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– ARTICLE –

Marquesan Colonisation Chronologies and Post-colonisation Interaction: Implications for Hawaiian origins and the 'Marquesan Homeland' hypothesis

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ABSTRACT

The research of Patrick Kirch, within the Hawaiian Islands and beyond, has forged understanding of Hawaiian origins and the chronology of Polynesian island settlement for more than four decades. As he outlines in his recent review of the Hawaiian sequence, improved radiocarbon chronologies, along with new archaeological and palaeoecological evidence, has led to a growing consensus that Hawaiʻi was probably settled around the 11th to 13th centuries AD. Historically, archaeologists have considered the Marquesas Islands, some 3,500 km to the southeast, a likely Hawaiian homeland. This issue is revisited here, asking whether recent studies reinforce or undermine the Marquesas Islands as a source area. New sites and new chronometric data show that the Marquesas were settled as early as any other central East Polynesian archipelago (with the possible exception of the Societies) and perhaps early enough to have fostered Hawaiian colonists. Analysis of Marquesan ^{14}C results on short-lived materials (lifespans of ≤10 yr) unambiguously place Polynesians in the archipelago in the 13th century, while numerous dates on other materials point to the likelihood of colonisation from the 11th to 12th centuries. Less secure results intimate colonization could date from the 10th to 11th centuries AD. Other evidence (ceramics and stone tool geochemistry) indicates multiple and unusually far-ranging regional contacts between roughly the 12th to 15th centuries, a situation which suggests superior and sustained voyaging. The evidence reviewed here is sufficient to continue entertaining the possibility that the Marquesas Islands were a departure point for the Polynesian settlers of Hawaiʻi, although many uncertainties remain.

Keywords: Marquesas Islands, Hawaiian colonisation, radiocarbon chronologies, stone tool geochemistry, voyaging and interaction, Polynesia

INTRODUCTION

From the time of Captain James Cook forward, western scholars have marvelled over the blue-water sailing abilities of Polynesians, the geographic scale of their dispersal and settlement of the Hawaiian Islands in particular. More than 3,500 km from the East Polynesian heartland, colonisation of the Hawaiian chain required negotiation of large expanses of nearly empty ocean and challenging sailing conditions; it was in many respects the pinnacle of Polynesian maritime achievements and significant on a global scale. Determining when, and from where, the Polynesian colonists of Hawaiʻi set sail is crucial to understanding local and regional processes of cultural, linguistic and biological divergence (Kirch & Green 1987). These issues have engaged Pat Kirch, both in Hawaiʻi and the broader Pacific, for much of his career, leading to important field discoveries and theoretical insights (e.g., Kirch 1973, 1986, 1996; Kirch *et al*. 2010; Kirch & Green 2001; Kirch *et al*. 2004; Kirch & Kelly 1975; Kirch & Yen 1982; Pearson *et al*. 1971), as well as substantive syntheses (e.g., Kirch 1984, 1985, 1997, 2000; Kirch & Green 2001). Kirch (e.g., 2004, 2007a, 2007b) also has stimulated global and cross-disciplinary interest in Polynesian colonisation, settlement, and adaptations (e.g., Diamond 2005; Vitousek *et al.* 2010; Whittaker 1998), with important flow-on effects for other Pacific scholars.

In the past oral traditions, material culture, and linguistics have variably identified the Society, Marquesas, Cook and/or Samoa islands as possible Hawaiian homelands. Historically, archaeology has privileged the Marquesas, but relying heavily on what we now know are problematic radiocarbon dates (e.g., Suggs 1961) and related ideas about the regional primacy of Marquesan settlement (Sinoto 1970). While it is not possible on present evidence to pinpoint the precise Hawaiian homeland(s), particularly on archaeological grounds alone, we can consider whether the necessary conditions for discovery and colonisation of the Hawaiian chain were met in potential

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source archipelagos. Among the questions which might be asked: Were potential source islands like the Marquesas settled early enough to be a departure point for Hawai'i? Did these populations have the sailing capacity to reach the Hawaiian Islands? Did local conditions encourage or stimulate voyaging and exploration? In this paper I evaluate and compare the early Hawaiian settlement record with chronological evidence from early Marquesan sites. I also consider whether Marquesan populations were isolated and sedentary or, alternatively, mobile and regionally-connected, during the most likely periods of Hawaiian settlement, drawing mainly on ceramic and stone tool geochemistry evidence.

HAWAIIAN COLONISATION MODELS

Three recently proposed models for the timing of Polynesian colonisation of Hawai'i provide a backdrop for this discussion. They are referred to here as the *Conservative*, *Synthetic* and *Bayesian Models*, and differ not only with respect to the proposed timing of Hawaiian colonisation but also in their evidence and assumptions. The intention is not to critique these models but to examine the Marquesan record against their predictions.

The *Conservative Model* derives from a meta-analysis of the corpus of East Polynesian ^{14}C results. It relies on a subset of the regional ^{14}C inventory, a series of results the authors refer to as 'Class 1 dates' which are defined as samples '*dominated* [emphasis mine[2]] by short-lived plant materials (such as small twigs, leaves, and seeds)' (Wilmshurst *et al*. 2011: 1816). Of the 306 Hawaiian radiocarbon results assessed by Wilmshurst and colleagues (2011), only 22 were assigned to their 'Overall reliability Class 1' (Table S1) and 21 of these form the basis for their estimation of Hawaiian colonisation (p. 1817, Figure 3). These derive from four sites distributed across Kaua'i, O'ahu, Moloka'i, and Hawai'i islands, with conventional radiocarbon ages (CRA) ranging from 790±40 to 330±30. On the basis of the summed probability distribution of these samples, they place Hawaiian colonisation between AD 1219 and 1266 (p. 1818, Figure 4).

The *Synthetic Model* (Kirch 2011) considers not only ^{14}C dates from archaeological sites but also palaeoenvironmental evidence that suggests anthropogenic disturbance, and chronological evidence from the East Polynesian region at large. After assessing a handful of sites once believed to represent the earliest phase of Hawaiian settlement, Kirch concludes that only Bellows Dune (Site O18) provides a reliable set of radiocarbon results relevant to Hawaiian colonisation. Considering the three foregoing lines of evidence, Kirch (2011: 22) concludes that Polynesian settlement of Hawai'i dates between AD 1040 and 1219 and was 'unlikely to have occurred much before AD 1000, although the event could conceivably have been sometime in the 10th century.'

Dye (2011) employs a Bayesian approach, constraining the potential period of settlement using: 1) the earliest dates on imported Polynesian plants and animals; and 2) the latest date on pre-human materials from the well stratified Ordy Pond, O'ahu sequence (Athens *et al.* 2002). At the latter site, there are unambiguous anthropogenic signatures (i.e., Polynesian biotic introductions) which post-date 800 AD but at the time of Dye's (2011) analysis, could not be more definitively assigned to a particular time period. Depending on which specific flora and fauna are considered acceptable, Dye's approach yields a 95% probability of Hawaiian settlement between AD 810 and 1289 or, alternatively, AD 780 and 1119. More recently, Athens *et al.* (2014) have extended Dye's original analysis, incorporating additional sites and samples. The effect of this new analysis is to bring the original *Bayesian Model* more into line with Kirch's *Synthetic Model*. Referred to here as the *Revised Bayesian Model*, the authors estimate Hawaiian settlement at AD 940–1130 (95% highest posterior density or HPD region) based on Polynesian flora, hearth, and rat bone dates or AD 1000–1210 (95% HPD) on the basis of Polynesian flora and hearth dates alone. In the discussion which follows I use their more conservative estimate which excludes potentially problematic rat bone results (see Athens *et al.* 2014: 151–2).

The foregoing models vary in precision (same or close result on repeated measurement) and accuracy (degree to which they are likely to approximate the actual timing of Hawaiian colonisation). The *Conservative Model* is very precise, but while reliable with respect to identifying a time when Hawai'i was definitively settled, it may be inaccurate in relation to the time of initial colonisation. Dye's (2011) original *Bayesian Model*, in contrast, specified a very long time frame within which Hawaiian settlement probably took place. It is likely to be accurate (the probability that Hawaiian colonisation falls within this time period is high) but the estimate has low precision. The *Synthetic Model*, with settlement estimated at around the 11th to 13th centuries AD, is intermediate in timing, precision, and probably accuracy. Although it relies largely on chronometric results from a single site, Bellows Dune (Dye 2000; Dye & Pantaleo 2010; Pearson *et al.* 1971), in drawing on local Hawaiian paleoenvironmental records and chronometric evidence from East Polynesia at large, accuracy is improved (see also Athens *et al.* 2014).

