesia has had a difficult history. Recent re-analysis of sites excavated in the 1960s—early on in the development of radiocarbon as a dating technique—have shown that original age estimates are often incorrect by several hundred years or more. Advancements in the radiocarbon technique, most notably the Accelerated Mass Spectrometry method, and the ability to date extremely small samples that have been identified to short-lived species, have allowed researchers to refine the East Polynesia chronological sequence. Many re-dating efforts have focused on New Zealand, the Hawaiian Islands and the Marquesas Islands to refine local and regional settlement chronologies, with a consensus emerging that initial colonisation from West Polynesia began around 950–1000 BP, with the far margins settled by 700–750 BP (Allen 2014; Kahn 2014; Kirch 2011; Reith and Cochrane 2015).

For the Society Islands archipelago, the first re-dating study was that of Atholl Anderson and colleagues (2000) who used samples derived from new excavations to re-analyse the Maupiti burial site, Motu Paeao (Ma3) (Fig. 1). The site had material culture assemblages with artefacts diagnostic of Archaic East Polynesian culture (Emory and Sinoto 1964, 1965). Site occupation, originally thought to be early in the sequence c. 1100 BP (Emory and Sinoto 1964), was re-dated to the 13th to 15th centuries but most likely dates to the 15th century, significantly younger than the original determinations. The single wood charcoal sample that was dated by Anderson and colleagues was not identified to species and might have had some in-built age. The authors also noted that some of their bone collagen dates might be contaminated, leaving the bone dates too old (Anderson *et al.* 2000: 60–61).

Anderson and Sinoto (2002) then re-dated the Vaito'otia-Fa'ahia sites (ScH1-1, 2) on Huahine, originally excavated by Sinoto in the 1970s (Fig. 1; Sinoto 1979; Sinoto and McCoy 1975). Like the Maupiti burial ground, the site had material culture assemblages with artefacts diagnostic of Archaic East Polynesian culture. The Vaito'otia-Fa'ahia sites originally produced radiocarbon determinations extending to c. 1150 BP, or c. AD 800–850 (Sinoto and McCoy 1975). Anderson and Sinoto (2002) built a new site chronology derived from shell and charcoal samples dating between AD 1050–1450 (2 σ). However, only a few of their samples derived from short to medium-lived species, including coconut shell dating to AD 989–1277 (2 σ) and shell dating to the 11th to 14th centuries AD. Given the large age spans, the occupation of the Vaito'otia-Fa'ahia sites cannot be accurately placed in either the Colonisation or Developmental/Expansion Phases (see discussion below); however, as with the earlier study, the new dates were younger than the original determinations. More recently, Anderson reported a new suite of dates (n=11) from the Society Islands in a meta-analysis of East Polynesian

dates by Wilmshurst and colleagues (2011). In a recent article discussing the Marquesan sequence and the CEP sequence more broadly, Melinda Allen verified with Anderson (in Allen 2014: 8) that these new samples derive specifically from the Vaito'otia-Fa'ahia sites and were run on short-lived materials, but their provenience details remain to be published. The reported calibrated age ranges are listed as a minimum of 768 ± 31 to 982 ± 32 BP (Wilmshurst *et al.* 2011, Table S1), suggesting initial settlement of the sites could be as early as the 10th to 13th centuries.

Finally, Kahn (2011) provided new data from a coastal site found along Cook's Bay on the north shore of Mo'orea (Fig. 1). At the GS-1 site, the basal cultural deposit included charcoal flecking and a limited number of basalt flakes. A *Hibiscus tiliaceus* fragment from the deposit was dated and provided a range of AD 1031–1210 (2σ). The date may have some inbuilt age, but calibrates to the same time period as the Society Island dates published by Wilmshurst *et al.* (2011).

Overall, the suite of dated coastal sites from the Society Islands with samples dated via modern techniques is small, but they suggest colonisation as early as the late 10th century up to the late 12th century. As this brief review suggests, the Colonisation Phase in CEP remains hotly debated even after three decades. Strict classification-based approaches to CEP settlement argue for colonisation of the Societies (AD 1025–1120) and the Gambier archipelago (AD 1108–1275) (Wilmshurst *et al.* 2011). Approaches utilising broader evidence for early cultural activity, including evidence for plants and animals introduced via colonising populations, argue for initial settlement of CEP almost one hundred years earlier, c. AD 900–1000 (Conte and Kirch 2004; Kirch 2011; Kirch *et al.* 2010; Molle 2011). Some of the strongest evidence for settlement in the region dating to ca. AD 900–1000 include Molle and Conte's recent work at Hane (Conte and Molle 2014; Molle 2011; see also Anderson *et al.* 1994) and Kirch *et al.*'s work at the Onemea site on Taravai (2010) (see discussion in Allen 2014).

Currently, there are two cultural-chronological sequences for the Society Islands. Lepofsky and Kahn (2011) developed an 'Opunohu Valley, Mo'orea sequence and an archipelago-wide sequence tied to temporal phases. A more recent model by Kahn (2014) situates the Society Islands within the regional CEP context and draws from Hawaiian models (Kirch and McCoy 2007) in utilising Colonisation, Developmental/Expansion and Classic phases. The latter will be used in this article for the ease of comparing the Society Islands sequence to others within East Polynesia. As Kahn (2014) outlined, the Society Island Colonisation Phase dates to c. AD 1000–1250, the Developmental/Expansion Phase dates to AD 1250–1550, and the Classic Phase runs from AD 1550 up to European Contact in 1767. As previously noted, the Colonisation Phase remains the most under-studied within the Society Islands.

BACKGROUND TO THE MO‘OREA ISLAND SITES
AND THE EXCAVATIONS

In the late 1950s and 1960s, much of the focus of archaeological analysis in East Polynesian was on coastal middens and rockshelters, although Green’s pioneering settlement pattern analysis in the ‘Opunohu Valley (Green 1961; Green *et al.* 1967) provided an alternative, as did Robert Suggs’s Marquesan work (Suggs 1961a; see discussion in Kirch 2000). Compared to Hawai‘i, Emory and Sinoto’s survey in the Society Archipelago failed to discover richly stratified sites with high artefact content (Emory and Sinoto 1965: 18), yet numerous coastal sites were test excavated between 1960 and 1961. On Mo‘orea, M3 (Ana Paia Rockshelter) and M5 (Afareaitu Fishing Village) (Fig. 1) represented the most promising sites in terms of stratified deposits and artefact recovery, particularly fishhooks. As such, both sites were further investigated in the early 1960s with broader excavation samples. Green’s research team likewise investigated coastal sites on Mo‘orea as a means to provide comparative materials for their inland valley excavations, given that the inland assemblages lacked preservation sufficient for organic artefacts such as fishing gear, shell remains or animal bone (Green *et al.* 1967).

