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A radiocarbon chronology for Sāmoan prehistory

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Abstract

The corpus of radiocarbon dates for Sāmoan archaeology has grown exponentially since the pioneering work of Green and Davidson in the 1960s, enabling us to re-analyze the archipelago's cultural chronology. A reliable and valid radiocarbon chronology forms the basis for describing and explaining cultural variability and change in the central Pacific. Towards that end, in this paper we compile the available radiocarbon dates from published and unpublished (''grey literature'') sources. We critically evaluate 236 radiocarbon dates following a chronometric hygiene protocol to identify the most secure and reliable age estimates. We accept 147 dates (62.3%) as a means of addressing two significant issues for Sāmoan prehistory: (1) the chronology of settlement and human expansion across the archipelago pre-2000 cal BP, which relates to issues of Lapita colonization, and the effect of island geomorphology on settlement; and (2) analysis of the so-called ''Dark Ages'' (ca. 1500–1000 cal BP), a period relevant to issues of social complexity and East Polynesian settlement. Our research highlights the need for a rigorous sampling protocol for radiocarbon dating.

Keywords: Sāmoa; Polynesia; Radiocarbon; Colonization; Lapita; Chronometric hygiene

The chronology of the human colonization of Oceania is a fundamental, yet at times, controversial issue. A well-established chronology provides the foundation for addressing broader research questions including the evolution of resource use, agricultural strategies, competition and interaction, social complexity, and human-induced environmental impacts. A robust knowledge of the cultural chronology for West Polynesia (Fig. 1) is essential to assess the timing, rate, and direction of interaction and settlement in this region. Here we summarize the conventional culture history of Sāmoa and synthesize the radiocarbon data analyzing two periods in Sāmoan prehistory: initial Lapita settlement, and the centuries ca. 1500–1000 cal BP. Data from these periods relate to issues of initial colonization, population expansion, and social change in the archipelago, as well as the later movement of people into East Polynesia.

The past two decades have seen a substantial increase in archaeological field research in the Sāmoan archipelago, particularly in American Sāmoa. Academic research programs and, importantly, cultural resource management (CRM) archaeology projects have created an assemblage of radiocarbon dates in need of synthesis and evaluation. This is particularly true for the bulk of the assemblage, which has been generated by CRM projects where dates remain in a little-known and poorly circulated ''grey literature.'' Without a comprehensive and accessible review of these data, archaeologists have continued to work from the original, but now outdated, culture history model derived from the pioneering archaeological fieldwork of the 1960s and 1970s in Sāmoa (Green and Davidson, 1969a, 1974a; Jennings and Holmer, 1980a; Jennings et al., 1976). Recently, Wallin et al. (2007) have summarized the radiocarbon dates from the western part of the archipelago (Independent Sāmoa) and Smith (2002) examined many of the published dates from the islands in her review of West Polynesian prehistory. These are valuable reviews which we build on by synthesizing the most complete collection of radiocarbon

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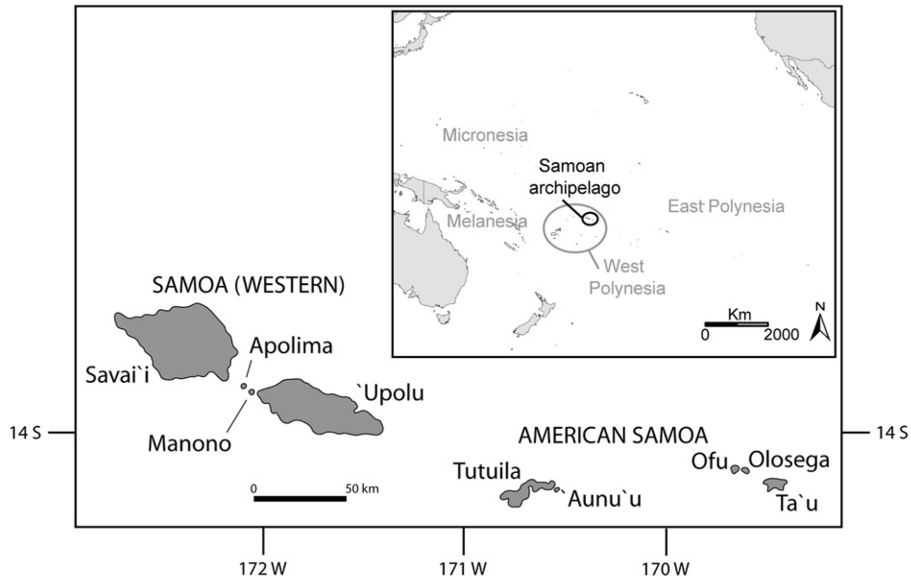

Fig. 1. Map of Sāmoa and the Fiji-West Polynesia Region.

dates from the entire Sāmoan archipelago[1] and critically evaluate the chronology of colonization and settlement across the archipelago. We evaluate the dates using a chronometric hygiene protocol to determine their reliability and validity.

We review acceptable dates in considering two fundamental questions for Sāmoan archaeology: (1) the timing and extent of initial colonization before 2000 cal BP, and (2) the state of archaeological knowledge of the so-called Dark Ages from ca. 1500 to 1000 cal BP. These questions are relevant to issues of Lapita settlement, and later cultural changes, as well as having implications for East Polynesian colonization.

1. Sāmoan prehistory

Green (2002) has provided a recent review of Sāmoan prehistory, one that generally follows the culture history originally proposed over 30 years ago (see Smith, 2002). His more recent overview was meant to provide an organization of settlement pattern data, and, as others have noted (Addison and Asaua, 2006), there has been a conscious resistance to dividing Sāmoan prehistory into culture historical phases (Green and Davidson, 1974b: p. 212). The early emphasis on settlement pattern studies (Green and Davidson, 1969a, 1974a; Jennings et al., 1976; Jennings and Holmer, 1980a) has continued in Sāmoan archaeology (Clark, 1996; Clark and Herdrich, 1993). Thus the culture history model has emphasized not only changes in material culture, but also in settlement patterns and landscape evolution.

[1] To the best of our knowledge we have compiled all of the radiocarbon dates generated by archaeological research in the archipelago up to 2005. An exception is the recent publication of 100 new dates from Tutuila and Manu'a (Addison and Asaua, 2006), which lack associated stratigraphic and culture material information necessary for assessment using our chronometric hygiene protocol.

Green and Davidson (1974b) proposed a chronological framework that Green (2002) largely retains, dividing Sāmoan prehistory, based on settlement pattern data, into four periods: (1) initial Lapita settlement; (2) Polynesian Plainware and the development of a so-called ‘‘Ancestral Polynesian Society’’; (3) a Dark Ages with limited archaeological evidence; and (4) the last ca. 1000 years of Sāmoan history with an emphasis on the Sāmoan village pattern in evidence at the time of European contact. Researchers have continued to find this as a useful way to organize their data (Wallin et al., 2007).

1.1. Lapita settlement (ca. 2900–2700 cal BP)

The current consensus for the initial settlement of Sāmoa follows the broader, regional model for Fiji-West Polynesia (Fig. 1). Early work in the region put initial settlement by colonists associated with the Lapita Cultural Complex at ca. 3200 cal BP, but re-analysis showed this event occurred no earlier than ca. 2900 cal BP (Anderson and Clark, 1999; Burley and Clark, 2003; Burley et al., 1999). This is viewed as a rapid initial settlement represented by a homogenous material culture found across the region. These occupations and their associated material culture have come under the rubric Eastern Lapita, in contrast to assemblages from the western distribution of Lapita. Initial colonists produced pottery with dentate-stamped designs, although plainware dominates all early assemblages (at rates of 85–95%), along with tools and ornaments of stone, shell, and bone. The non-ceramic component of these assemblages includes obsidian, basalt, and chert flakes, adzes produced from shell and basalt, hammerstones, fishhooks, shell peelers, shell rings, and shell ‘‘rectangular units’’ (Green, 1979; Kirch, 1997). Marine resources dominate faunal assemblages, with sparse evidence for the Pacific domesticates: pig, dog, and chicken (Nagaoka, 1993; but see Butler, 1988). The preferred settlement locales were on embayments with reef passages, as would be expected from an apparent emphasis on exploitation of marine resources (Burley and Clark, 2003; Green, 2002), but access to fresh water and potentially cultivable land may have influenced settlement location as well (Lepofsky, 1988).

Lapita ceramic assemblages, as defined by dentate-stamped decoration (Anderson et al., 2002), occupy a limited duration in Fiji-West Polynesia. Throughout the region, forms comprising an Eastern Lapita dentate-stamped decorative system were abandoned within 1–2 centuries after initial settlement (Anderson and Clark, 1999; Burley and Clark, 2003; Burley et al., 1999; Clark, 1996; Green, 2002). The loss of decorated vessels corresponds to a reduction in the number of vessel forms (Burley, 1998; Green, 1974a) and frequency changes in temper size and body fabric (Green, 1974a; Hunt and Erkelens, 1993). These changes are seen to mark the development of an ''Ancestral Polynesian Society'' (Kirch and Green, 2001) and ceramic assemblages termed ''Polynesian Plainware.''

In Sāmoa the primary evidence in support of this model is the early Mulifanua deposit just off the coast of ʻUpolu Island. Mulifanua represents the initial phase of Lapita colonization between ca. 3000 and 2600 cal BP, associated with dentate-stamped pottery (Green, 1974b; Petchey, 1995, 2001), lithic artifacts (Leach and Green, 1989), and a typical coastal location (Dickinson and Green, 1998; Green, 2002; Leach and Green, 1989). Although no other deposits containing dentate-stamped ceramics have been identified, nearly contemporaneous radiocarbon dates from Polynesian Plainware deposits have been recorded at ʻAoa, Tutuila (Clark and Michlovic, 1996) and Toʻaga, Ofu Island (Hunt and Kirch, 1988; Kirch and Hunt, 1993a). Taken together, these deposits and their ceramic assemblages are seen as local variants of a regional pattern of Lapita and early Polynesian Plainware pottery.