MARQUESAN COLONISATON AND SETTLEMENT

The Marquesas Islands have long been considered a potential Hawaiian homeland on chronological, linguistic, and material culture grounds. However, several presumed early sites have more recently been shown to be much younger

2 Consistent with this definition, a few samples assigned to Class 1 by Wilmshurst *et al.* (2011) included wood charcoal from tree taxa that can be long-lived, as for example some mixed material samples reported by Allen & Wallace 2007, Table 1.

than originally thought, as for example Hane (Sinoto 1966, 1970 versus Anderson & Sinoto 2002) and Ha'atuatua (Suggs 1961 versus Rolett & Conte 1995). At the same time, several new settlement age sites have been reported, including Hanamiai (Rolett 1998), Hokatu (Conte & Anderson 2003), Manihina Dune (Conte 2002), and Teavau'ua (Allen 2004). Recently, targeted investigations of favourable coastal areas on Nuku Hiva have identified other early occupation sites. The most well investigated of these are Hakaea Beach (Allen & McAlister 2010), Pahumano-o-te-tai in Hatiheu Valley (Allen & McAlister 2013) and a deeply buried layer with cultural remains at Ho'oumi Beach (details forthcoming in Allen *et al.* in prep.), well below occupation layers previously reported by Suggs (1961). Additionally, the early occupation of Teavau'ua in Anaho Valley (Nuku Hiva) is augmented by early dates from other less well investigated areas in the same valley, including the Moetai and Kaniho sites (see below).

Chronology

To facilitate comparison with the Hawaiian models outlined above, initially Marquesan dates on short-lived materials were separated from those on medium-lived, long-lived or unidentified materials. Short-lived materials (SLM) are defined here as those with life spans of 10 years or less following Allen & Huebert (2014). These include nut shells, seeds and other fruits parts, as well as leaves, grass stems, and specimens that can unambiguously be identified as twigs on botanical criteria; mixed samples (those that include longer lived material like branch or trunk wood) are excluded. Second, at stratified sites only ^{14}C results from basal cultural layers were considered. This contrasts with the approach of Wilmshurst *et al.* (2011) where, in some cases, ^{14}C results from overlying strata were included in their summed probabilities, as for example Hakaea Beach. The assumption is made here that occupations in overlying strata cannot represent initial site use. Third, where multiple dates on SLM were available for a given cultural occupation level or stratum outliers (results significantly different at the 0.5 level) were excluded and the remaining results pooled (Figure 1). Outliers were determined using the pooling function of the CALIB ^{14}C calibration program (ver. 7.0.1). This involved initially running a Chi-square test to determine whether pooling was appropriate for a given set of ^{14}C results. When outliers were identified, the most extreme values were removed, one-by-one, until the pooled results returned a 'significantly the same' outcome. This third step provides a 'best age estimate' for a given provenience (e.g., layer or site) and, by pooling samples from the same provenience, each occupation is only counted once in subsequent comparisons at larger geographic scales (e.g., island or archipelago). Finally, only the oldest locality, as determined by ^{14}C results on SLM, is used to derive a conservative estimate of Marquesan colonisation as the aim is to identify first human arrival not established settlement.

Using the above procedures, Marquesas colonisation is conservatively estimated to date to no later than AD 1166 to 1258, the pooled age range from the earliest site where ^{14}C results on SLM are available, the Moetai site in Anaho Valley (Figure 1). This range is a few decades earlier than the Hawaiian *Conservative Model* (AD 1219 to 1266) which is similarly defined on the basis of SLM. It overlaps with the Hawaiian *Synthetic Model* (AD 1040 to 1219) and the *Revised Bayesian Model* (AD 1000 to 1210), but both of these allow for Hawaiian settlement up to a century and a half earlier. However, given that both draw on other kinds of evidence (e.g., palaeoenvironmental data, ^{14}C results on medium-lived plant taxa, etc.) they are not entirely comparable.

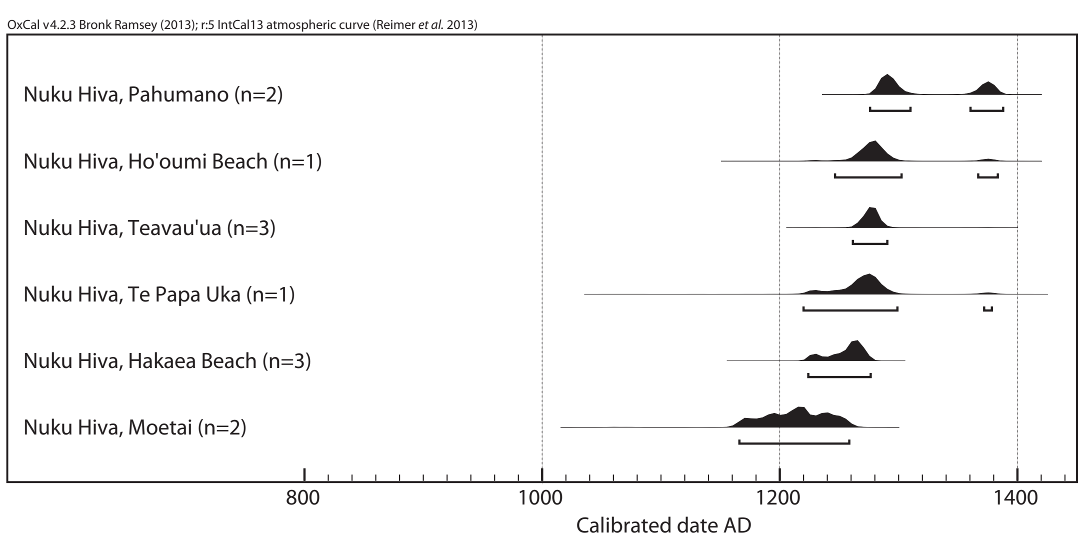

Figure 1. Early Marquesan occupation layers dated by short-lived materials (lifespan of 10 years or less). Results from layers with more than one sample were pooled as per text (data in Table 1).

Table 1. *Marquesan dates from short-lived materials; multiple dates from single proveniences pooled (in bold) where appropriate (see text for details). Distributions are shown in Figure 1.*

Lab Number[1]	Island	Site	Provenience	Material Dated	δ^{13}C‰	Convention ^{14}C age BP	CalAD 2σ range[2]	Type of analysis	Reference
Beta-303439	Nuku Hiva	Pahumano	Layer VII, Zone H, in situ	*Cocos nucifera*, endocarp	−23.9	660±30	1277–1393	AMS	Allen & McAlister 2013
Beta-303440	Nuku Hiva	Pahumano	Layer III, Zone H, oven	*Cocos nucifera*, endocarp	−24.8	690±30	1265–1388	AMS	Allen & McAlister 2013
POOLED MEAN	**Nuku Hiva**	**Pahumano**				**675±21**	**1276–1388**		
Beta-303442	Nuku Hiva	Ho'oumi Beach	Trench 1, Layer III	*Cocos nucifera*, endocarp	−25.4	720±30	1246–1383	AMS	this paper
Wk-20134	Nuku Hiva	Teavau'ua	Layer IV	nutshell, cf. *Cocos nucifera*	−24.7±0.2	696±31	1262–1388	AMS	Petchey *et al.* 2009
OZI-974	Nuku Hiva	Teavau'ua	Layer IV, fire feature	nutshell	−22.7±0.2	730±40	1217–1385	AMS	this paper
Wk-20135	Nuku Hiva	Teavau'ua	Layer IV	nutshell, cf. *Cocos nucifera*	−24.2±0.2	751±31	1221–1288	AMS	Petchey *et al.* 2009
POOLED MEAN	**Nuku Hiva**	**Teavau'ua**				**725±19**	**1261–1290**		
OZK-037	Nuku Hiva	Te Papa Uka	Layer II	nutshell or fruit endocarp	−23.5	735±35	1220–1378	AMS	Allen 2010 (2009)
Wk-22226	Nuku Hiva	Hakaea Beach	Layer VII, in situ	endocarp, cf. *Cocos nucifera*	−24.2±0.2	744±30	1223–1290	AMS	Allen & McAlister 2010
Wk-22228	Nuku Hiva	Hakaea Beach	Layer VII, hearth	endocarp, cf. *Cocos nucifera*	−23.8±0.2	746±30	1222–1289	AMS	Allen & McAlister 2010
Wk-22227	Nuku Hiva	Hakaea Beach	Layer VII, in situ	endocarp, cf. *Cocos nucifera*	−24.2±0.2	824±30	1164–1264	AMS	Allen & McAlister 2010
POOLED MEAN	**Nuku Hiva**	**Hakaea Beach**				**771±17**	**1224–1276**		
Wk-29743	Nuku Hiva	Moetai	Layer IIb	*Cocos nucifera*, endocarp	See below[3]	821±29	1165–1265	AMS	this paper
OZI-977	Nuku Hiva	Moetai	Layer IIb, in situ	nutshell, cf. *Cocos nucifera*	−24.0	855±45	1043–1264	AMS	Allen 2010 (2009)
POOLED MEAN	**Nuku Hiva**	**Moetai**				**831±24**	**1166–1258**		