Ana Paia Rockshelter (M3)

This small rockshelter was found along the southern portion of Mo‘orea in the Ha‘apiti District (Figs 1 and 2). The modern circum-island road has destroyed this site, which was situated inland of the ocean along a narrow coastal flat. The interior of the shelter was small, c. 15 m long by 2 to 3 m wide (Fig. 2). A stone wall of 70 cm length was found running parallel to the rockshelter’s dripline and delineated the sheltered interior portion of the site from its unsheltered exterior portion.

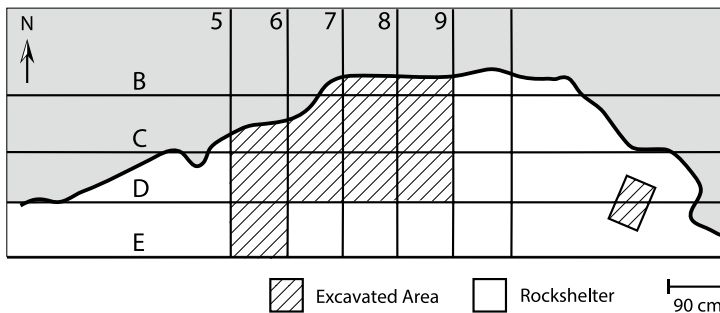


Figure 2. Plan view of the M3 site with the areas excavated.

The rockshelter was excavated in 1960 by Pierre Verin, an archaeologist affiliated with ORSTOM, in collaboration with Yosihiko Sinoto from the Bishop Museum. While test excavations suggested that the M3 site was not rich in artefacts, the site stratigraphy was undisturbed, lacking tree roots and frequent crab holes, and had high frequencies of midden and charcoal, leading the two archaeologists to expand their excavations.

Overall c. 9 m² were excavated to sterile at M3. Five stratigraphic levels were identified with the entirety of the cultural deposit ranging from 60 to 100 cm deep (Fig. 3). The basal deposit (referred to here as LV) was a sterile reddish clay with frequent rocks (Sinoto 1960, field notebook, July 22 entry). Above this was a blackish cultural deposit (LIV), c. 25–40 cm thick, at the base of which was a stone pavement. Above this was a c. 15–39 cm thick deposit (LIII), replete with charcoal and ash lenses. Above this was a black humic layer (LII), c. 20–28 cm thick, with dense shell midden, capped by 10–15 cm of overburden (LI). Field notes and profiles indicate that the ash lenses began c. 30–40 cmbd (cm below datum). Fish bone and shell midden were most abundant in LII–LIV. The surface lacked historic artefacts, but a pearl-shell button with two holes found in the upper deposits (LI or LII) indicated some site occupation during the first half of the 19th century (Sinoto and Verin 1965: 574; Verin 1960–61: 5). The site was interpreted as a fishermen's cave given the dense marine midden and the recovery of pearl-shell and *Turbo* fishhooks, and a limited number of adzes, adze debitage and coral files.

Afareaitu "Fishing Village" (M5)

This site is found in the Afareaitu District on the southeast coast of Mo'orea (Fig. 1). The site complex is situated on a coastal flat c. 180 m in width. The surface architecture includes four temple sites (*marae*), an upraised stone platform (*paepae*) interpreted as a feasting platform (M5-1), and a small rectangular house foundation (M5-2). The surface midden extended over a 34,000 m². The area was intensively surface collected in 1961–62, yielding fishing gear (complete fishhooks, blanks, shell sinkers, octopus lures and cut shell), stone tools (adzes, adze flakes, polishing stones, hammerstones) and a wide range of other tools (coral files, shell chisels, worked bone, sling stones).

At the M5 site Sinoto and Verin utilised a six inch auger to locate sub-surface midden deposits. Sub-surface excavations commenced in 1961 and continued into 1962 (Fig. 4). Overall, 72 units were excavated. Test pits ranged from 2 by 2 m in size to 2 by 1 m and were completed in different numbered units/zones. Limited excavations were carried out in the vicinity of the Unit 1 zone, the region around and in-between the M5-1 feasting platform and M5-2 rectangular house. Limited excavations were also completed at the Unit 2 zone adjacent to the enclosing wall and the *ahu* of M5-3, in and

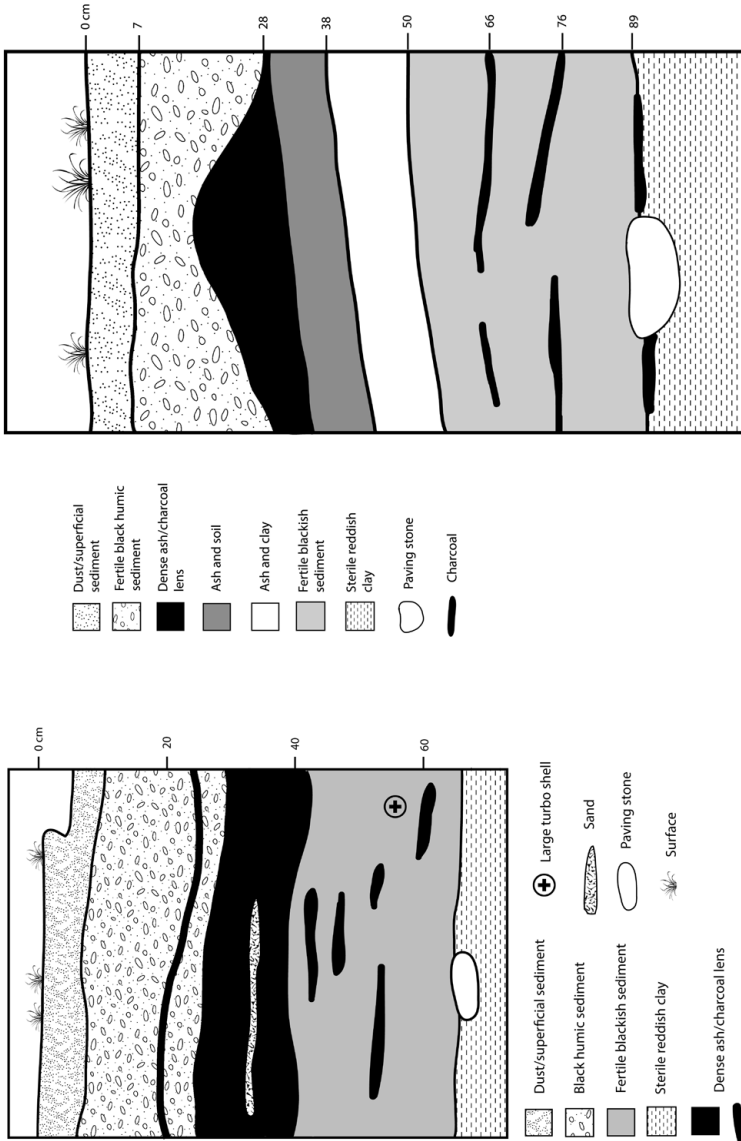


Figure 3. M3 stratigraphic profiles, Units C8, B7.