In the current view of a rapid and widespread dispersal of colonists marked by Lapita pottery in the Fiji-West Polynesia region, the difference in the number and visibility of early ceramic-bearing deposits in Sāmoa is unique. Efforts to explain the paucity of archaeological deposits containing dentate-stamped ceramics, as well as early plainware deposits in Sāmoa, have raised questions about the consequences of coastal geomorphological processes on deposit formation and preservation. The submerged nature of Mulifanua combined with the deeply buried early pottery deposits at ʻAoa and Toʻaga, located over 150 m from the current shoreline, underscore the dynamic nature of Sāmoan coastlines during the last several millennia (Dickinson and Green, 1998; Clark, 1996; Green, 2002; Kirch, 1993a). As Green (2002: p. 134) correctly observed, ''archaeologists studying settlement patterns over time in Sāmoa must model this in the light of complex geomorphological and dynamic landscape processes that are in each case firmly embedded within both the local island context and the more general pattern of human and natural factors driving the changes.''

These geomorphological factors led Dickinson and Green (1998) and Green (2002) to propose that initial Lapita settlements comparable to Mulifanua were dispersed along the coastlines of ʻUpolu and Savaiʻi. Based on modeling of subsidence for these islands and marine bathymetry, Green (2002) identified likely locations for Lapita settlements, below today's intertidal zone (see Morrison et al., 2007 for a GIS-based model for initial settlement). This perspective assumes that Lapita settlement was spread throughout the archipelago at embayments on larger islands and on some smaller islands (Dickinson and Green, 1998; Green, 2002). In contrast, Clark (1996: p. 450) proposed that initial colonization associated with dentate-stamped ceramics ''was very limited, being represented by Mulifanua and perhaps a few yet undiscovered sites.'' While debate continues on the geographic extent of initial colonization, there is agreement that geomorphological processes including subsidence, volcanism, sea-level change, and coastal progradation and sedimentation have obscured the early deposits. ʻAoa and Toʻaga are deeply buried early ceramic-bearing deposits affected by these factors. Shoreline progradation and the associated increase in the sediment budgets from marine and terrigenous sources, possibly combined with some subsidence at Toʻaga, have resulted in burial of the primary ceramic-bearing deposits under several meters of sediment over 100 m from the present shoreline (Clark and Michlovic, 1996; Kirch, 1993a). Based on these kinds of deposits, it is hypothesized that early settlements, whether containing dentate-stamped pottery or Polynesian Plainware, are likely deeply buried under colluvial and/or biogenic sediments along ancient shorelines.

We can identify six key elements of the consensus view of the initial colonization of Sāmoa.

1. Initial colonists arrived between ca. 3000 and 2600 cal BP and produced dentate-stamped pottery.
2. Multiple early settlements with dentate-stamped pottery may exist, although their number and geographical extent are unclear, and Mulifanua is the only known example.
3. Pottery with dentate-stamped decoration was quickly abandoned, likely within 100–200 years of initial settlement.
4. Early Lapita deposits in the western half of the archipelago are probably submerged in the intertidal zone as a result of island subsidence.
5. On interior parts of the islands, early pottery-bearing deposits may be found deeply buried under terrigenous and/or biogenic sediments along ancient shorelines because of a variety of inter-related geomorphological factors.
6. Although identification of early deposits in Sāmoa is more difficult than in other parts of the Fiji-West Polynesia region, the cultural sequence and patterns are broadly similar, notwithstanding some local variation.

1.2. Polynesian Plainware ceramics and development of ''Ancestral Polynesian Society'' (ca. 2700–1500 cal BP)

The period following Lapita settlement of Sāmoa is characterized by changes in ceramic design and technology as well as a presumed shift in social organization (Kirch and Green, 2001). The transition is marked by the loss of dentate-stamped decorated pottery and a decrease in the number of vessel forms associated with Polynesian Plainware. Distinctions between "thin fine ware" and "thick coarse ware" have been made for the plainware tradition. Over time the ceramic assemblages change from greater proportions of thin fine ware to thick course ware (Green, 1974a; Hunt and Erkelens, 1993). As Clark (1996: p. 450) and others (Jennings and Holmer, 1980b) note, this change is not evident in many deposits where both wares are found. Classification of plainware into thin or thick is based on intra-assemblage statistical measurements, with categories typically defined by the modal distribution of sherd thickness and temper size (e.g., Hunt and Erkelens, 1993).

While initial settlement of Sāmoa occurred at coastal locations, the next several centuries saw inland activities (e.g., agriculture, resource extraction) and expansion of settlement (Green, 2002). Many of the younger Polynesian Plainware deposits commonly accepted as older than ca. 2000 BP are found in coastal zones, including Falemoa, Manono (Jennings and Holmer, 1980c; Lohse, 1980), Vailele and Jane's Camp, 'Upolu (Jennings and Holmer, 1980c), and Ta'ū Village, Ta'ū (Hunt and Kirch, 1988). At least two early plainware deposits are located mid-distance from the coast, although they are not necessarily associated with inland settlement. These locations are Pulemelei on Savai'i (Martinsson-Wallin et al., 2005) and Vaipito on Tutuila (Addison and Asaua, 2006). Evidence of burning, thought to be associated with agriculture, at inland locations of Luatuanu'u and the Falefā valley, 'Upolu (Davidson, 1974a,b,c; Green and Davidson, 1974b), dates to the first several centuries AD. A greater inland expansion associated with residential features continued for several centuries.

The notion that during this post-Lapita period an "Ancestral Polynesian Society" develops is based primarily on comparative linguistic and ethnographic studies (Green, 2002; Kirch and Green, 2001). In a recent analysis, Smith (2002) provides a comprehensive and critical review of the early prehistory of West Polynesia, specifically examining the archaeological evidence for "Ancestral Polynesian Society." She examines the dates and material culture of early Lapita and later Polynesian Plainware deposits. Smith (2002: p. 194) points out that the notion of an "Ancestral Polynesian Society" is based on a linguistic model, where "the expectation that archaeological evidence will reflect language change is unfounded". We concur and add that such models conflate methodology with substantive conclusions about history.

1.3. The "Dark Ages" (ca. 1500–1000 cal BP)

The so-called Dark Ages (Davidson, 1979: pp. 94–95) comprise a period that is lacking abundant archaeological evidence and remains poorly understood. The lack of evidence pertaining to this time seems to be a consequence of the aceramic nature of most of the known deposits dating to ca. 1500–1000 cal BP, thus providing limited surface and subsurface indications of human activity. Archaeological deposits lacking pottery were likely overlooked in field surveys focused on early pottery-bearing deposits, on the one hand, and late monumental architecture on the other. As Green (2002: p. 140) notes, "without pottery to easily alert us to habitation layers in the interval between AD 500 and AD 1000, most dates falling between these intervals relate to traces of agricultural practices found at the base of later more substantial occupation features." Despite problems detecting deposits of this age, he believes that during this time settlement expanded over much of the landscape of the archipelago (Green, 2002: p. 140). Archaeologists recognize that the Dark Ages form a gap in knowledge as an artifact of archaeological research agendas. Given attention to early pottery-bearing deposits and later monumental architecture, no research program has specifically focused on this poorly visible portion of the archaeological record. However, a number of deposits have been dated to this time and provide some information about material culture and subsistence.

1.4. Monument building and the "Traditional" Sāmoan village (ca. 1000–200 cal BP)

The last 1000 years of Sāmoan prehistory saw the development of monumental architecture and expansive settlements extending along the coasts and into valleys. The household unit (HHU) has been proposed as the basic unit of a nucleated village settlement (Holmer, 1980a; Jennings et al., 1982). Some researchers have suggested that the HHU as aggregate features, usually consisting of raised and/or sunken walkways, stonewalls, stone and earth platforms, and large raised rim earth ovens, reflect extended family group occupations as recorded ethnohistorically (Green, 2002: p. 140; Holmer, 1980a; Jennings et al., 1982). As such, statistical analyses of HHU size and various metric attributes of individual features of the HHU have been calculated in attempts to differentiate village ranking and status (Holmer, 1980a; Jennings et al., 1982). Although the coastal village settlement pattern recorded at European contact and during the early 19th century is believed to have developed as the predominant settlement pattern, some variations have been documented. These include more dispersed HHUs in inland Falefā Valley (Davidson, 1974c), settlement of ridgelines in inland Luatuanu'u (Davidson, 1969a), and a continuous distribution of extensive settlement features from the coast to far inland at Mt. Olo, 'Upolu, and Letolo, Savai'i (Jennings et al., 1982). However, Davidson (1969b) offered a different conclusion, suggesting that the coastal villages observed in the 19th century reflect post-contact changes, primarily settlement nucleation that followed missionary influence and Sāmoan interests in acquiring Western commercial goods.

It is also over about the past thousand years that star mounds were constructed at inland locations (Herdrich, 1991; Herdrich and Clark, 1993). Ethnohistoric accounts and oral traditions identify these features with the chiefly sport of pigeon catching, and it has been proposed that they mark an increasing social complexity in Sāmoa (Herdrich, 1991; Herdrich and Clark, 1993). Other large earthen and stone mounds were built at this time as well, but unlike the star mounds, they appear to have been domestic features and not public or ceremonial structures. Fortifications (Best, 1993) and large stonewalls, typically termed *Pa Toga* (Tongan fortifications), are another non-domestic monumental form that likely date to this time. These monumental structures are taken to be further evidence of increased social complexity related to a chiefly hierarchy (Burley and Clark, 2003: p. 241).