1 Samples were processed by the following laboratories: Australian Nuclear Science and Technology Organisation (OZ), Beta Analytic Radiocarbon Laboratory (Beta-), and Waikato Radiocarbon Laboratory (Wk-).
2 Samples were re-calibrated with OxCal 4.2.3 (Bronk Ramsey, 2009) using the Northern Hemisphere IntCal13 atmospheric curve (Reimer *et al.* 2013) as recommended by Petchey *et al.* (2009: 2242) for the Marquesas Islands. All samples were carbonised materials.
3 The lab noted that 'because of the small size of this sample, the Carbon-13 stable isotope value (δ^{13}C) was measured on prepared graphite using the AMS spectrometer. The radiocarbon date has therefore been corrected for isotopic fractionation. However the AMS-measured δ^{13}C value can differ from the δ^{13}C of the original material and it is therefore not shown.'

Another concern is that this conservative estimate of Marquesan colonisation excludes some historically important sites from consideration. The lowest strata of Hane (Ua Huka) and Hanamiai (Tahuata) in particular are likely to date to the early settlement period on the basis of the associated fauna, which include remains of extinct and extirpated avifauna (Steadman 2006). How likely is inbuilt age in the ^{14}C results from these sites, and what is the potential magnitude? Allen and Hubert (2014) address this question from a ^{14}C sampling perspective, providing a list of woody taxa to avoid and estimates of their lifespans. Post-hoc, inbuilt age effects can be considered using paired samples from the same provenience. ^{14}C results from the earliest occupation at Teavau'ua (Layer IV) in Anaho Valley, a mesic to dry locality on the northeast coast of Nuku Hiva, are useful in this regard (Figure 2; data from Allen 2004; Allen & McAlister 2010; Petchey *et al.* 2009). The most precise (and presumably most accurate) age estimate for the early Teavau'ua occupation is provided by three samples run on SLM materials, all nutshell and probably coconut (the uncertainty deriving from the small size of the specimens). The marine shell dates (*Pinctada* and *Periglypta*) have broader age ranges, but overlap well with the nutshell results. The wood charcoal determinations, however, one on hardwood and the other on monocot wood (e.g., coconut, *Pandanus*, etc.), are older and the monocot sample suggests inbuilt age could be on the order of a century. Assuming comparability in fuel species and their growing conditions, the Teavau'ua results are a rough guide to the potential for, and magnitude of, inbuilt age effects in other Marquesan sites where SLM are not available (Figure 3, Table 2).

Potentially one of the earliest Marquesan sites, Hane Dune, has a rich stratified sequence of artefacts, faunal

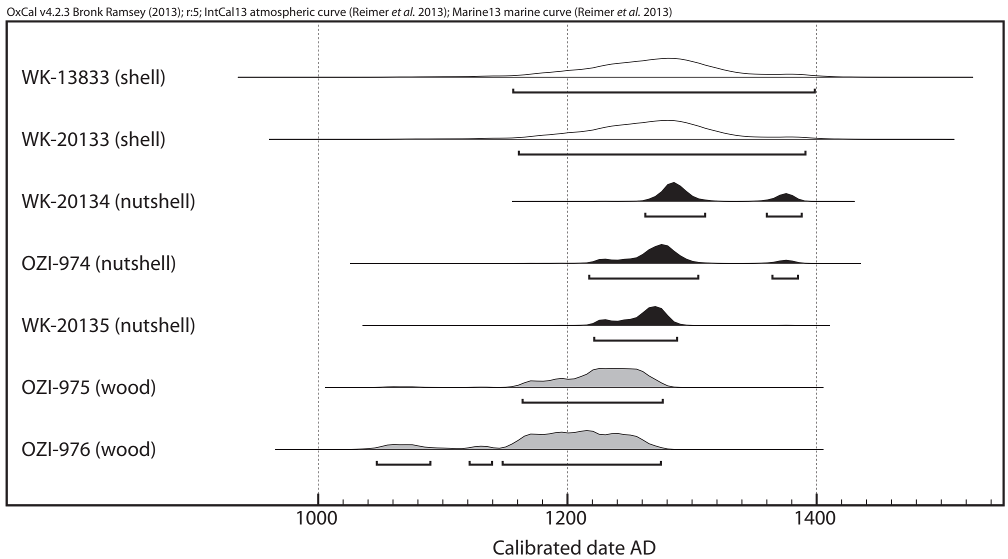

Figure 2. Comparison of ^{14}C results on different sample materials from Layer IV, Teavau'ua (AHO-1), Anaho Valley, Nuku Hiva, Marquesas Islands (data in Tables 1 & 2). Results on short-lived materials in black, marine shell in white, and wood charcoal in grey.

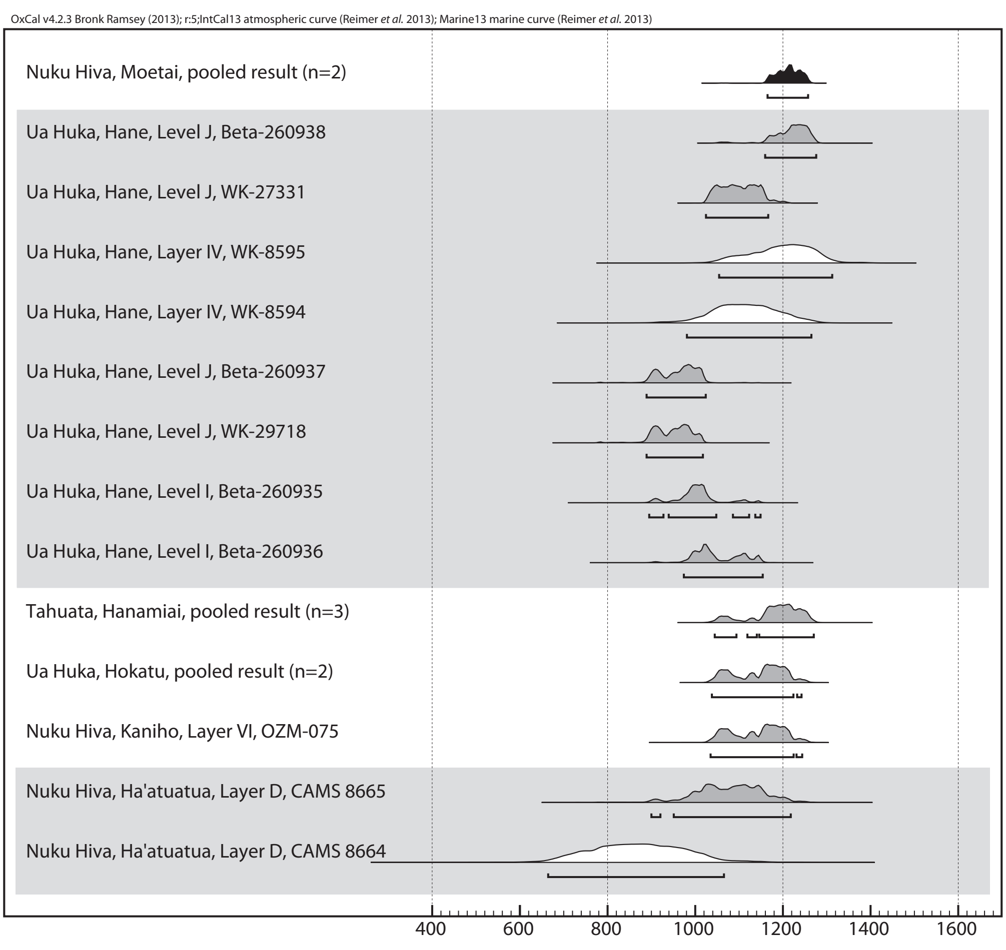

Figure 3. ^{14}C results from early Marquesan sites dated by less secure materials (wood charcoal in grey, shell in white); pooled short-lived material result (black) from Moetai site shown for comparison. Only the most secure Hane Dune dates are shown here; only the two oldest samples met the statistical requirements for pooling (see text).