Figure 4. Excavations in progress at M5.

around a simple coastal *marae* with dressed loaf-shaped stones, and adjacent to M5-4 and M5-5, two coastal *marae* with dressed loaf stones. Extensive excavations focused on the Unit 3 zone, the surface flat to the east of the M5-3 *marae*. In this area, 44 test pits were excavated, uncovering a concentration of midden and sub-surface features, including pits and fire features, some with stone outlines.

While the specifics of the M5 site stratigraphy have not been published, the unpublished report indicates that the Unit 1 zone near M5-1 and M5-2 had three cultural deposits, while the Unit 3 zone had a single cultural deposit with a depth of c. 30 cm. Artefact and midden recovery was frequent across the site but most pronounced in the Unit 2 zone. Emory and Sinoto's (1965) generalised culture-historical analysis of the M5 artefacts stressed that "adz and fishhook types (one-piece hook heads and t[r]olling-hook points), and a consideration of the type of maraes at Afareaitu, seem to indicate that the whole

complex of the Afareaitu site is characteristic of the late period of Tahitian prehistoric culture, some of which was retained into protohistoric time” (p. 57).

ScMf-2

This site, also known as Hauiti on the land parcel of Oramatoua (Rappaport and Rappaport 1960, field notebook), is situated at the easternmost portion of the Papeto‘ai District at the western headlands of ‘Opunohu Bay along the north shore of Mo‘orea (Fig. 1). The site is found on a narrow coastal flat, and had a moderate amount of surface midden. As part of Green’s crew, the Rappaports excavated seven units, each 9 ft by 9 ft (c. 51 m²), at the site (Fig. 5); each unit was excavated as four separate quadrants. Quarter-inch screen was used to sift the excavated deposits (Green *et al.* 1967).

A detailed description of the ScMf-2 site stratigraphy has not been published. Unpublished notes (Rappaport and Rappaport 1960, field notebook) and published descriptions suggest that the stratigraphy of the Unit 1 and Unit 2 excavation blocks varied slightly from one another. Notes indicate that the basal deposit was coralline sand or limestone conglomerate. A single cultural deposit, described as a black midden layer, was excavated in arbitrary six inch levels. This cultural deposit varied in depth across the site, ranging from 45 cm to 100 cm. While the Rappaports discussed this as a single cultural deposit, their stratigraphic descriptions and profiles suggest that the upper deposit may be differentiated from the lower deposit (Fig. 6). The uppermost portion of the deposit contained a mixture of pre-contact and historic artefacts in a loose, black-grey, sandy midden. At about a depth of 30 cm, the deposit has frequent ash and charcoal lenses, as well as fire pits with fire-cracked rock and earth oven stones which continue until c. 56 cmbd (Fig. 7). At about 60 cm the sediment lightens in colour and becomes sandier in texture, but no changes in midden composition were observed.

Two postholes were also documented in the excavations, along with a possible storage pit. Recovered artefacts included fishing gear, adzes and related stone artefacts, faunal remains, marine shell and historic materials. Forty-five wood charcoal samples were collected but none were sent for radiocarbon dating. Both in their unpublished field notes and in the monograph, the Rappaports referred to specific charcoal samples that were associated with the basal limit of the cultural deposit. They also noted that post-depositional disturbance, most notably crab burrowing, was found across the site.

ScMf-5

ScMf-5, also known as the Te Amaama site, is found at the western headlands of Papeto‘ai Bay, across from the Terau reef pass, on the north shore of Mo‘orea (Fig. 1). As Green notes (1967: 181), the site is recorded in oral histories as

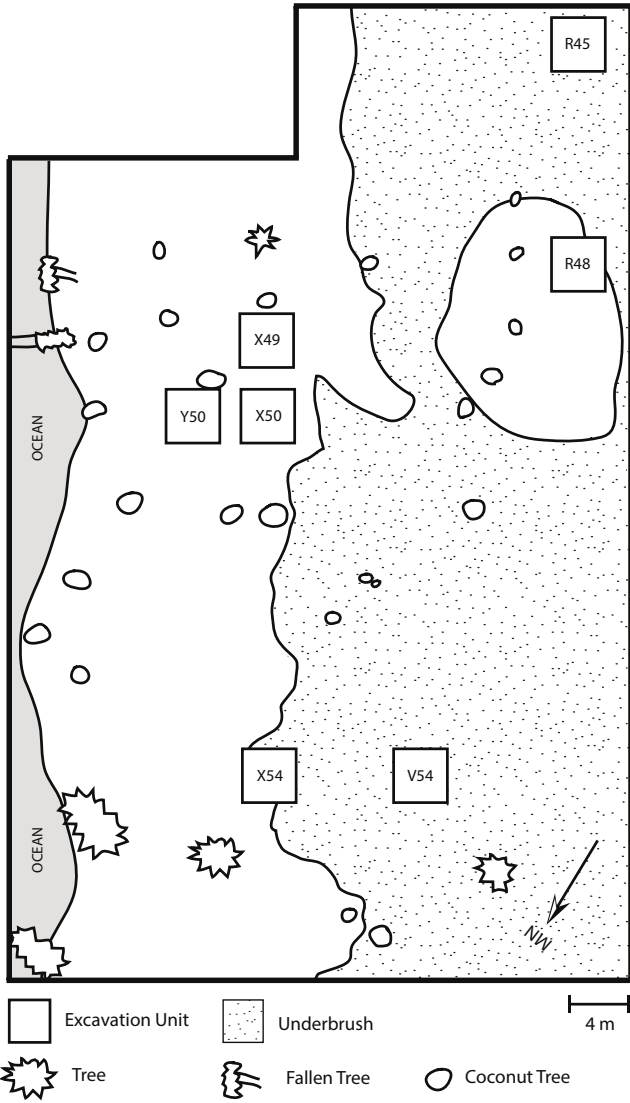


Figure 5. ScMf-2, schematic plan of the site excavations (after Rappaport and Rappaport 1960, field notebook).