Research has documented the widespread inter-archipelagic distribution of adzes from Tutuila quarries, particularly from Tātāga mātau, over about the last 900 years of Sāmoan prehistory (Best et al., 1992; Winterhoff, 2005). The geochemical studies have identified Tutuila basalt adzes found in Fiji, Tonga, Tokelau, Phoenix Islands, Taumako, and the Cook Islands (Best et al., 1992; Winterhoff, 2005). Best (1993) and Best et al. (1992) suggest that a portion of the Tātāga mātau quarry was fortified during the period of quarrying and adze manufacturing.

2. Radiocarbon dating and ‘‘chronometric hygiene’’

The development of an absolute chronology of Sāmoan prehistory was an implicit yet critical objective of Green and Davidson's (1969a, 1974a) seminal research program. Green (1969a: p. 5) outlined the main research objectives, which were primarily concerned with typological descriptions of features and portable artifacts, as well as field surveys and settlement pattern analysis. The radiocarbon dates from their excavations provided an absolute chronology for their settlement pattern studies and typological analyses. Although classification of adzes (Green and Davidson, 1969b) and changes in ceramics (e.g., Green, 1974a; Hunt and Erkelens, 1993) continue to aid relative age estimates, the use of radiocarbon dating has been paramount.

We have compiled 236 radiocarbon dates from archaeological excavations in Sāmoa for this analysis. These dates are recalibrated using OxCal v3.10 (Bronk Ramsey, 2005; atmospheric data from Reimer et al., 2004). For wood charcoal samples we calibrated the dates using the Northern Hemisphere calibration curve (Intcal04). We use this curve because the boundary between the atmospheres of the Northern and Southern Hemispheres is considered to lie along the thermal equator or the Inter-tropical Convergence Zone (ITCZ) (McCormac et al., 2004: p. 1088), and Sāmoa lies at the western limit of the ITCZ. We also calibrated human bone collagen samples using the Northern Hemisphere calibration curve; although we acknowledge that marine resources likely provided a significant portion of the ancient diet and calibration including a marine component would produce a somewhat younger age. Accordingly, stable isotope data are needed to refine use of the atmospheric and marine curves to these samples. Marine samples, which include shell and turtle bone collagen, are calibrated using the marine curve (marine04) and a delta r of 57 ± 23, as calculated by Phelan (1999). The dates we report here have been calibrated to two standard deviations (95.4% probability).

3. Radiocarbon events and target events

Radiocarbon dating must be understood as a direct measure of a radiocarbon event, which is used to infer the age of an archaeological target event (Dean, 1978). By measuring the residual radiocarbon content of a sample that has been isolated from the carbon reservoir(s), the age of this separation from atmospheric or marine carbon, i.e., the death of an organism, can be calculated. This event must then be correlated, by a bridging argument, with a target event of archaeological interest. The reliability and validity of a radiocarbon measurement as an estimate of the age of a target event are interrelated issues that form the basis to evaluate the meaning of a radiocarbon date.

In general, radiocarbon dating laboratories provide reliable and accurate results for estimating the age of a radiocarbon event. The ‘‘degree of care and refinement employed in making a measurement’’ (precision) and closeness of the results to a true value (accuracy) (Barry, 1978: p. 15) are both typically high. A reliable and valid age for an archaeological target event is not always the same as a highly precise and accurate radiocarbon result, because these are different events that can be separated by a significant amount of time. The ‘‘old wood’’ and ‘‘old shell’’ (Rick et al., 2005) problems reflect the potentially significant disjunction between a radiocarbon and target event. On the other hand, dating of human bone collagen brings the radiocarbon and target event into congruence. In this case the death of the individual (radiocarbon event) may be identical to the archaeological event of interest (death of the individual). In every case a logical bridging argument must link the event actually dated with the archaeological inference.

Provenience is often used as a measure of association between a radiocarbon sample and a target event (Taylor, 1987:p. 106). The argument that results of radiocarbon dating relate to depositionally associated cultural material is often tacitly accepted. However, using stratigraphic correlation, particularly when dating dispersed charcoal in variable depositional environments, does not always assure a reliable and valid measure of the archaeological event in question (Dye, 2000). A chronometric hygiene protocol offers an explicit strategy to evaluate the relationship between the measured radiocarbon events and the archaeological target events.

3.1. Chronometric hygiene

For this study we establish a chronometric hygiene protocol to evaluate each radiocarbon date (see Anderson, 1991; Spriggs and Anderson, 1993; Spriggs, 1989; Smith, 2002). We modified our protocol from previous chronometric studies focused on the initial settlement of New Zealand (Anderson, 1991; Higham and Hogg, 1997; Schmidt, 2000), East Polynesia (Spriggs and Anderson, 1993), and the Neolithic of Southeast Asia (Spriggs, 1989, 1996). More recently, similar procedures have been applied to examinations of early West Polynesian prehistory (Smith, 2002), cultural chronologies in Palau (Liston, 2005), the colonization of Rapa Nui (Hunt and Lipo, 2006), and in research beyond the Pacific (e.g., Fitzpatrick, 2006; Zilhao, 2001).

A chronometric hygiene protocol is a classificatory procedure that explicitly states the necessary and sufficient criteria for inclusion in the class of acceptable dates. As with any phenomena, multiple classifications may be produced depending on research objectives and goals. Unlike artifact or feature classifications, which are common in archaeology, radiocarbon dates are rarely explicitly classified. Without such a classification or critical means of evaluation, a date is typically deemed acceptable if it meets expected results. When this implicit procedure is combined with research that does not rigorously evaluate the association between the radiocarbon sample, radiocarbon event, and the target event (see Dye, 2000), it remains difficult to assess dates in the context of archaeological research questions. In this regard, we outline a chronometric hygiene protocol for Sāmoan radiocarbon dates to provide the most reliable and valid chronological information for cultural events (i.e., we can confidently associate the radiocarbon event and the target archaeological event).

Under ideal conditions, we should include as valid radiocarbon dates that meet the following criteria.

1. The sample is part of a suite of at least two radiocarbon dates from the same deposit. Importantly, the radiocarbon dates are consistent with stratigraphic order and those from the same stratum are statistically comparable (following Smith, 2002; modified from Spriggs and Anderson, 1993). A single date from a deposit does provide chronological information, but it lacks corroborative information that additional dates would provide (Taylor, 1987: p. 105). Multiple dates comprise a measure of reliability providing some degree of assurance against accepting outlier dates. Corroborative samples can be obtained from vertical and horizontal stratigraphic contexts. Cultural material may be sequentially deposited vertically within a restricted area and horizontally across a landscape. Thus, dates from multiple deposits across a given area can be used as a test against each other if they can be correlated, either based on strata, cultural material, seriation, or other relative dating methods (e.g., abutment and intersection of surface architectural features).
2. The sample material and provenience information are reported. Ideally, a wood charcoal sample has been identified to taxon and represents a short-lived species or specimen with a small inbuilt age (e.g., twigs). For a marine shell sample, the taxon has been identified and assessed for its appropriateness for radiocarbon dating based on its feeding behavior and the local geology (Dye, 1994; following Smith, 2002). It is worth noting that often no wood charcoal identification is reported, and detailed provenience information is lacking. In these instances, as long as general material and provenience information is reported (e.g., charcoal, excavation unit, and stratum) we do not exclude the date based on this criterion.
3. The sample was obtained from a clear cultural context that lacked evidence for secondary deposition or significant post-depositional alterations (following Smith, 2002). Evidence for secondary deposition or post-depositional activities may be based on stratigraphic and/or artifactual data.

The following protocol is used to exclude a radiocarbon date from chronometric analysis.

A. Dates from the Gakushuin Laboratory (Gak-) prior to the 4500 series. Pre-4500 series dates have been anomalous when compared with other laboratory results (following Spriggs and Anderson, 1993; modified from Smith, 2002; see also Kirch, 1984: p. 73 and Spriggs, 1999). Until each early Gakushuin Laboratory date is corroborated by additional radiocarbon dates, assessing their validity is fraught with uncertainty.
B. Samples that produce a conventional radiocarbon age (CRA) with a standard deviation greater than, or equal to, 100 years (modified from Smith, 2002). Given the relatively short chronology (ca. 3000 years), such conventional ages produce probability age distributions that are too large for precise estimations of colonization events or other chronological issues. This criterion is most relevant when shorter-duration events (e.g., initial colonization) are the focus of research.
C. A single radiocarbon sample that combines materials of mixed isotopic fractionation (following Spriggs and Anderson, 1993).
D. Stratigraphically inverted dates that do not overlap at two standard deviations (following Spriggs and Anderson, 1993; modified from Smith, 2002). The inversion of non-overlapping dates suggests that the archaeological context may have been altered and/or a sample was obtained from an intrusive feature.
E. Samples that are not obtained from a cultural context (following Spriggs and Anderson, 1993; Smith, 2002). This applies to the dating of geological deposits that lack archaeological material.
F. Samples obtained from secondary or mixed deposits (following Smith, 2002).
G. Samples that are not reported with sufficient information regarding the conventional age, sample material, or provenience.

We chose to retain dates for the analysis, but deemed them questionable if they meet the following criterion.

H. The sample provides the only radiocarbon date from the deposit (following Smith, 2002; modified from Spriggs and Anderson, 1993; see Taylor, 1987: p. 105). Although ideally a deposit will have multiple dates, with the intent of creating an inclusive protocol, we included single dates if they passed the stipulations of criteria A−G.