Table 2. *Other early Marquesan dates on less secure materials. Multiple dates from single provenience pooled (in bold) where statistically appropriate (see text for details). Distributions are shown in Figures 2 and 3.*

Lab Number[1]	Island	Site	Provenience	Material Dated	$\delta^{13}C$ ‰	Conventional ^{14}C age BP	Cal AD 2σ range[2]	Type of analysis	Reference
Wk-13833	Nuku Hiva	Teavau'ua	Layer IV	*Pinctada margaritifera* shell	2.21±0.2	1169±36	1156–1398	regular	Petchey *et al.* 2009
Wk-20133	Nuku Hiva	Teavau'ua	Layer IV	*Periglypta reticulata* shell	1.76±0.2	1172±30	1161–1391	AMS	Petchey *et al.* 2009
OZI-975	Nuku Hiva	Teavau'ua	Layer IV	charcoal, broadleaf wood	−23.2	805±40	1164–1276	AMS	this paper
OZI-976	Nuku Hiva	Teavau'ua	Layer IV	charcoal, monocot wood	−23.9	835±45	1047–1275	AMS	this paper
Wk-29718	Ua Huka	Hane	Level J, firepit	Charcoal, broadleaf wood	not known	1088±25	890–1018	AMS	Conte & Molle 2014
Beta-260937	Ua Huka	Hane	Level J, firepit	cf. palm (wood)	−24.3	1070±40	890–1025	AMS	Conte & Molle 2014
Wk-8595	Ua Huka	Hane	Layer VI	*Cassis* shell	1.9±0.2	1240±50	1055–1313	regular	Anderson & Sinoto 2002
Wk-8594	Ua Huka	Hane	Layer VI	*Pinctada* shell	2.3±0.2	1340±50	982–1266	regular	Anderson & Sinoto 2002
Wk-27331	Ua Huka	Hane	Level J, fire lens	Charcoal, broadleaf wood	−24.6±0.2	928±30	1025–1167	AMS	Conte & Molle 2014
Beta-260938	Ua Huka	Hane	Level J	Charcoal, unid. wood	−26.2	810±40	1160–1277	AMS	Conte & Molle 2014
Beta-260936	Ua Huka	Hane	Level I	cf. palm husk/ outer bark	−23.8	1000±40	975–1155	AMS	Conte & Molle 2014
Beta-260935	Ua Huka	Hane	Level I	Charcoal, cf. palm wood	−23.8	1030±40	896–1150	AMS	Conte & Molle 2014
POOLED MEAN	**Ua Huka**	**Hane**				**1015±28**	**974–1146**		
OZM-075	Nuku Hiva	Kaniho	Layer VI, pit	Monocot, poss. coconut wood	−23.7±0.1	880±40	1036–1245	AMS	this paper
AA2, 819-V3, 737	Tahuata	Hanamiai	Layer H, burnt surface	Charcoal, unid. wood	−25	790±80	1037–1385	AMS	Rolett 1998
AA2, 820-V3, 738	Tahuata	Hanamiai	Layer H	Charcoal, unid. wood	−25	890±80	1015–1273	AMS	Rolett 1998
Beta-15567	Tahuata	Hanamiai	Layer G/H, hearth	Charcoal, unid wood	−26.4	850±60	1040–1270	AMS	Rolett 1998
POOLED MEAN	**Tahuata**	**Hanamiai**				**843±46**	**1045–1271**		
Wk-8059	Ua Huka	Hokatu	Layer F: 1	Charcoal, unid.	−26	860±60	1037–1264	AMS	Conte & Anderson 2003
Wk-8060	Ua Huka	Hokatu	trench base	Charcoal, unid.	−25.8	890±50	1027–1238	regular	Conte & Anderson 2003
POOLED MEAN	**Ua Huka**	**Hokatu**				**878±38**	**1039–1243**		
CAMS-8665	Nuku Hiva	Ha'atuatua	TP14, Layer D	Charcoal	−25.8	970±70	901–1219	AMS	Rolett & Conte 1995
CAMS-8664	Nuku Hiva	Ha'atuatua	TP14, Layer D	*Cellana radiata* shell	0.7	1570±90	665–1066	AMS	Rolett & Conte 1995

1 In addition to the labs identified in Table 1, samples were processed by: Arizona Accelerator Mass Spectrometer Laboratory (AA2) and Centre for Accelerator Mass Spectrometry (Lawrence Livermore) (CAMS-). $^{13}C/^{12}C$ ratios were not measured for the Hanamiai AA2 samples (Rolett 1998: 85).

2 Samples were re-calibrated with OxCal 4.2.3 (Bronk Ramsey 2013). For terrestrial samples, the Northern Hemisphere IntCal13 atmospheric curve (Reimer *et al.* 2013) was used, as recommended by Petchey *et al.* (2009: 2242) for the Marquesas Islands. Marine samples were calibrated using a ΔR value of 45±48 based on known age shells (Petchey *et al.* 2009: 2242) in conjunction with the Marine13 curve (Reimer *et al.* 2013). All samples other than shell were carbonised materials.

remains, and architecture (Sinoto 1970, 1970; Conte & Molle 2014; Molle 2011). A large number of radiocarbon dates are available (n=41) but unfortunately most have been analysed on unidentified materials. Shell dates run by Anderson and Sinoto (2002) are considered here, along with several determinations from Conte and Molle's (2014) new excavations in Area B, with a focus on the site's lowest stratigraphic units (see Table 2). Samples from Conte and

Molle's basal Level J fall into two time intervals (see Figure 3): the late 9th to early 11th centuries (one sample possible palm wood, another unidentified dicot wood) and the early 11th to late 13th centuries (both unidentified wood, one reported as a 'twig' but these are defined elsewhere by the authors as up to 24 mm in diameter). Additionally, a sample tentatively identified as palm husk/outer bark derives from overlying Level I and provides a late 10th to mid-12th century calibrated age range. In Figure 3 Conte and Molle's (2014) dates are shown alongside two shell results from Sinoto's Layer VI (Anderson & Sinoto 2002), a layer Conte and Molle (2014) suggest is contemporary with their Levels I and J on stratigraphic grounds. The *Pinctada* date (AD 982–1266) in particular is likely to be secure given that this is a filter feeder, of modest longevity (< 30 years), and was probably introduced to the site in a fresh state for tool manufacture.

One interpretation of the Hane date series described above is that the two oldest samples are affected by inbuilt age, as at Teavau'ua. If this were the case then Level J might be assigned to the late 10th to early 12th centuries, constrained by results from stratigraphically superior samples, and Level I assumed to be close in time. Alternatively, Level J may represent multiple short-duration cultural activities which occurred over an extended period of time. This latter interpretation is suggested by the site stratigraphy, but there are other reasons as well that this possibility might be further considered. Foremost, the two older samples are from different species (one a dicot, the other a monocot), and they were found in different areas of the site. As such, they are clearly independent chronological estimators, that is, they cannot be different samples of the same tree. Additionally, it seems unlikely that representatives from two quite distinct taxonomic classes (i.e., dicots and monocots) would have identical amounts of inbuilt age (e.g., compare with results in Figure 3). And finally, the lack of overlap with all other ^{14}C results from the same stratigraphic interval is notable. If the latter interpretation is accurate (Level J represents an extended period of time), the oldest dates from Hane (AD 890 to 1025) predate all three Hawaiian colonisation models.

Hanamiai, Tahutata (Rolett 1998) is another important settlement site with a diverse record of human activities but no published SLM dates[3]. The pooled result for three unidentified charcoal samples from the lowest occupation (Layers G/GH[4]) (from Rolett 1998) are shown in grey on Figure 3 (see also Table 2). The 2σ calibrated age range overlaps with a pooled result from Hokatu, Ua Huka (Conte and Anderson 2003) and with another sample from Kaniho, Nuku Hiva where a monocot stem/trunk fragment was recovered in association with a pit feature and sparse cultural remains at the bottom of a stratified sequence. These dates also overlap with Conte and Molle's (2014) later results from Hane Level J, and with the shell dates from the same occupation unit (Anderson and Sinoto 2002).