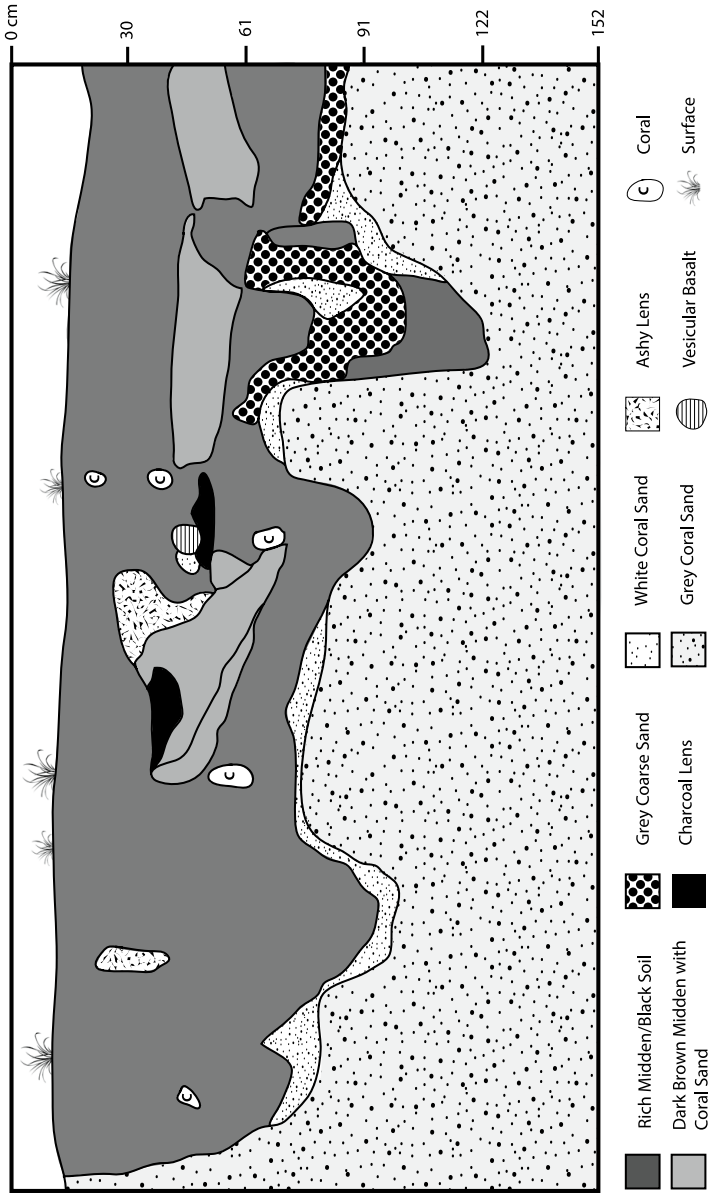


Figure 6. Stratigraphic profile of Unit X49 at ScMf-2.

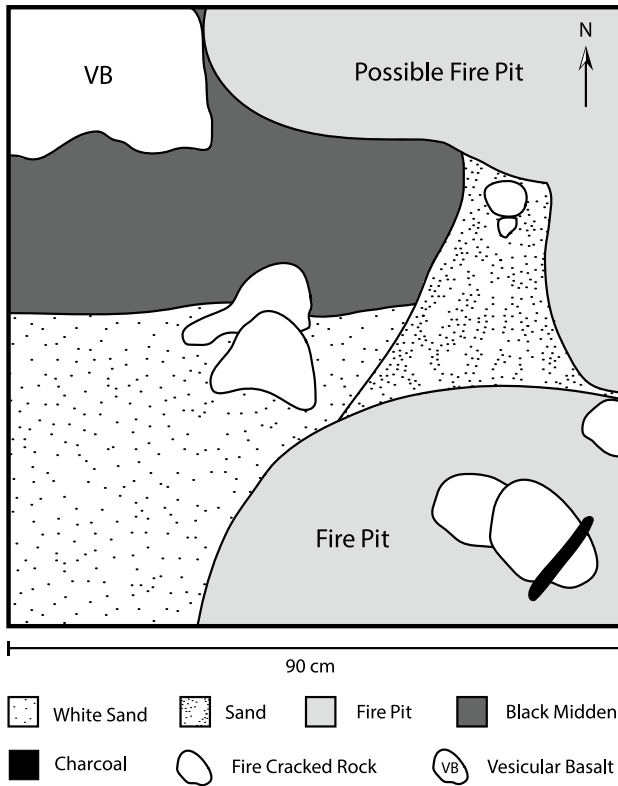


Figure 7. Plan of ScMf-2 Unit X49, SW quadrant, at 48–56 cm below datum, showing fire pits with concentrated charcoal and fire-cracked rock.

an important residential area and was the location of a large coastal temple named Taputapuātea, after the “origin” temple of the same name in Ra’iatea (see also Cauchois 2015). Approximately 43 m² were excavated at ScMf-5 in two large blocks that were excavated as quadrants (Green 1960, field notebook). The Unit 1 excavation block was situated 61 m in from the coast. The Unit 2 excavation block was located 76 m inland, closer to edge of the site that was bounded by a stream. It is unclear if quarter-inch screen was used to sieve all of the excavated deposits or if only the column samples were sieved and the rest of the deposits were hand-picked without being screened.

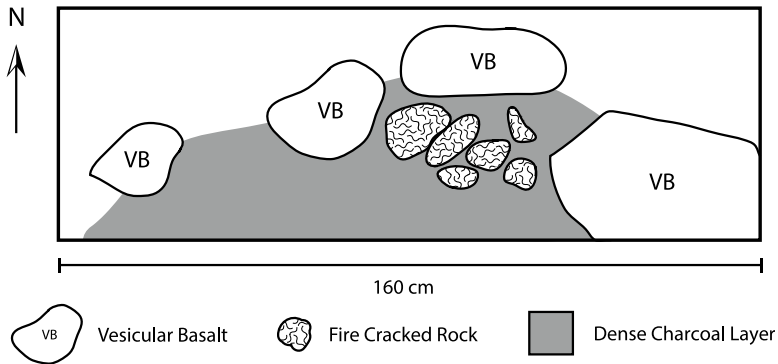


Figure 8. Plan of ScMf-5, Unit 2, NW Quadrant.