4. Chronometric hygiene results

Of a total of 236 radiocarbon dates available for the archipelago, we accept 147 (62.3%) dates. Appendix A (in the online supporting materials) provides a complete tabulation of the radiocarbon dates and explanations for their classification. We excluded most dates based on criteria A and B, dating by the Gakushuin Laboratory and a CRA standard deviation

≥100 years, respectively. The Gakushuin Laboratory problem can be rectified with additional dates from the same deposits. New dates may corroborate the original Gakushuin results, allowing their acceptance in future analyses. Because this criterion differentially affects the results of the earlier research programs in Sāmoa and re-sampling the original excavation areas may be problematic, we raise the possibility of dating of curated radiocarbon samples.

Although charcoal identification to taxon was not a specific criterion in our protocol, it warrants attention. The use of wood identification for charcoal samples remains rare in Sāmoan archaeology. Such identification would aid our understanding of the archaeological record by (1) producing radiocarbon dates of greater reliability and validity through the identification and dating of short-lived taxa or elements, thus reducing any ‘‘old wood’’ issues; (2) providing a direct method of dating introduced plants such as cultigens; and (3) yielding information on floral elements in the environment and used as fuel.

4.1. Savai‘i island

Fourteen radiocarbon dates are accepted from Savai‘i Island (Table 1). These dates come from excavations at Sapapali‘i, the Pa Tonga inland from Pulemelei, and the Pulemelei mound and surrounding features (Fig. 2). These are interior areas with large continuous surface distributions of platforms, paths, stonewalls and additional features. The area designated as the ‘‘early settlement’’ at Pulemelei has yielded the earliest evidence for occupation on Savai‘i, with two dates associated with plainware pottery at ca. 2100–1800 cal BP (Martinsson-Wallin et al., 2005). Additional dates from Pulemelei are significantly younger, dating from ca. 1000 cal BP to the present. It is during this period, from ca. 950 to 550 cal BP, which Martinsson-Wallin et al. (2005) identify the initial construction of the large Pulemelei mound, with a later building phase dating to ca. 550–350 cal BP.

Two additional dates from Savai‘i also fall within the last 1000 years. The date from the Pa Tonga (‘‘Tongan fortification’’) comes from charcoal collected from beneath a stone paved path, thus providing a minimum estimate for the path’s construction. The date from Sapapali‘i has a more direct relationship between the radiocarbon sample and the target event, providing a date of ca. 700–450 cal BP for a large raised rim earth oven (*umu ti*) (Jackmond and Holmer, 1980). Fig. 3 provides a graphical display of the probability distributions of these dates.

4.2. ‘Upolu

Twenty-one radiocarbon dates are accepted from ‘Upolu Island (Table 2). ‘Upolu has the oldest chronology for Sāmoa, with the only identified Lapita (i.e., dentate-stamped decorated pottery) deposit at Mulifanua (Green, 1974b; Petchey, 1995) (Fig. 4). This is a submarine deposit that reflects dramatic shoreline changes with rapid island subsidence (Dickinson and Green, 1998). The acceptable date from Mulifanua

Table 1
Accepted radiocarbon dates from Savai‘i

Sample No.	Site	Provenience	Sample material	$^{13}C/^{12}C$ ratio	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Reference
WK-15501	Pulemelei-early settlement	Trench 9, earth oven	Charcoal	−28.0	2058 ± 38	2130–1920	180 BC–30 AD	Martinsson-Wallin et al. (2005)
WK-13868	Pulemelei-early settlement	Trench 7, earth oven	Charcoal	−27.5	1993 ± 55	2110–2080 (3.3%), 2070–1820 (92.1%)	160 BC–130 BC (3.3%), 120 BC–130 AD (92.1%)	Martinsson-Wallin et al. (2005)
WK-13869	Pulemelei	Trench 3, earth oven	Charcoal	−26.1	1157 ± 44	1180–960	770–990 AD	Martinsson-Wallin et al. (2005)
WK-15502	Pulemelei	Trench 13, charcoal concentration	Charcoal	−26.7	1134 ± 37	1180–960	770–990 AD	Martinsson-Wallin et al. (2005)
WK-15504	Pa Tonga	Trench 1	Charcoal	−26.9	992 ± 34	970–790	980–1160 AD	Martinsson-Wallin et al. (2005)
WK-13864	Pulemelei	Trench 1b	Charcoal	−26.3	900 ± 34	920–730	1030–1280 AD	Martinsson-Wallin et al. (2005)
Beta-172927	Pulemelei	Test pit 3	Charcoal	−27.5	850 ± 50	910–680	1040–1270 AD	Martinsson-Wallin et al. (2003, 2005)
WK-13865	Pulemelei	Trench 2, charcoal concentration	Charcoal	−26.9	754 ± 59	800–630 (89.1%), 600–560 (6.3%)	1150–1320 AD (89.1%), 1350–1390 AD (6.5%)	Martinsson-Wallin et al. (2005)
Beta-177607	Pulemelei	Test pit 6	Charcoal	−26.6	660 ± 80	730–520	1220–1430 AD	Martinsson-Wallin et al. (2003, 2005)
WK-15503	Pulemelei-north settlement	Trench 15	Charcoal	−27.8	657 ± 34	680–620 (46.4%), 610–550 (49.0%)	1270–1330 AD (46.4%), 1340–1400 AD (49.0%)	Martinsson-Wallin et al. (2005)
UGa-1673	Sapapali‘i (SS13-193)	Earth oven	Charcoal		510 ± 60	660–460	1290–1490 AD	Jackmond and Holmer (1980)
WK-13867	Pulemelei-south pavement	Trench 6, charcoal concentration	Charcoal	−27.3	454 ± 46	560–420 (88.8%), 380–320 (6.6%)	1390–1530 AD (88.8%), 1570–1630 AD (6.6%)	Martinsson-Wallin et al. (2005)
WK-13866	Pulemelei-north settlement	Trench 5, earth oven	Charcoal	−26.5	372 ± 43	510–310	1440–1640 AD	Martinsson-Wallin et al. (2005)
ANU-11890	Pulemelei	Top platform	Charcoal	−24.0	310 ± 90	550 to −51	1400–2000 AD	Martinsson-Wallin et al. (2003, 2005)

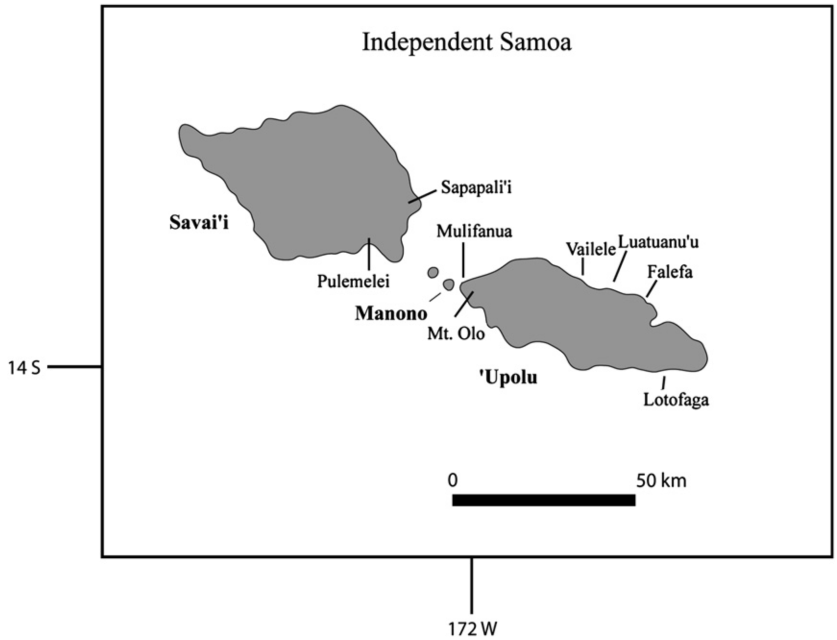

Fig. 2. Map of Independent (Western) Sāmoa showing selected archaeological sites.

calibrates to ca. 3000–2600 BP, followed by an approximately 300 cal year gap in the ʻUpolu chronology. From 2300 cal BP the ʻUpolu radiocarbon assemblage provides a continuous chronology to the historic/modern era. After Mulifanua, the earliest dates are from coastal deposits at Jane's Camp calibrated from ca. 2300 to 2000 BP (Jennings and Holmer, 1980c), followed by dates from ca. 1900 to 1700 cal BP from a mound deposit further inland at Vailele (Green and Davidson, 1965, 1974b). The remaining dates in the sequence come primarily from inland locations generally, 3–5 km from the coast, which include extensive settlements evident in structures on the surface including stone platforms, walls, paths, mounds, and other features. Excavations undertaken primarily in earthen and stone platforms and large mound features produced a continuous chronological sequence from the occupation at Vailele to the early historic period.

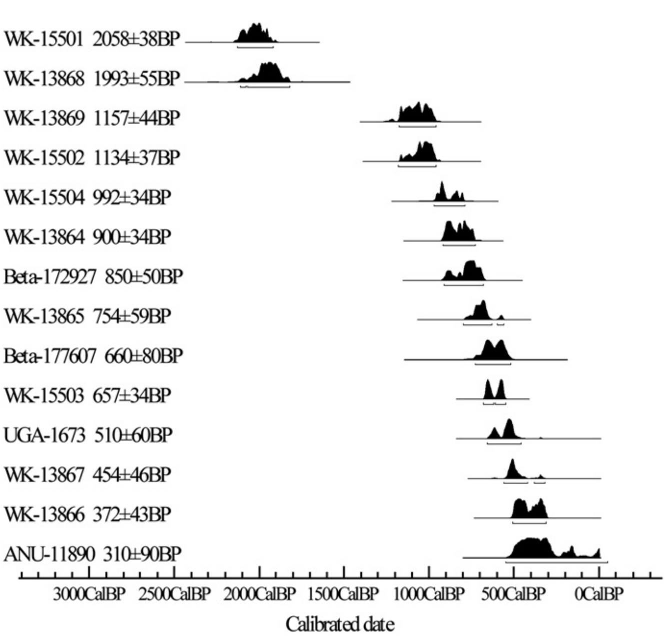

Fig. 3. Probability distributions of the accepted radiocarbon dates from Savaiʻi. Atmospheric data from Reimer et al. (2004); OxCalv3.10 Bronk Ramsey (2005); cub r.5 sd:2 prob usp[chron].