Finally, there is the large and internally complex Ha'atuatua site which has been excavated on three occasions (Suggs 1961; Sinoto 1970; Rolett & Conte 1995; Rolett *et al.* 1997) but remains chronologically poorly understood. Rolett and Conte (1995: 225) demonstrated that the main settlement here dates between AD 1270 and 1450, and possibly later. There are, however, indications of earlier cultural activity. The deepest excavation level (660–670 cmbd) of Layer D in TP14 provided two early dates, one on unidentified wood charcoal (CAMS-8665) and the other on marine shell (*Cellana radiata*; CAMS-8664). Layer D is described as a 'diffuse cultural deposit lacking features and extending to a depth of around 1 m below Layer C' (Rolett and Conte 1995: 210) and contained faunal remains, artefacts, and charcoal chunks in the lower portion (p. 209). The ^{14}C results hint that cultural activity here may be contemporaneous with the lowest occupation level of Hane Dune, or even earlier, but marked differences in the date ranges of two samples from the same provenience is concerning. The shell could be the result of non-cultural deposition and/or affected by extended surface residence.

As a whole, these less secure samples from five sites on three islands suggest cultural activities throughout the archipelago in the period ~AD 1040–1275 and quite possibly earlier at Hane, and maybe also at Ha'atuatua. This is roughly a century before the SLM age estimate for Marquesan colonisation as defined above (AD 1166 to 1258). Notably, this parallels the Hawaiian case where colonisation estimates based on evidence other than SLM ^{14}C results alone are earlier.

Nature and Distribution of Early Settlements

It also is instructive to compare the earliest Marquesan dates with evidence from succeeding occupations at the same sites. At Hane, initial site use appears ephemeral, with Conte and Molle (2014) identifying three pre-Phase II cultural layers: two domestic activity surfaces (Levels I and J) and a third layer with fauna that lacks features (Layer H). Subsequent levels (Conte and Molle's Level G, Sinoto's Layer V) contain pavements, postmolds, hearths, ovens, and a high density of artefacts and faunal remains dated to the 12th to 14th centuries. At this point in time Hane was apparently a large, permanent, and internally complex settlement spread across a ~300 m^2 area. Similarly, at Hanamiai, Tahuata Rolett's (1998) Phase II, dated to ~12th to 14th centuries AD, is marked by structural evidence, a diversity of artefacts and abundant faunal remains. Established settlement at Ha'atuatua is somewhat later but by the mid-13th to mid-15th centuries AD a settlement of

3 Rolett (2014) recently reported a new SLM date from Phase II of Hanamiai, along with three unidentified wood ^{14}C results from Phase I.

4 Rolett (1998: 75) notes that 'Layer GH…represents the same cultural occupation as Layer H'.

some complexity and duration is in place, with structures, features, and varied artefact and faunal remains (Rolett & Conte 1995: 225).

Overall, these results point to well established Marquesan populations from the 12th to 14th centuries AD. Occupations dating to this time period (Tables 1 and 2) are found the length of the archipelago, from Nuku Hiva in the north to Tahuata in the south. Marquesans also can be placed on Eiao Island at this time, the northern-most island of the archipelago, a major source locality for fine-grained basalt (Charleux *et al.* 2014; Linton 1925). Finished Eiao basalt adzes and chisels have been recovered from the earliest cultural occupations at Hanamiai, Tahuata (Rolett 1998) and on Nuku Hiva in the basal strata at Pahumano (Allen and McAlister 2013) and Teavauu'a (McAlister 2011), as well as being distributed to other East Polynesian localities early in time (see below).

REGIONAL COMPARISONS

The Marquesan record can usefully be compared with other potential Hawaiian homeland archipelagos in central East Polynesia.[5] Although several localities have produced early dates, few analyses have been run on SLM. Probably the most important alternative source areas are the larger land masses of the Society Islands. Fa'ahia-Vaito'otia on Huahine Island is a key site in this respect. This large (ca. 200 by 300 m) settlement has evidence of a wide range of activities which are suggestive of an established village, including domestic residences, canoe shelters, and storage huts (Sinoto 1979, 1983, 1988; Sinoto & McCoy 1975). Of particular interest are Layers IV and V of Vaito'otia and Layer V of Fa'ahia. Anderson and Sinoto (2002, Table 1) report 12 dates from these specific layers, including seven results from their 2002 analysis. However, only five are on short or medium-lived materials: pearl-shell (Wk-8093, ANU-11233), *Terebra* (ANU-11377, ANU-11235), and coconut shell (Gak-5244). The coconut shell sample provided a CRA of 910±75 and was calibrated by the authors to AD 989–1277 (2σ), while the shell dates generally fall within the 11th to 14th centuries AD. More recently, Atholl Anderson and colleagues have obtained another 11 dates from the site (reported in Wilmshurst *et al.* 2011, Table S1). Anderson (pers. com., 2014) has confirmed that they are all on materials with life spans of 10 years or less, and further contextual details are forthcoming. The CRAs range from 768±31 to 982±32 BP. These ^{14}C results could indicate that settlement here predates that of the Marquesas by a century. However, if the earliest dates from Hane are supported by further analyses on SLM, then the case for the priority of Society Island settlement would be considerably weakened.

Other evidence for roughly contemporaneous activity in the windward Society Islands comes from Cook's Bay, Mo'orea Island. Kahn (2012) found probable cultural materials in an apparently secondary context. The cultural material was limited to charcoal flecking and two debitage flakes (p. 57, Table 2) and, while not an occupation layer *per se,* the remains unambiguously document human activity in the general area. These were associated with a ^{14}C date on *Hibiscus tiliaceus* which provided a 2σ age range of AD 1031–1210 (Beta-278687, CRA 910±40). While the possibility of some inbuilt age cannot be excluded (Allen & Huebert 2014: 261, Table 1), the date is in line with the Vaito'otia coconut determination noted above.

The southern Cook Islands are another potential source area for Hawaiian colonists and currently the most reliable age estimate for this archipelago comes from Moturakau Rockshelter, Aitutaki Island (Allen 1994; Allen & Morrison 2013). While a single result from the basal stratum (Zone K) is on unidentified wood charcoal (Beta-25767, CRA 840±80), with a reported age range of AD 1043–1383 (2σ), the upper age limit of this sample is constrained by multiple samples from the overlying stratum. Bayesian analysis narrowed the mostly likely age for initial site use to between AD 1047 and 1297. Equally early samples are available from Tangatatau Rockshelter on Mangaia Island (Kirch *et al.* 1995) but consistent with practices of the time, the dated materials were generally not identified. As such inbuilt age effects cannot be discounted. Dates from the lowest stratigraphic levels concentrate between AD 1260 and 1440, but the early end of some 1σ ranges reported by the authors extend to the 11th century AD.

Looking further south, Onemea, Mangareva also provides relatively early evidence of human activity (Kirch *et al.* 2010). The authors argue that the basal stratum here represents a palimpsest of low intensity but recurring visits, carried out over the course of two-to-three centuries. A variety of materials were dated, including seabird bone, marine shell, land snails, crab shell, *Hibiscus tiliaceus* wood, and possible *Pandanus* matting. Excluding two obvious outliers (unidentified wood and land snails), the seabird (Procellariidae) bone date (Beta-190114, CRA 1380±40) places site use between the late 10th to late 11th centuries AD, while a matting sample of possible *Pandanus* (leaf) (Beta-216278, CRA 790±40) returned a 13th century AD age range (1σ). Similarly early dates have been recovered from sites on nearby Henderson Island but none are on identified materials (Weisler 1995). On geographic grounds both islands are unlikely source areas for Hawaiian settlement; however, they do inform on the timing of Polynesian southward dispersals.

Two conclusions can be drawn from the foregoing. First, outside of Anderson's new Society Island dates, the Marquesan ^{14}C record is essentially as early as that from any other central East Polynesian archipelago, and possibly earlier. A second point is that the current inventory of early East Polynesian sites is small and consequently

5 Outside of the ^{14}C results given in Tables 1 and 2, or where explicitly indicated, all calibrated ranges are as reported by the original authors. Radiocarbon ages are given as in the original texts and when these are identified as CRAs this is indicated.

may be an unreliable basis from which to model regional colonisation processes. Many sites lack ^{14}C results on SLM and often the inventory of radiocarbon results is an insufficient basis for discounting other potential sources of error (e.g., taphonomic disturbances). The result is a great deal of uncertainty about the chronology of initial site use in many localities. The volatility of the East Polynesian radiocarbon record was amply demonstrated at the 78th Annual SAA meetings in Honolulu in 2013 where Hawaiian settlement models were both lengthened and shortened over the course of a few hours. In the intervening months new dates have been published for the Marquesas (Conte & Molle 2014) and the southern Cook Islands (Allen & Morrison 2013) as well. The currently available corpus of ^{14}C results leaves open the possibility of Hawaiian colonisation from the Marquesas, but also the possibility of migrations from the Society Islands, the Cook Islands, and elsewhere.