A detailed description of the ScMf-5 site stratigraphy has not been published. Published notes indicate that the basal deposit was a brown clay in the Unit 1 block and a coral sand in the Unit 2 block (Green *et al.* 1967: 182). A single cultural deposit of dark grey sandy loam was encountered across the site and ranged in depth from 67 cm in the Unit 1 block to 106 cm in the Unit 2 block. The cultural deposit at ScMf-5 contained historic artefacts (most frequent in the upper layers), dense shell and fish and mammal bone midden, as well as adzes and adze-related debris, a pearl-shell coconut grater and a *Conus* shell chisel. Numerous possible earth ovens and fire features are depicted in the quadrant plan views (Fig. 8; see Green 1960, field notebook). A sub-surface earth oven was encountered in the Unit 2 block at 67–106 cm below surface, the bottom of which was under the water table. Wood charcoal from this feature was dated. Weisler (1998) geochemically analysed an adze recovered in the dated earth oven feature, documenting its source of origin to an adze quarry found on Eiao Island in the Marquesas Archipelago.

THE 1960S DATES

Numerous issues affect the interpretation of radiocarbon dates run in the Pacific Islands in the 1950s–60s. The earliest radiocarbon dating method, the only available at the time, required large samples, such as the entire contents from a single hearth or burn event. This practice potentially merged charcoal burned in different events. Wood charcoal identification was not practiced at the time, leaving samples open to the “old wood” bias. All of the original M3, M5, and ScMf-5 dates were not adjusted for isotopic fractionation (i.e., $\delta^{13}\text{C}$ value) and are uncalibrated (hence the “reported age” category in Table 1). They were originally presented as absolute calendar year dates that could

be subtracted from 1950, which is problematical. Given that many of the dates also have large error estimates, the reliability of these dates is highly questionable. Finally, four of the five original M3 and M5 dates were run by the Gakushin Lab (lab identifier GaK, Table 1). Subsequent re-dating studies have shown that GaK dates from the 1950s and 60s often produced overwhelmingly young dates, suggesting mistreatment, contamination, or use of unstable modern standards (Kahn 2006; Kirch 1984: 73, 1986: 23; Lepofsky 1994, 1995; Rolett 1998: 53; Spriggs 1989; Spriggs and Anderson 1993).

Two bulk wood charcoal samples from M3 were originally submitted for ¹⁴C dating to the Groningen Lab (Table 1). Sample GRN-2960, derived from a pavement associated with a hearth in LIV, Unit C8, at a depth of 90–105 cmbs (Emory 1962; Sinoto 1960, field notebook; Suggs 1961b: 89; Vogel and Waterbolk 1964). This date has been reported as 550 ± 55 or c. AD 1400 (Table 1). A second sample from the same unit, consisting of isolated charcoal recovered at a depth of 90–105 cmbs, was also dated and reported as 680 ± 60 or c. AD 1280. The two dates are stratigraphically consistent and suggested occupation of the site as early as the late 13th century and continuing up to the mid-15th century.

Four wood charcoal samples were dated from M5 (Emory and Sinoto 1965: 51-52); all of these samples were dated by the Gakushin Lab. Two samples (GaK-217, 218) were recovered from area excavations between the M5-1 feasting platform and the M5-2 rectangular house foundation. The two samples provided discordant and inverted dates, reported as 160 ± 80 or c. AD 1790 and 940 ± 90 or c. AD 1010 respectively. A third sample (GaK-215) was recovered nearby from TP16 in a scattering of charcoal found at 12–15 cmbs in association with the M5-2 rectangular house pavement. This dated sample was reported as 0 ± 100 or c. AD 1850 or younger. The final sample, GaK-332, recovered from the M5-3 temple excavations, yielded a reported date of 480 ± 240 or c. AD 1470 ± 240 . The large error ranges and lack of patterning in the M5 dates, in terms of stratigraphic position, leave these original dates from the site open to question. The potentially early component at M5 (GaK-218) is of interest, as only a few sites which potentially date to the Colonisation Phase have been identified on Mo‘orea.

Finally, a single wood charcoal sample was dated from ScMf-5. The sample derived from an earth oven cut from the middle of the main cultural deposit into the underlying sterile sand. The wood charcoal sample was taken at c. 106 cmbs at the base of the earth oven. It was reported as dating to 760 BP ± 80 or c. AD 1190 ± 80 (Green *et al.* 1967: 182). Again, the potential for this sub-surface feature to date to the Colonisation Phase is of interest. Only one other site on Mo‘orea (GS-1) is currently dated to this phase utilising modern AMS techniques (Kahn 2011), but the GS-1 date is not on a wood charcoal sample from a secure sub-surface feature.

Table 1. Original radiocarbon dates from the 1960s. The Oxcal 4.2 program was used to calibrate the dates (Bronk-Ramsey 2009).

Sample #	Lab #	Site #	Site Name	Provenience	Conventional ¹⁴ C Age Years BP	Reported Age
TRC-1	GRN-2960	M3	Ana Paia Rockshelter	C8, scattered charcoal from 76-89 cmb	550 ± 55	AD 1400 ± 55
TRC-82	GRN-2902	M3	Ana Paia Rockshelter	C8, northern part, 90-105 cmb	680 ± 60	AD 1280 ± 60
TRC-7	GaK-215	M5	Afareaitu Fishing Village	TP16, 12-15 cmb, scattered charcoal associated with M5-2 rectangular house pavement	0 ± 100	AD 1850 or younger
TRC-9	GaK-217	M5	Afareaitu Fishing Village	TP12, 45 cmb, scattered charcoal collected between M5-1 feasting platform & M5-2 rectangular house foundation	160 ± 80	AD 1790 ± 80
TRC-8	GaK-218	M5	Afareaitu Fishing Village	TP13, 30 cmb, basal limit of cultural deposit; collected between M5-1 feasting platform & M5-2 rectangular house foundation	940 ± 90	AD 1010 ± 90
TRC-11	GaK-332	M5	Afareaitu Fishing Village	M5-3 temple, Unit G10, 20-30 cmb, below east retaining wall of marae	480 ± 240	AD 1470 ± 240
AMNH-188	Not available	ScMf-5	Te Amaama	Square 2, 106 cmb, at base of earth oven	760 ± 80	AD 1190 ± 80

NEW AMS DATES

Archival samples from the Anthropology Department at the Bishop Museum and the American Museum of Natural History were used to select new wood charcoal samples for re-dating. The M3 and M5 samples were identified to species by Gail Murakami, while the ScMf-5 samples were identified by Emilie Dotte-Sarout. Each identified wood charcoal sample was submitted to Beta Analytic for AMS ^{14}C dating.