4.3. Manono

We did not include any radiocarbon dates from Manono for this analysis. Jennings and Holmer (1980d) investigated two deposits on the island: Potusā and Falemoa (Lohse, 1980). Jennings and Holmer (1980d: p. 22) identified the deposits at Potusā as secondary colluvium that had also been subjected to substantial bioturbation, thus we exclude these dates based on criterion F. Six radiocarbon dates were obtained from excavations at Falemoa, however, the dates did not produce a series consistent with the stratigraphy warranting rejection based on criteria D and F. For example, samples from the same stratum produced ages differing by approximately 1000 cal years. This discrepancy remains a problem. Both the Potusā and Falemoa deposits contain plainware pottery, shell fishhooks, other shell artifacts, coral artifacts, basalt adzes and flakes, and faunal remains. The presence of pottery in these deposits suggests a relatively early occupation, while the diverse artifact assemblages, particularly the fishing gear, are rare in the archipelago.

4.4. Tutuila

The assemblage from Tutuila Island comprises 81 acceptable radiocarbon dates (Table 3). Tutuila has the largest and

Table 2
Accepted radiocarbon dates from 'Upolu

Sample No.	Site	Provenience	Sample material	$^{13}C/^{12}C$ ratio	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Reference
NZA-5800	SU-17-1, Mulifanua	Dredging spoils	Turtle bone collagen	−16.9	3062 ± 66	2970−2640	1020−690 BC	Petchey (2001)
NZ-2728B[b]	SU-18-1, SU-F1-1, Jane's Camp	Test 1, Stratum I	*Tridacna* sp.		2590 ± 40	2320−2080	370−130 BC	Jennings and Holmer (1980c)
NZ-2727B[b]	SU-18-1, SU-F1-1, Jane's Camp	Test 1, Stratum I	*Tridacna* sp.		2550 ± 50	2300−2020	350−70 BC	Jennings and Holmer (1980c)
NZ-2726B[b]	SU-18-1, SU-F1-1, Jane's Camp	Test 1, Stratum I	*Tridacna* sp.		2510 ± 60	2280−1950	330 BC−0 AD	Smith (1976) and Jennings and Holmer (1980c)
NZ-361	SU-Va-1, Vailele area	L. V, top	Charcoal		1880 ± 60	1950−1690 (93.9), 1660−1630 (1.5%)	0−260 AD (93.9%), 290−320 AD (1.5%)	Green and Davidson (1965, 1974b)
NZ-362	SU-Va-1, Vailele area	L. V, bottom	Charcoal		1850 ± 50	1900−1690 (92.4%), 1670−1620 (3.0%)	50−260 AD (92.4%), 280−330 AD (3.0%)	Green and Davidson (1965, 1974b)
UGa-1991	SU-17-552, Ten points	Base of star mound	Charcoal		1620 ± 65	1700−1370	250−580 AD	Hewitt (1980c) and Jennings and Holmer (1980c)
UGa-1990	SU-17-483, Apulu HHU	Base of pit	Charcoal		1205 ± 70	1280−970	670−980 AD	Holmer (1980b) and Jennings and Holmer (1980c)
UGa-1985	SU-17-91, [a] Tulaga Fale	Pit A	Charcoal		1115 ± 75	1260−1200 (4.4%), 1190−910 (91.0%)	690−750 AD (4.4%), 760−1040 AD (91.0%)	Hewitt (1980a) and Jennings and Holmer (1980c)
UGa-1986	Near SU-17-483, Apulu HHU	Fill from shallow basin beneath stone pile	Charcoal		945 ± 60	960−730	990−1220 AD	Holmer (1980b) and Jennings and Holmer (1980c)
UGa-1487	SU-17-193, Cog Mound Complex	Earth oven	Charcoal		565 ± 60	660−510	1290−1440 AD	Hewitt (1980b) and Jennings and Holmer (1980c)
UGa-1987	SU-17-128, Ma'a Ti	Earth oven	Charcoal		440 ± 60	560−310	1390−1640 AD	Jackmond (1980) and Jennings and Holmer (1980c)
UGa-1992	SU-17-484, Apulu HHU	Posthole in platform 4	Charcoal		365 ± 70	530−290	1420−1660 AD	Holmer (1980b) and Jennings and Holmer (1980c)
NZ-1434	SU-Le-12, Leuluasi	Large post, L. 3, Sq. F-6	Charcoal		286 ± 91	550 to −51	1400−2000 AD	Davidson and Fagan (1974) and Green and Davidson (1974b)
UGa-1988	SU-17-128, Ma'a Ti	Earth oven	Charcoal		285 ± 55	500−270 (87.2%), 190−150 (6.3%), 20 to −11 (1.9%)	1450−1680 AD (87.2%), 1760−1800 AD (6.3%), 1930−1960 AD (1.9%)	Jackmond (1980) and Jennings and Holmer (1980c)
NZ-360	SU-Se-1, Seuao Cave	Fire lens on platform	Charcoal		240 ± 50	470−250 (55.3%), 230−130 (30.1%), 40 to −11 (10.1%)	1480−1700 AD (55.3%), 1720−1820 AD (30.1%), 1910−1960 AD (10.1%)	Green and Davidson (1974b)
NZ-1432	SU-Le-12, Leuluasi	Posthole, perimeter house 1, Sq. D-6	Charcoal (tree−fern)		188 ± 54	310 to −11	1640−1960 AD	Davidson and Fagan (1974) and Green and Davidson (1974b)
NZ-1430	SU-Le-12, Leuluasi	Posthole 2, perimeter house 1, Sq. G-5	Charcoal (tree−fern)		184 ± 75	430−370 (4.2%), 330 to −11 (91.2%)	1520−1580 AD (4.2%), 1620−1960 AD (91.2%)	Davidson and Fagan (1974) and Green and Davidson (1974b)
UGa-1486	SU-17-175, Tausagi	Platform 2	Charcoal		35 ± 70	280−170 (29.4%), 160−10 (62.3%), −1 to −11 (3.7%)	1670−1780 AD (29.4%), 1790−1940 AD (62.3%), 1950−1960 AD (3.7%)	Jennings and Holmer (1980c)
NZ-1427	SU-Le-12, Leuluasi	Center post, house 1, Sq. E/F-6	Wood		Modern	Before 110	Before 1840	Davidson and Fagan (1974) and Green and Davidson (1974b)
NZ-1431	SU-Le-12, Leuluasi	Posthole, perimeter house 1, Sq. E-7	Charcoal (tree−fern)		Modern	Before 110	Before 1840	Davidson and Fagan (1974) and Green and Davidson (1974b)

[a] There is a discrepancy between the site listing in Jennings and Holmer's (1980c) table and the text of Hewitt (1980a). Hewitt (1980a: p. 44) in the primary reference to the date records the provenience of the radiocarbon sample as SU-17-91, which is accepted in this paper.
[b] Same shell sample.

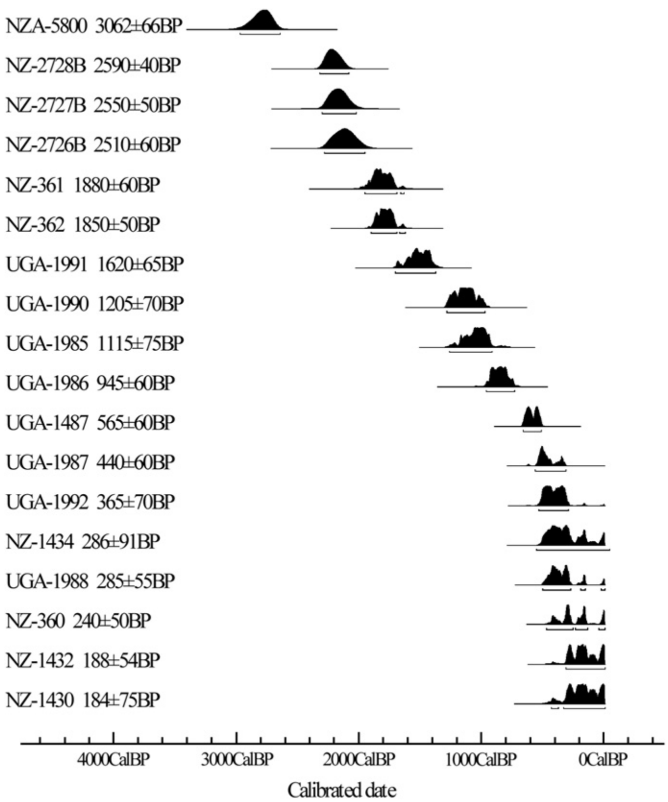

Fig. 4. Probability distributions of accepted radiocarbon dates from ‘Upolu. Atmospheric data from Reimer et al. (2004); OxCalv3.10 Bronk Ramsey (2005); cub r.5 sd:2 prob usp[chron].

most robust radiocarbon sequence for the archipelago, beginning at ca. 2500–2100 cal BP and continuing to historic/modern times (Fig. 5). As with ‘Upolu and Mulifanua, there remains a gap of at least 400 cal years between the earliest date from Utumea[2] on the southeast coast of Tutuila, and the remainder of the chronological sequence. The sequence resumes by 1700 cal BP with multiple dates from areas on the inland edge of the Tāfuna Plain, an area with generally shallow soil development and evidence of late Holocene volcanism (Addison et al., 2006; Stearns, 1944). During the succeeding 500 cal years, cultural deposits are known from the northwest coast (Maloata and Fagali‘i), across the Tāfuna Plain, and at Fatu ma Futi village along the south coast. By approximately 700 cal BP, occupation throughout the island has been identified in coastal and inland locations.