EARLY MARQUESAN MOBILITY AND INTERACTION

Traditionally, archaeologists have used similarities in artefact styles to inform on interaction between East Polynesian archipelagos. However, as Cachola-Abad's (1993) analysis shows, few artefact types or traits are restricted to the Hawaiian and Marquesas Islands during the early settlement period. On the basis of shared artefact traits, both the Cook and Society Islands remain potential Hawaiian homelands. There are, however, other kinds of evidence that might provide insights into the likelihood of a Marquesan-Hawaiian connection. I consider below patterns of inter-and intra-archipelago interaction during the 10th to 14th centuries and what they suggest about Marquesan mobility.

Marquesan Ceramics

The Marquesas Islands are distinguished as one of two central East Polynesian archipelagos where finds of prehistoric pottery have been identified, the other being the Cook Islands (Walter & Dickinson 1998). Historically, the small assemblage of Marquesan plainware sherds was interpreted as evidence for colonisation from a ceramic-producing West Polynesian area, and subsequent indigenous Marquesan production (Dickinson & Shutler 1974; Suggs 1961). Temper in two sherds from an interior Hiva Oa locality provided especially strong evidence for a local pottery tradition, as described by Kirch and colleagues (1988). However, these two sherds were the last specimens found, and the total number of Marquesan ceramic sherds is only fourteen (Allen *et al.* 2012).

The distribution of this handful of sherds, spread across three islands and four localities (Haʻatuatua, Hoʻoumi, Hane, and Atuona), is intriguing. Petrographic analyses in the 1970s sourced three Haʻatuatua specimens to the Rewa Delta region of Fiji (Dickinson & Shutler 1974). Another three were attributed to Fiji on the grounds that they derive from the same vessels. The remaining eight were once considered evidence of a local Marquesan ceramic tradition. However, Dickinson (in Allen *et al.* 2012) now suggests that the temper used in this final group is consistent with post-arc cover volcanics of Fiji, pyroxene-rich sands found along the north coast of Viti Levu and the northwest coast of Vanua Levu. This recent review of the Marquesan ceramic evidence concludes that, in the absence of any unambiguous evidence for local production, the eight remaining sherds are most likely *also* Fijian imports.

Allen *et al.* (2012) go on to advance three hypotheses for the timing of pottery arrivals: 1) with founding settlers; 2) as a component of long-distance exchange networks operating between the 12th to 16th centuries AD; or 3) as late prehistoric or historic imports. The preponderance of evidence points to the second alternative, although the other two cannot be completely discounted (see also Rolett 1996). The problems relate largely to poor stratigraphic and chronological controls at the sites of recovery. Only at Hane can a time-frame be assigned to the pottery with any confidence. All three Hane specimens derive from Sinoto's (1970) Layer VI (below his Paving 3) and probably date to sometime before the 14th century AD. No new finds were made during Conte and Molle's (2014) recent investigations. Of the remaining Marquesan sherds, those from Haʻatuatua date to sometime after the 13th century, that from Hoʻoumi may be quite late, and the two Hiva Oa examples have no provenience or chronological information (details in Allen *et al*. 2012).

Relevant to the present discussion is the question of how these ceramic vessels were acquired by Marquesans. It seems unlikely that Fijians bearing pots travelled to the Marquesas Islands by-passing all intervening archipelagos. Equally unlikely is the suggestion that down-the-line exchange between Fiji and the Marquesas left no ceramic trail in the intermediary islands, although sampling biases cannot be discounted. A third possibility is that ceramic vessels were obtained by westward-voyaging Marquesans. While direct acquisition of Fijian ceramics might be unlikely, these goods could have been acquired through an intermediary archipelago, such as the southern Cook Islands. Southern Cook Island connections to Samoa are well established through stone tool geochemistry studies (recently reviewed in McAlister *et al.* 2013), while connections with Tonga are suggested by oral traditions. Additionally, the sherds reported by Walter and Dickinson (1989) from Anaiʻo, Mauʻke Island are argued to be from Tongatapu based on the ceramic temper and probably mid-14th century in age.

Notably, there is evidence for considerable movement of people and goods within West Polynesia between the 12th to 17th centuries AD (Aswani and Graves 1998), with contacts occasionally extending eastward. Archaeological records identify the dispersal of fine-grained Samoan basalts to Fiji, Tonga, Tokelau, Tuvalu, southern Cook Islands and elsewhere between the 14th to 17th centuries (Allen & Johnson 1997; Best *et al.* 1992; Sheppard *et al.* 1997; Walter & Sheppard 1996). From the 15th century AD, if not earlier, Tongans were extending their sphere of influence, increasingly engaged in development of inter-island political alliances and expansionist inter-archipelago warfare (Aswani & Graves 1998; Burley 1998; Clark *et al.* 2008). If historical accounts (in Kirch 1984) are indicative, exchanges of earlier times may have included canoes, bark-cloth, whale teeth, *Pandanus* mats, red feathers and ceramics. Given this broader context, it is possible that a few Fijian ceramic vessels percolated through to the Cook Islands in earlier times, an archipelago where Marquesan Island connections have been directly indicated by the find of an Eiao Island stone adze (McAlister *et al.* 2013). To further consider the possibility of Marquesan long-distance interactions I turn to recent results from geochemical analyses of Marquesan stone tools.

Stone Tool Geochemistry

Geochemical analysis of stone tool raw material sources has in recent years emerged as one of the most useful and exciting approaches to Pacific interaction studies. The developments of low cost, non-destructive XRF technology and appropriate analytical methods have been particularly beneficial, allowing for rapid analyses of large numbers of basalt tool samples (adzes, chisels, etc.). McAlister (2011), Lundblad & Mills (e.g., Lundblad *et al.* 2008; Mills *et al.* 2008, 2011) and others are now building on the pioneering work of Best *et al.* (1992), Sheppard *et al.* (1997; Walter & Sheppard 2001), and Weisler (1997, 1998, 2008) who utilised more labour-intensive and expensive XRF technologies that, while still useful, are not always necessary.

More than a decade ago Weisler (1998) recognised the regional importance of the high quality stone found on Eiao Island in the northern Marquesan group (see also Linton 1925; McAlister 2011; Rolett 1998; Rolett et al. 1997). Detailed study of the island's considerable evidence for stone extraction and tool manufacture is currently underway by Michel Charleux, while Charleux and colleagues McAlister, Mills and Lundblad have recently undertaken a comprehensive geochemical analysis of the island's tool quality basalts (Charleux *et al.* 2014). Long-distance dispersals include an adze (AMNH Acc. No. 85-2294) recovered by Roger Green from the Te Amaama site (ScMf-5) on Moʻorea (Society Islands), 1425 km to southwest of the Marquesas. This specimen is associated with a date of 760±80 BP (AMNH-188), calibrated to AD 1173–1406 (2σ) (Weisler 1998: 523). Collerson and Weisler (2007) identified an Eiao Island adze (D465) in the geographically intermediary Tuamotu Islands as well. Further afield, two specimens derive from Kamaka Island (GK-1), Mangareva, 1750 km to the south. One specimen (AMNH Acc. No. 85–2023) is associated with a reported age two sigma range of AD 1294–1428 (640±60 BP, Beta-109016), while the second (AMNH Acc. No. 85-2032) is a surface find (Weisler 1998: 525). In the Mangarevan case, both artefact styles and linguistic traits further suggest not only casual interaction but possibly a Marquesan migration (Green & Weisler 2002: 237) or what Fischer (2001: 120) refers to as an 'invasion' based on linguistic evidence. His close analysis (p. 119) suggests 'The magnitude of lexical intrusion and replacement and of semantic displacement…that occurred at this time on Mangareva reveals that this was no casual exchange between trading partners. The Marquesic intruders subjugated the related Mangarevans.'

More recently, Hermann (2013) recovered Eiao Island stone amongst his Austral Island assemblages and McAlister and colleagues (2013) identified an Eiao adze from the Cook Island Library and Museum collections previously analysed by Sheppard *et al.* 1997. Approximately 2,500 km southwest of the Marquesas, this Cook Island find extends the geographic extent of Eiao Island exports (Figure 4). Most relevant to the present discussion, however, is the recovery of a small flake adze rendered in Eiao stone from Tabuaeran (Fanning Island) in the Line Islands (Di Piazza & Pearthree 2001). Located around 2,400 km northwest of the Marquesas, this archipelago would have been a convenient stopover for navigators searching northern seas for islands and resources. The adze is associated with a coconut shell date, re-calibrated here (OxCal version 4.2) given its direct relevance to present discussions, to AD 1050–1284 (2σ) (Beta-142178; CRA 810±50).