Few archival samples were available from the M3 and M5 sites, which limited our re-dating efforts. While we set out to identify and date short-lived species, short-lived nutshells, or branch wood for all the samples (Allen and Huebert 2014; Allen and Wallace 2007), these simply were not available for M3 and M5. As a result, we dated *Artocarpus altilis* (breadfruit) samples, (Table 2) in addition to *Hibiscus tiliaceus*, a soft-wood and native shrub; both can have life spans over 50 years (Table 2; Allen and Huebert 2014; Kahn 2006; Reith *et al.* 2011). However, the *Artocarpus altilis* samples have the advantage of being Polynesian introductions and thus must date activities related to Ma'ohi (or pre-contact Tahitian) occupation (see Dye 2011). All of the new ScMf-2 and ScMf-5 samples were run on short-lived materials with under ten years of inbuilt age, including *Cocos nucifera* endocarp, *Aleurites moluccana* (candlenut) endocarp and a *Syzygium malaccense* (Malay apple) twig with a diameter of 6 mm.

Two new samples were dated from the M3 site (Table 2). The first is an archived split sample of the TRC-82 sample originally dated in the 1960s. This sample (Beta-335458) derived from ash and charcoal lenses found in the basal level of the cultural deposit in Unit C8 (Fig. 3). The two sigma calibrated age range is AD 1033–1204. This is just a bit earlier than the original AD 1220–1340 date reported for this split sample. A second sample (Beta-335457) recovered from Unit B7, and again derived from ash and charcoal lenses found at the basal portion of the cultural deposit (Fig. 3), yielded a calibrated age range of AD 1184–1275. The two new dates overlap at two standard deviations and one overlaps with the original TRC-82 sample. These data indicate that the first occupation of the M3 site was most likely in the late 12th to mid-13th centuries during the Colonisation Phase.

Two new samples were dated from M5. These included a wood charcoal sample collected from Unit G9 (Beta-335459). This sample was retrieved at 22 cmbd from underneath a stone paving that was associated with the rectangular house (M5-2) site. When calibrated the sample has multiple intercepts and most likely dates to AD 1735–1806. A second sample (Beta-335456) collected from a similar depth in TP16 near the *paepae*, or the M5-1 feasting platform, calibrates to a similar period and most likely dates to between AD 1826–1832.

Table 2. New AMS radiocarbon determinations. The Oxcal 4.2 program was used to calibrate the dates (Bronk-Ramsey 2009).

Lab No.	Site	Site name	Provenience	Taxon dated	Potential inbuilt age	Conventional ^{14}C age BP	$\delta^{13}\text{C}$ ‰	Calibrated age at 2σ
Beta-335458	M3	Ana Paia Rockshelter	N part of C8, 90-105 cmbs, basal level of cultural deposit with charcoal & ash lenses, just above sterile; previously dated as TRC-82, lab #GRN 2902	<i>Hibiscus tiliaceus</i> wood charcoal	Little to many decades	910 ± 30	-25.6	AD 1033-1190 (94.0%) AD 1198-1204 (1.4%)
Beta-335457	M3	Ana Paia Rockshelter	TP1-e, 80-90 cmbs, basal level of cultural deposit with charcoal & ash lenses, just above sterile; originally collected as TRC-81	<i>Hibiscus tiliaceus</i> wood charcoal	Little to many decades	800 ± 30	-25.2	AD 1184-1275 (95.4%)
Beta-335459	M5	Afareaitu Fishing Village	G9, 22 cmdb, under pavement area of M5-2 house site; originally collected as TRC-13	<i>Artocarpus altilis</i> wood charcoal	Many decades; > 50 years	220 ± 30	-27.0	AD 1642-1684 (36.7%) AD 1735-1806 (44.7%) AD 1933-modern (14.0%)
Beta-335456	M5	Afareaitu Fishing Village	TP16, 12-15 cmdb, W half of <i>paepae</i> (M5-1); originally collected as TRC-6	<i>Artocarpus altilis</i> wood charcoal	Many decades; > 50 years	160 ± 30	-25.7	AD 1664-1706 (16.7%) AD 1719-1826 (47.4%) AD 1832-1884 (12.6%) AD 1914-modern (18.6%)
Beta-411447	ScM2	Haiti	Unit X, 49-50 baulk, fire pit, 41-66 cmdb	<i>Cocos nucifera</i> endocarp	Short-lived	660 ± 30	-24.8	AD 1276-1322AD (47.6%) AD 1347-1393 (47.8%)

Beta-411448	ScMf2	Haiti	Unit X-54, fire pit NW corner, 66 cmbd	<i>Aleurites moluccana</i> endocarp	Short-lived	580 ± 30	-23.8	AD 1300-1369 (63.6%) AD 1380-1418 (31.8%)
Beta-411449	ScMf2	Haiti	Unit V-54, 30 cm to bottom	<i>Cocos nucifera</i> endocarp	Short-lived	200 ± 30	-24.3	AD 1646-1690 (24.9%) AD 1728-1810 (51.2%) AD 1926-modern (19.3%)
Beta-411450	ScMf2	Haiti	Unit X49, 61 cmbd	<i>Syzygium malaccense</i> twig with 6.0 mm diameter	Short-lived	10 ± 30	-27.1	AD 1696-1725 (14.7%) AD 1814-1836 (10.2%) AD 1845-1850 (0.9%) AD 1876-1918 (69.7%)
Beta-411451	ScMf5	Te Amaama	Unit 1, earth oven rake out, 79 to 97 cmbd	<i>Cocos nucifera</i> endocarp	Short-lived	770 ± 30	-24.9	AD 1216-1282 (95.4%)
Beta-411452	ScMf5	Te Amaama	Unit 1, earth oven rake out, 64- 79 cmbd	<i>Cocos nucifera</i> endocarp	Short-lived	640 ± 30	-22.7	AD 1282-1329 (41.0%) AD 1340-1396 (54.4%)
Beta-411533	ScMf5	Te Amaama	Unit 2, 36-51 cmbd	<i>Cocos nucifera</i> endocarp	Short-lived	840 ± 30	-24.7	AD 1059-1062 (0.4%) AD 1154-1264 (95.0%)

The new dates suggest that some of the surface architecture at M5 most likely dates to the late prehistoric to early contact period spanning the late 17th to mid-19th centuries. Our new data suggests that the original AD 1010 date is too early, either due to the old wood problem or lab processing issues. We were unable to re-date any samples associated with the deposits pre-dating the construction of the three *marae*. This leaves open the possibility that the original GaK-332 (dating to the late 15th century) accurately dates a use of the site prior to the construction of the later 'Oro style temples and associated feasting platform and rectangular house.