It is worth noting that archaeological investigations on Tutuila are driven by development projects and their CRM investigations. Although areas along the north coast and some inland valleys and ridgelines have been investigated, archaeological data are skewed primarily towards the south shore and inland edge of the Tāfuna Plain, which contains the majority of today’s island population (e.g., Carson, 2005; Cochrane et al., 2004; Kailihiwa et al., 2005; Moore and Kennedy, 1999a,b).

[2] We do not include the early dates from the ‘Aoa deposit in this analysis, but we discuss them below.

4.5. Ta‘ū

We accepted 20 radiocarbon dates from three sites on Ta‘ū Island (Table 4). Fig. 6 provides a graphical display of the probability distributions of the dates. The majority of these dates ($n = 18$) come from excavations at site AS-11-1, Fagā Village (Clark, 1993a; Cleghorn and Shapiro, 2000; McGerty et al., 2002; Shapiro and Cleghorn, 2002), with single dates from both sites AS-11-51, Ta‘ū Village (Hunt and Kirch, 1987, 1988), and AS-11-73 (Herdrich et al., 1996). The date from Ta‘ū Village stands out at ca. 2000–1800 cal BP, and is the only one associated with a primary pottery-bearing deposit. The remaining dates from Ta‘ū represent a continuous sequence from ca. 1300 cal BP to the present. Many of these dates, from ca. 900 cal BP to modern, are associated with stone structural features such as pavings and platforms. Additional dates came from cultural deposits containing faunal remains and lithic artifacts, as well as burials.

4.6. Ofu

Eight radiocarbon dates have been accepted from Ofu Island (Table 5). These dates come from excavations at the To‘aga coastal flat (Kirch and Hunt, 1993a). The results provide a continuous chronology for occupation of the area from ca. 2700 to 1100 cal BP (Fig. 7). The presence of Polynesian Plainware pottery, lithic and shell artifacts, and abundant faunal remains characterize the early cultural deposits. The later dates are from aceramic cultural deposits that are associated with platform and stone paving architectural features.

4.7. Olosega

We accepted three radiocarbon dates from Olosega Island (Table 6). The three dates come from site AS-12-18, Sili Village (Moore and Kennedy, 1997). These dates are from samples of pit features containing charcoal, and in one instance, fire-cracked stone. As the only dates from Olosega Island, they provide a minimal chronology from ca. 1000 to 300 cal BP (Fig. 8), but we expect a longer duration for the island based on evidence from nearby Ofu and Ta‘ū.

5. Initial colonization of Sāmoa: a review of the pre-2000 cal BP dates

There is broad consensus (see papers in Clark et al., 2002) that Lapita appears near-instantaneously across Fiji-West Polynesia region, and that it rapidly simplifies into Polynesian Plainware. Evaluating the earliest human presence in the Sāmoan archipelago requires a critical review of the pre-2000 cal BP radiocarbon dates to refine the accuracy of the radiocarbon chronology. This is a necessary first step in assessing any model for the colonization of the archipelago. Fig. 9 shows the location of the cultural deposits with accepted radiocarbon dates in the pre-2000 cal BP range. A total of 38 radiocarbon dates (16.1% of the entire suite of dates) from the

Table 3
Accepted radiocarbon dates from Tutuila

Lab No.	Site	Provenience	Sample material	$^{13}C/^{12}C$ ratio	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Sources
Beta-120575	AS-22-44, Utumea	TU UT/3, L. IIIb	Charcoal		2310 ± 50	2470–2290 (61.6%), 2280–2150 (33.8%)	520–340 BC (61.6%), 330–200 BC (33.8%)	Moore and Kennedy (1999a)
Wk-13043	AS-31-131	Feas. 95 and 99, TU 6, L. II/Level 1	Charcoal, cf. *Syzygium* sp.		1679 ± 41	1710–1510 (93.5%), 1460–1420 (1.9%)	240–440 AD (93.5%), 490–530 AD (1.9%)	Carson (2005)
Wk-13037	AS-31-131	Fea. 40, TU 9, L. II/Level 3	Charcoal, *Bruguiera gymnorhiza*		1675 ± 41	1710–1510 (92.2%), 1470–1420 (3.2%)	240–440 AD (92.2%), 480–530 AD (3.2%)	Carson (2005)
Wk-14532	AS-31-171, Pava‘ia‘i	Location 3, L. III	Charcoal	−27.0	1657 ± 58	1700–1410	250–540 AD	Addison et al. (2006)
Wk-13050	AS-31-116	Fea. 253, TU 2, L. I/Level 2	Charcoal, cf. *Canarium* sp.		1584 ± 44	1570–1370	380–580 AD	Carson (2005)
Wk-13049	AS-31-116	Fea. 253, TU 2, L. I/Level 2	Charcoal		1564 ± 41	1540–1360	410–590 AD	Carson (2005)
Wk-15844	AS-31-171, Pava‘ia‘i	Location 1, L. III	Charcoal	−27.3	1561 ± 32	1530–1380	420–570 AD	Addison et al. (2006)
Wk-15842	AS-31-171, Pava‘ia‘i	Location 2, L. IV	Charcoal	−26.3	1512 ± 31	1520–1320	430–630 AD	Addison et al. (2006)
Beta-193878	AS-25-062, Fatu ma Futi village	Unit 5, L. IV, Fea. 7	Charcoal	−28.2	1340 ± 40	1300–1120 (92.5%), 1110–1080 (2.9%)	650–830 AD (92.5%), 840–870 AD (2.9%)	Kailihiwa et al. (2005)
Beta-15019	AS-34-34, Maloata	TP 1, L. IV	Charcoal		1240 ± 80	1300–980	650 AD–970 AD	Ayres and Eisler (1987)
Beta-193875	AS-25-062, Fatu ma Futi village	Unit 3, L. IV, Fea. 4	Charcoal	−28.2	1230 ± 40	1230–1200 (2.6%), 1180–970 (92.8%)	720–750 AD (2.6%), 770–980 AD (92.8%)	Kailihiwa et al. (2005)
Beta-195725	AS-25-062, Fatu ma Futi village	Unit 2, L. IV, Fea. 6	Charcoal	−26.0	1190 ± 40	1180–960	770–990 AD	Kailihiwa et al. (2005)
Beta-94528	Malaeimi	Unit 7 W, Stratum III	Charcoal		1200 ± 80	1290–960	660–990 AD	Suafo’a (1998)
Beta-82503	Amaua	Section C, Stratum F, Level V, Burial	Charcoal		1070 ± 60	1170–900 (92.2%), 860–800 (3.2%)	780–1050 AD (92.2%), 1090–1150 AD (3.2%)	Eisler (1995)
Wk-16246	AS-31-171, Pava‘ia‘i	Location 2, L. II	Charcoal	−26.3	1066 ± 35	1060–920	890–1030	Addison et al. (2006)
Beta-152732	AS-31-131	Fea. 40, STP 27/28, L. II, charcoal subfeature	Charcoal	−26.3	1050 ± 40	1060–910	890–1040 AD	Cochrane et al. (2004)
Beta-193872	AS-25-062, Fatu ma Futi village	Unit 1/3, L. III, Fea. 1B	Human bone collagen	−18.3	1050 ± 40	970–790	980–1160 AD	Kailihiwa et al. (2005)
Beta-193871	AS-25-062, Fatu ma Futi village	Unit 1/3, L. III, Fea. 1A	Human bone collagen	−18.6	1030 ± 40	960–790	990–1160 AD	Kailihiwa et al. (2005)
Beta-193874	AS-25-062, Fatu ma Futi village	Unit 3, L. III, Fea. 3	Human bone collagen	−19.1	1030 ± 40	960–790	990–1160 AD	Kailihiwa et al. (2005)
Beta-165151	AS-31-131	Fea. 106, TU 1, L. II/Level 1	Charcoal		1020 ± 50	1060–790	890–1160 AD	Carson (2005)
Beta-152734	AS-31-99	STP 9, SubFea. 1	Charcoal	−28.8	990 ± 50	1050–1030 (1.5%), 990–780 (93.9%)	900–920 AD (1.5%), 960–1170 AD (93.9%)	Cochrane et al. (2004)
Beta-193873	AS-25-062, Fatu ma Futi village	Unit 1, L. III, Fea. 2	Human bone collagen	−17.5	980 ± 40	930–760	1020–1190 AD	Kailihiwa et al. (2005)
Beta-13735	Fagali‘i Village	Pole 34BH33-C, Fea. 1, earth oven	Charcoal	−26.8	960 ± 40	960–780	990–1170 AD	Cleghorn and McIntosh (1999)
Wk-13036	AS-31-131	Fea. 40, TU 4, L. I/Level 1	Charcoal, *Brugiera gymnorhiza*		959 ± 42	960–780	990–1170 AD	Carson (2005)
Beta-13736	Fagali‘i Village	Pole 34BH33-C, Fea. 2, earth oven	Charcoal	−26.8	950 ± 40	940–760	1010–1190 AD	Cleghorn and McIntosh (1999)

(*continued on next page*)

Table 3 (*continued*)