Oral traditions suggest that at least some voyages involving transfers of Eiao Island adzes were undertaken by Marquesans (as opposed to down-the-line exchange). One well known Marquesan tradition relates how Aka and his crew travelled to Aotona (Rarotonga) to obtain red bird feathers (Handy 1930: 130–1). A parallel tradition in the Cook Islands tells of Ata from Iva, thought to be Nuku Hiva (see discussion in Bellwood 1978: 6–7), who spent some time in southern Cook Islands before returning home. Empirical support for these accounts comes from geochemical analysis of a Cook Island surface find (McAlister *et al.* 2014). Other oral histories tell of direct Marquesan contact with Tefiti (possibly Tahiti) and Tona Tapu (Tongatapu) (Handy 1923: 10–12), suggesting that Marquesans voyaged widely, although direct evidence of the latter has yet to be identified.

These findings can usefully be compared with the record of exotic stone imports into the Marquesas Islands. In central East Polynesia generally, imported adzes are widely represented in pre-15th century sites: in the southern Cook (Allen & Johnson 1997; Walter & Sheppard 1997), Line (Di Piazza & Pearthree 2001), Society (Kahn *et al.* 2013), and Gambier islands (Weisler *et al.* 2004), along with Henderson (Weisler 1997) (summarised in Weisler 2008). Much has been written about early East Polynesian exchange and interaction, its role in early regional homogeneity, and its post-16th century decline. Given this regional pat-

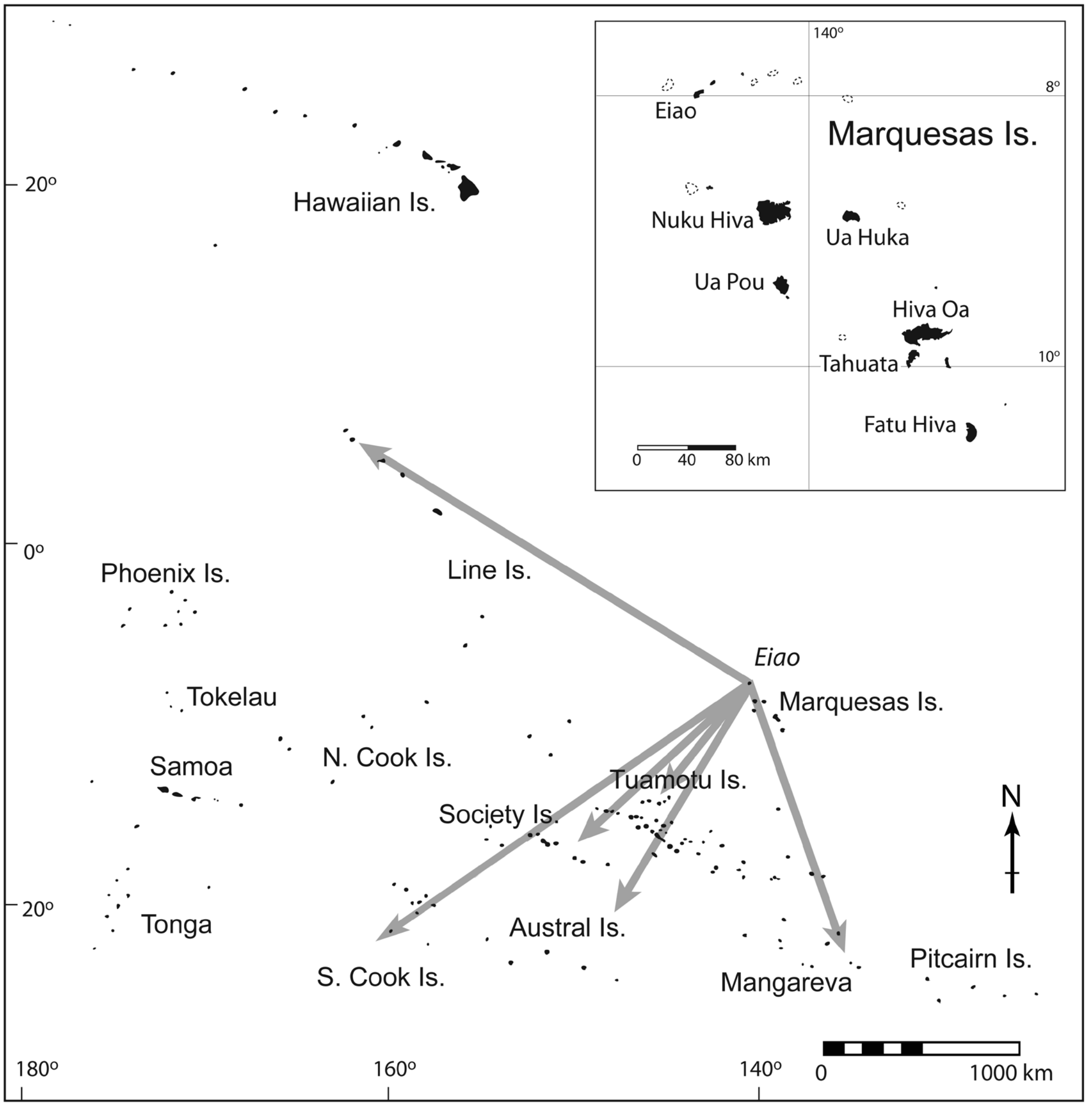

Figure 4. The regional dispersal of Eiao Island (Marquesas) stone adzes.

tern, it was surprising that McAlister's (2011) analysis of more than 200 surface adzes from four Nuku Hiva valleys did not identify a single tool on imported stone. However, these surface collections were most likely late prehistoric in age. An assemblage of 33 excavated specimens from the main Teavau'ua occupation (Layer IIIb) also lacked any materials from extra-archipelago sources. A subsequent study of 115 flaked stone artefacts from the late 13th to late 14th century Pahumano site (Hatiheu Valley) identified seven raw material sources but none from outside the Marquesas (Allen & McAlister 2013). Similarly, only Marquesan sources were identified by Rolett (1998; Rolett *et al.* 1997) at Hanamiai, Tahuata. In short, there is no record of exotic stone imports from other Polynesian archipelagos *into* the Marquesas – only of Eiao Island stone tool exports. The absence of imported stone tools is in stark contrast to other East Polynesian localities, where imports are uncommon but represented. One explanation is that the exceptionally large and high quality Eiao Island source made stone importation un-necessary (McAlister *et al.* 2013). Marquesans may have been more interested in acquiring red feathers, ceramic vessels and other prestige goods such as whale teeth and bark-cloth.

CONCLUDING DISCUSSION

Colonisation Chronologies

At the outset the question was posed, were the Marquesas Islands settled sufficiently early for them to have been a source area for Hawaiian colonists? The results of this analysis, summarised in Figure 5, are suggestive at best on the basis of the ^{14}C record alone. Although there is a long history of archaeological research in the Marquesas, and a modest number of early settlement sites, few of these have been dated by methods which meet contemporary