Four new samples were dated from the ScMf-2 site. Beta-411447 is a sample taken from a fire feature at the base of the cultural deposit at a depth of 41–66 cmbd. At 2σ the sample calibrates with multiple intercepts, producing an age range of AD 1276–1393. Beta-411448 dates another fire feature sample in a unit in the near vicinity and at a similar depth at the basal portion of the cultural deposit. This sample calibrates to AD 1300–1418 and most likely dates to the AD 1300–1369 portion of the age range. These two dates from the same portion of the site are internally consistent and suggest initial site occupation as early as the late 13th century, but most likely in the mid-14th century. Unfortunately, Beta-411450, which dated a short-lived material at a depth similar to that of Beta-411447 and Beta-411448, yielded a much later calibrated age range of AD 1675–1918. It seems likely that this sample derived from an upper portion of the cultural deposit that was secondarily deposited by crab burrowing. The final sample, Beta-411449, was analysed to investigate site stratigraphy and chronology in a different portion of the site. This sample did not have the most precise context and derived from the mid- to bottom portion of the cultural deposit (30 cm or deeper). The sample yielded a calibrated age range of AD 1646 to modern and most likely dates to the AD 1728–1810 age range. Taken as a whole, our results suggest that ScMf-2 site had multiple occupations, with the first in the Developmental/Expansion Phase and the second in the Classic Phase.

Three new samples were dated from ScMf-5. Beta-411451 and -411452 derive from two distinct earth oven rake-out events in the lower portion of the cultural deposit. Beta-411451 tightly calibrated to AD 1216–1282, while Beta-411452 has two intercepts and calibrates to between AD 1282–1396. The two dates overlap at 2σ and indicate that the basal portion of the cultural deposit in the Unit 1 block dates to the 13th to 14th centuries. A final sample, Beta-411533, was retrieved from the lower portion of the Unit 2 block cultural deposit. This sample yielded the oldest date, calibrating to AD 1059–1264. The newly dated Unit 2 sample overlaps at 2σ with Green's original date from an earth oven at the base of this cultural deposit, indicating that ScMf-5 was initially occupied in the Colonisation Phase.

A REVISED SOCIETY ISLAND CHRONOLOGY

With this new corpus of ^{14}C dates, we now have evidence for three well-studied Society Islands sites dating to the Colonisation Phase, including two sites on Mo‘orea (GS-1 and ScMf-5) and one on Huahine (ScH1-1, -2) (Fig. 1). Both GS-1 and ScMf-5 are situated on gently sloping coastal flats of some width on Mo‘orea. They are each found at the headlands of northern bays and are situated across from important reef passes. The early component of the GS-1 site is largely ephemeral, similar to data from Colonisation Phase sites in Mangareva (Kirch *et al.* 2010) and the Marquesas Islands (Allen 2014). The site’s upper deposits (reported as ScMo-341 in Kahn *et al.* 2015b) represent episodes of high and low-energy fluvial deposition of terrigenous sediments; these data have been linked to soil erosion resulting from slash and burn agriculture and high-energy storm events. These geomorphological activities buried the earliest cultural deposits with 220 cm of sediment, effectively erasing the Colonisation Phase activities from easy detection.

In contrast, the earliest dated occupation of the ScMf-5 site contained an earth oven, diverse artefacts and dense faunal remains indicative of a permanent and perhaps large, settlement along the northern shore of Mo‘orea. The ScMf-5 Colonisation Phase component is similar to that found at the Fa‘ahia-Vaito‘otia site on Huahine. There, extensive Colonisation Phase deposits were found on a large, flat coastal plain near a major reef pass. Site excavations recovered diverse artefacts types, dense midden and house posts. The Vaito‘otia excavations uncovered several zones of spatially segregated activities, including a sector for storage houses located away from the main habitation area. The Fa‘ahia excavations demonstrated the spatial differentiation of habitation and certain production activities, including a “stone workshop area” and zone for craft production (Sinoto 179: 4, 8), while *tapa* ‘bark-cloth’ production may have taken place outside of the probable house structure (1979: 8).

Overall, these results point to established Society Islands populations from the 11th to 13th centuries AD, supporting both the Wilmshurst and colleagues (2011) Conservative Model of East Polynesian settlement and more inclusive synthetic models (Allen 2014; Kirch 2011). Occupations dating to this time period are widespread in the archipelago, found in the Windward Islands (north shore of Mo‘orea) and the Leeward islands (northwest shore of Huahine). The inhabitants of at least one of these sites, those at ScMf-5, imported or traded for adzes deriving from Eiao in the Marquesas Islands (Weisler 1998: 523). Materials from this adze quarry are also found at Colonisation Phase sites in the Marquesas Islands (Allen 2014), the Line Islands (Di Piazza and Pearthree 2001), and the Cook Islands (McAlister *et al.* 2013), as summarised by Allen (2014), in addition to sites in the Austral Islands (Hermann 2013).

Another Society Islands site potentially dating to the Colonisation Phase is the Vaihi site on the north shore of Rai‘atea (Charleux 1977; Semah *et al.* 1978) where Archaic style artefacts were recovered. The site has a single conventional radiocarbon date on unidentified charcoal reported as AD 1210 \pm 80, but must be re-dated to precisely place it within the revised Society Islands cultural chronology.

It is telling that two of the three Colonisation Phase sites in the Society Islands include waterlogged deposits or cultural deposits that are under the current water table. It has long been argued that geomorphological conditions in the Societies, notably subsidence, have been a major hindrance to the recovery of coastal sites (Bellwood 1970; Kirch 1986). Extensive excavations of the last few years along the coasts of Mo‘orea and Maupiti have likewise illustrated how major erosional deposits have masked the evidence of early settlement in the Societies (Kahn *et al.* 2015a, 2015b). Settlements on old beach ridges are now covered with 2 to 3 m of alluvial sedimentation. It is then no surprise that three of the four Colonisation Phase sites (the one exception is ScMf-5) were found by accident. We are in full agreement with Allen (2014: 13) that “targeted geomorphologically informed field studies will be required for solving the puzzle of East Polynesian dispersals” in the Society Islands. The lack of concerted sub-surface archaeology in the archipelago leaves open a high possibility that additional Colonisation Phase sites will be located in the future.