Lab No.	Site	Provenience	Sample material	$^{13}C/^{12}C$ ratio	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Sources
Beta-48912	AS-34-45, Leone Valley	TP 6, L. V	Charcoal	−28.8	930 ± 80	970–680	980–1270	Clark (1993a)
Beta-48052	AS-34-44, Leone Valley	TP 9, L. I	Charcoal	−28.1	780 ± 70	910–850 (6.1%), 840–640 (85.9%), 600–560 (3.4%)	1040–1100 AD (6.1%), 1110–1310 AD (85.9%), 1350–1390 AD (3.4%)	Clark (1993a)
Beta-13733	Vatia Village	Pole 3CB53-A, L. III, Fea. 1	Charcoal	−24.6	740 ± 40	740–650 (92.4%), 590–560 (3.0%)	1210–1300 AD (92.4%), 1360–1390 AD (3.0%)	Cleghorn and McIntosh (1999)
Beta-193195	AS-25-009, Levaga Village	TU 1, lowest cultural stratum	Charcoal, twig	25.2	720 ± 40	740–640 (83.8%), 590–560 (11.6%)	1210–1310 AD (83.8%), 1360–1390 AD (11.6%)	Pearl (2004)
Beta-120572	AS-23-42, Masausi	TU MA/1, L. VII	Charcoal		710 ± 50	740–620 (72.7%), 610–550 (22.7%)	1210–1330 (72.7%), 1340–1400 (22.7%)	Moore and Kennedy (1999a)
Beta-171845	AS-32-008, A'asu Valley	Block A, L. IIIb	Charcoal	−28.6	710 ± 40	730–630 (77.2%), 600–560 (18.2%)	1220–1320 AD (77.2%), 1350–1390 AD (18.2%)	Pearl (2006)
Beta-193194	AS-21-002, Lefutu	TU 1, Burned layer	Charcoal, vine	−27.0	690 ± 40	700–620 (62.1%), 610–550 (33.3%)	1250–1330 AD (62.1%), 1340–1400 AD (33.3%)	Pearl (2004)
Beta-193196	AS-24-002, Old Vatia	TU 2, lowest cultural stratum	Charcoal, hardwood stem	−27.4	670 ± 40	690–620 (51.4%), 610–550 (44.0%)	1260–1330 AD (51.4%), 1340–1400 AD (44.0%)	Pearl (2004)
Beta-13734	Vatia Village	Pole 3BK67-A, L. IV, possible earth oven	Charcoal	−27.0	670 ± 40	690–620 (51.4%), 610–550 (44.0%)	1260–1330 AD (51.4%), 1340–1400 AD (44.0%)	Cleghorn and McIntosh (1999)
Beta-82504	Utusia	Utusia A, Column 1, Level II	Charcoal		650 ± 90	740–510	1210–1440 AD	Eisler (1995)
Beta-180372	AS-32-008, A'asu Valley	Block D, L. IIIa	Charcoal	−25.8	650 ± 50	680–540	1270–1410 AD	Pearl (2006)
Wk-13042	AS-31-131	Fea. 115, TU 5, L. II/Level 1	Charcoal, cf. *Glochidium ramiflorum*		646 ± 40	680–550	1270–1400 AD	Carson (2005)
Beta-194326	AS-21-002, Lefutu	TU 1, Burned layer	Charcoal, hardwood stem	−26.1	640 ± 40	670–550	1280–1400 AD	Pearl (2004)
Beta-171844	AS-32-008, A'asu Valley	Block A, L. IIIb, hearth feature	Charcoal	−23.4	630 ± 40	670–540	1280–1410 AD	Pearl (2006)
AA-51256	AS-32-008, A'asu Valley	Block A, L. IIIb	Charcoal	−27.1	635 ± 35	670–550	1280–1400 AD	Pearl (2006)
AA-51257	AS-32-008, A'asu Valley	Block A, L. IIIb, hearth feature	Charcoal	−26.5	625 ± 35	670–550	1280–1400 AD	Pearl (2006)
Beta-193877	AS-25-062, Fatu ma Futi village	Unit 2, L. II, Fea. 5	Charcoal	−27.5	610 ± 50	660–510	1290–1440 AD	Kailihiwa et al. (2005)
NZ-7598	Tātāga mātau, star mound terrace	Unit 1, L. B2	Charcoal		602 ± 50	670–530	1280 AD −1420 AD	Best et al. (1989)
Beta-38753	AS-23-21, Alega Valley	Fea. 1a, Units 2–4, L. II	Charcoal		590 ± 70	670–510	1280–1440 AD	Clark (1993a,b)
NZ-7594	Tātāga mātau, Rubble Terrace Complex	Pits 1 and 2, Trench 3, L. 2	Charcoal		580 ± 63	670–510	1280 AD–1440 AD	Best et al. (1989)
Beta-194325	AS-21-002, Lefutu	TU 1, Lowest cultural stratum	Charcoal	−26.2	570 ± 40	660–520	1290–1430 AD	Pearl (2004)
Beta-193876	AS-25-062. Fatu ma Futi village	Unit 2, L. II, Fea. 5	Charcoal	−26.5	570 ± 50	640–590 (18.3%), 570–490 (77.1%)	1310–1360 AD (18.3%), 1380–1460 AD (77.1%)	Kailihiwa et al. (2005)
Wk-13041	AS-31-106	Fea. 207, TU 2, L. I/Level 3	Charcoal, cf. *Diospyros* sp.		552 ± 40	650–580 (45.9%), 570–510 (49.5%)	1300–1370 AD (45.9%), 1380–1440 AD (49.5%)	Carson (2005)
Wk-13039	AS-31-116	Fea. 236, TU 1, L. I/Level 5	Charcoal, *Ficus* sp.		538 ± 40	650–580 (35.2%), 570–500 (60.2%)	1300–1370 AD (35.2%), 1380–1450 AD (60.2%)	Carson (2005)
NZ-7596	Tātāga mātau, Off-set Terrace	Trench 4, L. 2	Charcoal		521 ± 55	660–490	1290–1460 AD	Best et al. (1989)
Beta-48051	AS-34-38, Leone Valley	TP 5, L. IX	Charcoal		520 ± 60	660–480	1290–1470 AD	Clark (1993a)
Wk-13038	AS-31-116	Fea. 236, TU 3, L. I/Level 2	Charcoal, *Ficus* sp.		513 ± 43	640–590 (19.0%), 570–490 (76.4%)	1310–1360 AD (19.0%), 1380–1460 AD (76.4%)	Carson (2005)

Table 3 (*continued*)

Lab No.	Site	Provenience	Sample material	$^{13}C/^{12}C$ ratio	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Sources
Beta-48910	AS-21-005, ‘Aoa	Locality 2, Unit SB, L. II	Charcoal	−26.9	510 ± 70	670–430 (93.7%), 350 to 330 (1.7%)	1280–1520 AD (93.7%), 1600–1620 (1.7%)	Clark (1993a) and Clark and Michlovic (1996)
Beta-48048	AS-21-005, ‘Aoa	Locality 2, Unit 5, L. V	Charcoal	−28.0	470 ± 60	640–590 (8.2%), 570–420 (78.0%), 400–320 (9.2%)	1310–1360 AD (8.2%), 1380–1530 AD (78.0%), 1550–1630 AD (9.2%)	Clark (1993a) and Clark and Michlovic (1996)
Wk-13040	AS-31-116	Fea. 236, TU 1, L. I/Level 5	Charcoal, *Canarium* sp.		460 ± 51	630–600 (2.4%), 560–420 (85.3%), 380–320 (7.7%)	1320–1350 AD (2.4%), 1390–1530 AD (85.3%), 1570–1630 AD (7.7%)	Carson (2005)
NZ-7595	Tātāga mātau, Rubble Terrace Complex	Pits 1 and 2, Trench 3, L. 3	Charcoal		448 ± 70	630–600 (3.4%), 560–310 (92.0%)	1320–1350 AD (3.4%), 1390–1640 AD (92.0%)	Best et al. (1989)
Wk-13045	AS-31-163	Fea. 165, TU 5, L. II/Level 1	Charcoal, cf. *Aleurites moluccana*		443 ± 41	550–430 (88.9%), 360–330 (6.5%)	1400–1520 AD (88.9%), 1590–1620 AD (6.5%)	Carson (2005)
Beta-82501	Amaua	Amaua B, Column 3, earth oven	Charcoal		410 ± 60	540–310	1410–1640 AD	Eisler (1995)
Beta-48047	AS-21-005, ‘Aoa	Locality 2, Unit SB, L. V	Charcoal	−27.0	400 ± 80	550–280	1400–1670 AD	Clark (1993a) and Clark and Michlovic (1996)
Beta-120569	AS-22-43, Aganoa	Fea. 4, STP AG/1, L. II	Charcoal		400 ± 50	530–310	1420–1640	Moore and Kennedy (1999a)
Beta-82500	Avaio	Trench 3, Stratum 4	Charcoal		390 ± 50	520–310	1430–1640 AD	Eisler (1995)
Wk-13046	AS-31-163	Fea. 165, TU 7, L. II/Level 1	Charcoal, cf. Aracaceae		379 ± 40	510–310	1440–1640 AD	Carson (2005)
Beta-120574	AS-34-53, Poloa	Embankment	Charcoal		370 ± 30	510–420 (55.0%), 400–310 (40.4%)	1440–1530 AD (55.0%), 1550–1640 (40.4%)	Moore and Kennedy (1999a)
AA-51255	AS-32-008, A’asu Valley	Block A, L. IIb	Charcoal	−25.5	355 ± 55	510–300	1440–1650	Pearl (2006)
Beta-28211	AS-21-005, ‘Aoa	Locality 2, Unit 4, L. V	Charcoal		350 ± 50	500–300	1450–1650 AD	Clark (1993a) and Clark and Michlovic (1996)
Beta-194807	AS-24-002, Old Vatia	TU 1, circular cooking feature	Charcoal	−27.8	350 ± 40	500–310	1450–1640 AD	Pearl (2004)
Beta-48913	AS-34-38, Leone Valley	TP 5, L. VII	Charcoal	−26.5	340 ± 80	550–250 (92.4%), 200–150 (3.0%)	1400–1700 AD (92.4%), 1750–1800 AD (3.0%)	Clark (1993a)
Pra-9183	AS-32-008, A’asu Valley	Block D, L. IIb	Charcoal	−25.1	340 ± 50	500–300	1450–1650 AD	Pearl (2006)
Beta-28210	AS-21-005, ‘Aoa	Locality 2, Unit 4, L. II, Fea. 1	Charcoal		330 ± 40	490–300	1460–1650 AD	Clark (1993a) and Clark and Michlovic (1996)
Pra-9185	AS-32-008, A’asu Valley	Block D, L. IIa	Charcoal	−24.8	320 ± 45	490–290	1460–1660 AD	Pearl (2006)
Beta-194323	AS-25-009, Levaga Village	TU 1, 28–38 cmbs	Charcoal	26.9	310 ± 70	550–100 (93.9%), 50 to −51 (1.5%)	1400–1850 AD (93.9%), 1900–2000 (1.5%)	Pearl (2004)
Wk-13044	AS-31-162	Fea. 173, TU 4, L. I/Level 1	Charcoal		283 ± 42	480–280 (91.4%), 170–150 (4.0%)	1470–1670 AD (91.4%), 1780–1800 AD (4.0%)	Carson (2005)
Beta-48915	AS-34-40, Leone Valley	TP 3, L. II	Charcoal	−28.8	280 ± 60	500–100 (92.6%), 50 to −51 (2.8%)	1450–1850 AD (92.6%), 1900–2000 AD (2.8%)	Clark (1993a)
Beta-94527	Malaeimi	Unit 7, Stratum II	Charcoal		260 ± 70	500 to −51	1450–2000 AD	Suafo’a (1998)
Beta-85965	AS-26-12, Fagasā	TU 1, L. II	Charcoal		250 ± 60	490–250 (62.3%), 230–130 (23.6%), 120–70 (1.5%), 40 to −11 (8.0%)	1460–1700 AD (62.3%), 1720–1820 (23.6%), 1830–1880 AD (1.5%), 1910–1960 AD (8.0%)	Moore and Kennedy (1996)
Beta-152733	AS-31-107/108/109	STP 2, L. II, charcoal subfeature	Charcoal, cf. *Ficus* sp.	−25.2	220 ± 40	430–390 (3.0%), 320–250 (32.9%), 230–130 (43.5%), 120–70 (1.0%), 40 to −11 (14.9%)	1520–1560 AD (3.0%), 1630–1700 AD (32.9%), 1720–1820 AD (43.5%), 1830–1880 (1.0%), 1910–1960 AD (14.9%)	Cochrane et al. (2004)
Wk-13047	AS-31-131	Fea. 124, TU 11, L. I/Level 2	Charcoal		149 ± 40	290 to −11	1660–1960 AD	Carson (2005)