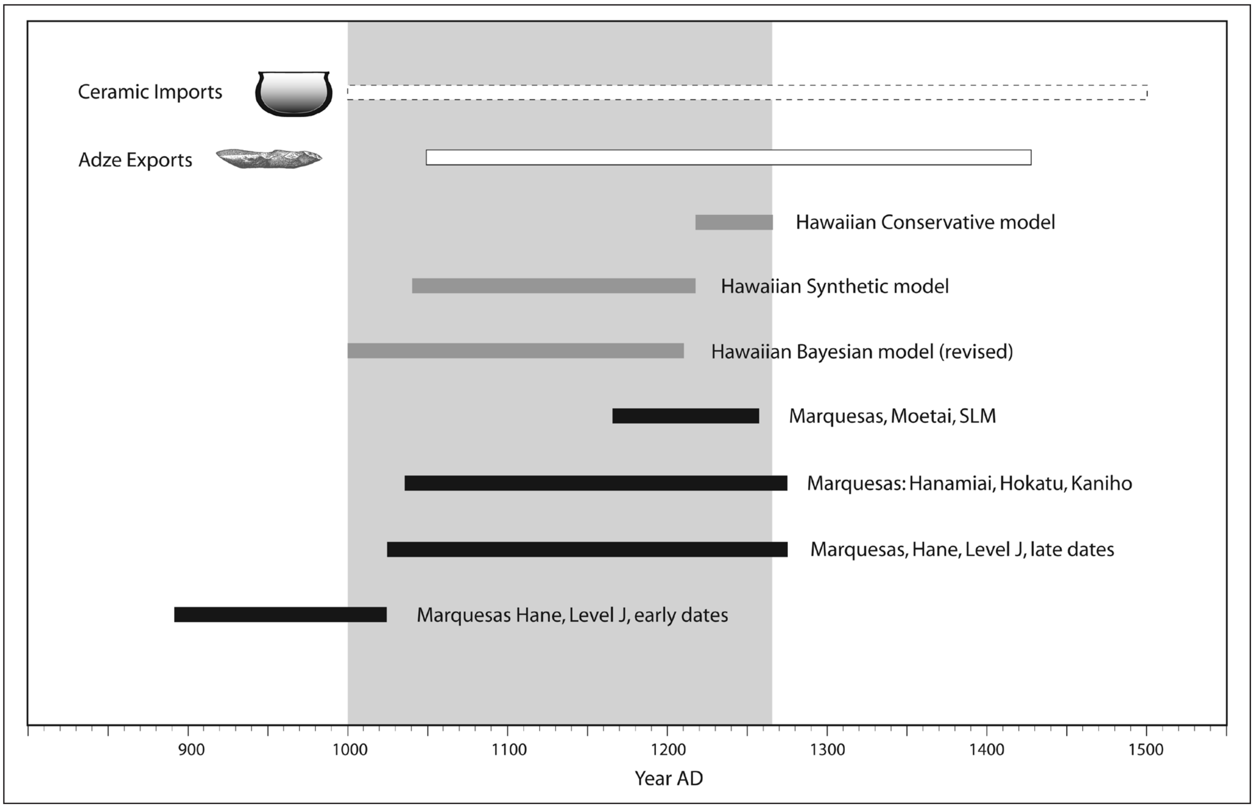

Figure 5. Comparison of the three Hawaiian colonisation models with early Marquesan ^{14}C results, approximate timing of Fijian ceramic imports and dated Eiao Island stone exports. For Hane, only Conte and Molle's (2014) four Level J samples are shown (2σ age ranges). Grey shading identifies the overall hypothesized period of Hawaiian colonisation as modelled by Athens *et al*. 2014, Kirch 2010, and Wilmshurst *et al*. 2011.

standards (Spriggs & Anderson 1993). ^{14}C results on short-lived materials (lifespans of ≤10 yr) unambiguously place Polynesians in the Marquesas Islands in the 13th century (Figure 1), with the Moetai site dating to the period AD 1166–1258 (2σ); in this regard they accommodate Hawaiian colonization as estimated by the *Conservative Model* (Wilmshurst *et al.* 2011). It seems likely, however, that Marquesan colonisation predates this period, as populations were widely dispersed, and some settlements large and established, by the 12th to 14th centuries. Also, several ^{14}C analyses on materials that do not meet the stringent criterion of being short-lived point to the likelihood of settlement from the 11th to 12th centuries AD (Figure 3). The associated occupations are potentially contemporaneous with Bellows Beach, and Hawaiian settlement generally, as predicted by the *Synthetic* (AD 1040–1219; Kirch 2010) and *Revised Bayesian* (AD 1000–1210; Athens *et al.* 2014) models. Hane Dune, however, and the basal cultural activities identified at Ha'atuatua, may be even earlier (Figure 3) and intimate that Marquesan colonization could date from the 10th to 11th centuries AD.

In comparing Marquesan colonisation estimates with those from other central East Polynesian archipelagos, there is much overlap, and dates on SLM are also limited elsewhere. Of note, the early end of the Hawaiian colonisation period as modelled by Dye (2011) in particular, but also Athens *et al.* (2014) to a degree, in effect excludes not only the Marquesas Islands as a potential Hawaiian homeland but also all other East Polynesian islands, unless some central East Polynesian population departed for Hawai'i within a century or so of arrival. A dispersal of this kind would conform to Wilmshurst *et al.*'s (2011) argument for very rapid regional colonisation (see also 'advancing wave' model of Allen & McAlister 2010). However, it is equally likely that as the small inventory of SLM dates expands, and field studies in key archipelagos continue, the picture of East Polynesian colonisation will become more complex. Additionally, along with our quest to understand the chronology of settlement, the cultural and natural processes which underlay regional colonisation need to be more fully considered (see Allen & McAlister 2010: 61–2; Anderson *et al.* 2009).

Marquesan Mobility

The primacy of the Marquesas as a Hawaiian homeland is more strongly supported by the emerging records of long-distance artefact transfers. The outward movement of Eiao

Island stone, probably in the form of finished adzes, over distances of up to 2500 km is remarkable (McAlister *et al.* 2013). This distribution exceeds that of all other central East Polynesian basalt sources. Another striking pattern is the absence of extra-archipelago imports in Marquesan sites, despite geochemical analysis of a large number of stone artefacts from multiple sites spread over a wide geographic area (McAlister 2011, Rolett 1998). While we cannot assume that all Eiao adzes were transported elsewhere by Marquesans, oral traditions suggest at least some were. In this respect, the distances over which they were distributed, combined with the multiplicity of directions they were distributed to (Figure 4), suggest significant navigational skills on the part of Marquesans. The finds of Fijian pottery on three Marquesan Islands also is intriguing, particularly in the absence of ceramics on other central East Polynesian islands, the one exception being Tongan ware in the southern Cook Islands (Walter & Dickinson 1989). The four distinct temper types in these Marquesas sherds also speak to the possibility of multiple occasions of import.

Although the timing of ceramic imports and stone tool dispersals is poorly controlled, the data suggest that the period of greatest Marquesan mobility was between the 12th to 15th centuries AD. During this period Marquesans were interacting, at least indirectly but possibly directly, with numerous archipelagos including the Societies, Mangareva, southern Cook Islands, Line Islands, and possibly even Fiji. Chronologically this is a time when sizable, well-established Marquesan settlements begin to appear, perhaps with sufficient capacity to support the high costs of undertaking long-distance explorations (Finney 1997: 50). American naval commander David Porter (1822: 93) was told that well provisioned and planned voyages had departed the Marquesas on more than one occasion, with one migratory group allegedly involving around 800 people. Linguistic evidence identifies Mangareva as one recipient of Marquesan populations, with the scale of linguistic change indicative of a large scale intrusion (Fischer 2001). Within this context, explorations northward to the Hawaiian Islands are conceivable and, while nautically challenging, the Marquesas Islands compare well with other central East Polynesian archipelagos as a departure point for such voyages.

The possibility of earlier Marquesan voyages of exploration and Hawaiian colonisation in particular are more difficult to appraise. The earliest Marquesan occupations are, in many cases, under-studied and external interactions poorly known. The Hane ceramic sherds hint at external contacts prior to the 13th century AD. More definitively, the Line Island Eiao adze dated by SLM to AD 1050–1284 (2σ range) is important evidence that the Marquesas Islands had been located and most likely colonised by this time interval. However, stone tool geochemistry records from other important early regional sites, such as Faʻahia-Vaitoʻotia in the Societies, Onemea in Mangareva, and Bellows Beach in Hawaiʻi, might help establish the timing of links between early central East Polynesian settlements and those of the Hawaiian islands.

Future Directions

To further the conversation more dates on well identified short-lived materials are needed, as argued by Spriggs and Anderson (1993) more than two decades ago. More geochemical studies, an area that is proving quite fruitful, also would be useful. However, perhaps most importantly, targeted geomorphically-informed field studies will be required for solving the puzzle of East Polynesian dispersals and Hawaiian origins in particular (see also Athens *et al.* 2014). Pat Kirch's pioneering studies of Tikopia (Kirch & Yen 1982), Niuatoputapu (Kirch 1989), Toʻaga (Kirch & Hunt 1993), Mangareva (Kirch *et al.* 2010) and elsewhere are models in this regard. The current regional sample of early sites is a very small and fragile basis for inferring colonisation processes and inter-island relationships, a problem best solved by new field investigations.

Our understanding of East Polynesian prehistory owes much to research of Patrick Kirch, with only a few examples highlighted here. Beyond his numerous field studies in many archipelagos, we have benefitted from his theoretical insights, his long-standing commitment to inter-disciplinary research and his enthusiasm for publishing. We look forward to his continued leadership and insights as we build on his intellectual and empirical foundations. *Mahalo nui loa. He noio ʻaʻe ʻale no ke kai* (Pukui 1983).

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