In terms of the new Developmental Phase dates from ScMf-2, at this time new parts of the Mo‘orea north shore were inhabited, while other earlier coastal sites continued to be occupied, tentatively suggesting population increase. This correlates well with Lepofsky’s (1994, 1995) ‘Opunohu Valley (Mo‘orea) work which established the presence of widespread inland valley agriculture by the end of the 13th century, with both rain-fed terraces and barrage pondfields represented. Inland expansion by c. AD 1350 is also documented in ‘Opunohu Valley residential sites, which exhibit characteristics of low, moderate and high rank (Green 1996: 218; Green *et al.* 1967: 166; Kahn and Kirch 2013). This major inland expansion brought newly established interior valley communities into the territories of expanded coastal polities. It was likely motivated by population increase and the need for increased economic production (Kahn 2006; Lepofsky and Kahn 2011).

The M5 component, with its elaborate temples of the ‘Oro cult style (Green and Green 1968), fits well into accepted dates for the Classic Phase (Kahn 2014). Re-analyses of ‘Oro style temples with loaf shaped stones in the Windward Society Islands document their construction during the 17th to 18th centuries. Their construction may have signalled allegiances to the newly established paramount Pomare lineage on Tahiti (Kahn 2010; Maric

2012), as well as localised incursions of the *ario'i* (fertility) and war cults originating in the Leeward Islands and moving into the Windward Islands. The elaboration and expansion of *marae* and ritual centres during the Classic Phase occurs in both interior valley contexts and coastal zones throughout the principal islands of the archipelago (Kahn and Kirch 2014; Maric 2012; Sharp *et al.* 2010; Wallin and Solsvik 2006: 17), signalling widespread intensification of socio-ritual and economic systems. Intensified feasting is also prevalent during this period, permitting socio-ritual elites to compete in highly visible material expressions of their rank and power.

CONCLUSIONS

Our re-dating program has not only allowed us to refine the Society Islands cultural sequence, but has permitted precise identification or confirmation of two sites dating to the Colonisation Phase. The new Society Islands cultural chronology supports a rapid regional colonisation or “advancing wave” of colonists in CEP (Allen and McAlister 2013; Kahn 2014; Wilmshurst *et al.* 2011). These data have, in part, spurred new interest in modelling push versus pull factors in the settlement of CEP (Anderson *et al.* 2006; Bell *et al.* 2015; Montenegro *et al.* 2014). In addition, the shortened CEP chronology has required that archaeologists re-think models concerning the pace and development of social complexity in the region. Certainly as sub-surface excavations in the Society Islands archipelago continue in conjunction with geomorphological analyses, we must expect that additional Colonisation Phase sites will be identified. Equally important will be the study of Developmental/Expansion Phase sites in coastal contexts, as current samples from the 1950s and 1960s lack methodological rigor in excavation techniques and artefact recovery (due to screen sizes or lack of screening).

ACKNOWLEDGEMENTS

We extend warm thanks to the Bishop Museum Anthropology Department for providing us with access to the archived M3 and M5 site materials. The American Museum of Natural History generously awarded JK a Collection Study Award allowing her to work with Roger Green’s Papeto’ai Collections. Jennifer Newell, Kristen Mable and Jacklyn Lacie greatly facilitated access to archived collections at AMNH, as well as approval of a collections loan request, and approval of the destructive dating analysis. Kristen Mable is likewise thanked for scanning the Green and Rappaport field notebooks. Gail Murakami (IARII) completed the wood charcoal identifications of the M3 and M5 collections, while Emilie Dotte-Sarout completed the wood charcoal identification on the ScMf-2 and ScMf-5 collections. A recent collaboration with archaeologists from the Department of Archaeology, French Polynesia on salvage archaeology in the vicinity of ScMf-5 at Papeto’ai, Mo’orea, and discussions therein, peaked JK’s interest in re-dating the Green collections. She thanks Belona Mou and

Tamara Maric for the invitation to collaborate on the Papeto‘ai excavations, as well as the Tahitian and French students and members of the Service de la Culture who aided in the 2014 excavations. National Science Foundation Grant CNH Award Number 1313830 provided funds to JK for dating the archived samples.

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ABSTRACT

The Society Islands are critical to chronology building in East Polynesia, as the archipelago served as a potential first landfall for voyagers moving out of the West Polynesia homeland. Yet determining the particulars of migration sequences and settlement chronology in the Society Islands, like the rest of East Polynesia, has been challenging. Here, we report on a dating and re-dating program of four coastal sites on the island of Mo'orea, Windward Society Islands, aimed at refining the archipelago's cultural chronology and its place within larger settlement trends for East Polynesia. We begin with a brief discussion of 1960s archaeological research in the Society Islands and the archipelago's role in the East Polynesian colonisation debate before turning to a discussion of the newly dated and re-dated Mo'orea coastal sites. Our new corpus of ¹⁴C dates provides evidence for two well-studied Mo'orea Island sites dating to the Colonisation Phase (GS-1 and ScMf-5). The earliest dated occupation of the ScMf-5 site contained an earth oven, diverse artefacts and dense faunal remains indicative of a permanent, and perhaps large, settlement along the north shore of Mo'orea. Results point to established Society Island populations from the 11th to 13th centuries AD, supporting both the Conservative Model of East Polynesian settlement and more inclusive synthetic models. Developmental Phase dates from ScMf-2 illustrate that new parts of the Mo'orea north shore were inhabited at this time, while other earlier coastal sites continued to be occupied, tentatively suggesting population increase. The re-dated M5 site, with its elaborate temples of the 'Oro cult style, fits well into accepted dates for the Classic Phase. Our re-dating program has not only allowed us to refine the Society Islands cultural sequence, but has permitted precise identification or confirmation of two sites dating to the Colonisation Phase.

Keywords: Chronology building, settlement, Society Islands, central East Polynesia, colonisation, Mo'orea Island

CITATION AND AUTHOR CONTACT DETAILS

Kahn,¹ Jennifer G. and Yoshihiko Sinoto,² 2017. Refining the Society Islands Cultural Sequence: Colonization Phase and Developmental Phase Coastal Occupation on Mo'orea Island. *Journal of the Polynesian Society* 126 (1): 33-60. DOI: <http://dx.doi.org/10.15286/jps.126.1.33-60>

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