(*continued on next page*)

Table 3 (*continued*)

Lab No.	Site	Provenience	Sample material	$^{13}C/^{12}C$ ratio	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Sources
Wk-13048	AS-31-131	Fea. 124, TU 9, L. I/Level 2	Charcoal, cf. *Ficus* sp.		78 ± 40	270–210 (26.5%), 150–10 (68.9%)	1680–1740 AD (26.5%), 1800–1940 AD (68.9%)	Carson (2005)
Beta-94526	Malaeimi	Unit 7 W, Stratum I	Charcoal		40 ± 60	270–170 (27.6%), 150–10 (64.0%), −1 to −11 (3.8%)	1680–1780 AD (27.6%), 1800–1940 (64.0%), 1950–1960 AD (3.8%)	Suafo'a (1998)
A-12406	AS-32-008, A'asu Valley	Block A, L. Ie	Charcoal	−26.8	0 ± 110	290 to present	1660 to present	Pearl (2006)
Beta-13737	Poloa Village	Pole 42BB14, L. III	Charcoal	−25.6	Modern	Modern	Modern	Cleghorn and McIntosh (1999)

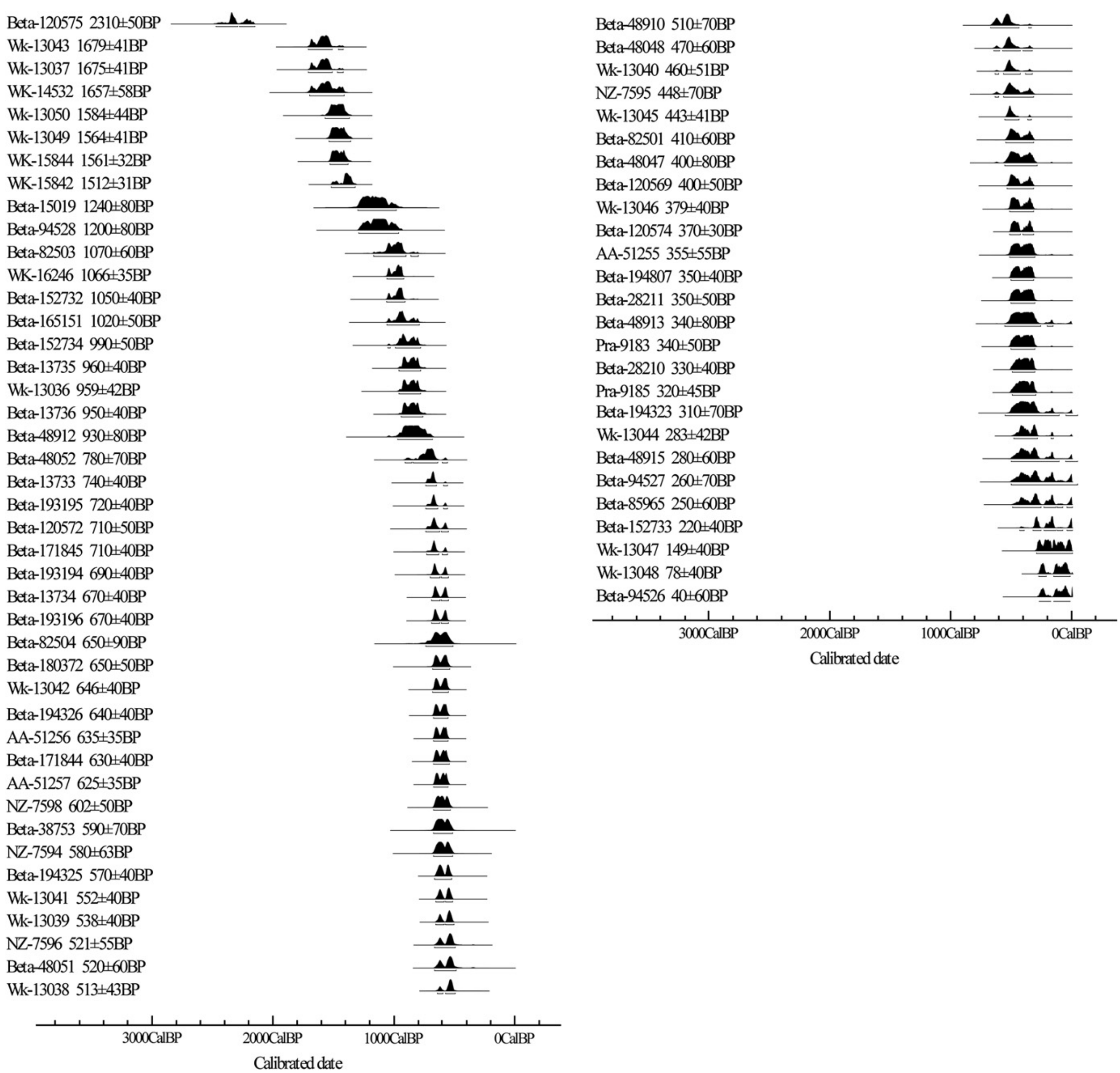

Fig. 5. Probability distributions of accepted radiocarbon dates from Tutuila. Atmospheric data from Reimer et al. (2004); OxCalv3.10 Bronk Ramsey (2005); cub r.5 sd:2 prob usp[chron].

Table 4
Accepted radiocarbon dates from Ta'ū

Sample No.	Site	Provenience	Sample material	$^{13}C/^{12}C$ ratio	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Reference
Beta-19741	AS-11-51, Ta'ū village	Unit 1, Layer D/6	*Trochus* sp., *Cypraea* sp., *Conus* sp., *Drupa* cf. *ricinus*, Cymatiidae, Mitridae		2330 ± 50	1970–1820	100 BC–200 AD	Hunt and Kirch (1987, 1988)
Beta-109582	AS-11-1, Fagā, Fea. Complex L	TU-9, L. IV	Charcoal	−29.4	1260 ± 50	1290–1070	660–880 AD	Cleghorn and Shapiro (2000)
Beta-154147	AS-11-1, Fagā	L. V, beneath Burial 5	Charcoal	−24.4	1240 ± 40	1280–1060	670–890 AD	Shapiro and Cleghorn (2002)
Beta-104536	AS-11-1, Fagā	Seaward–inland transect, TU 1, L. VIII	Charcoal	−28.0	1100 ± 60	1180–920	770–1030 AD	Cleghorn and Shapiro (2000)
Beta-104539	AS-11-1, Fagā, Fea. Complex S, Fea. S-3	TU 5, L. II	Charcoal	−23.6	1090 ± 80	1240–1200 (1.6%), 1190–890 (88.0%), 880–790 (5.8%)	710–750 AD (1.6%), 760–1060 AD (88.0%), 1070–1160 AD (5.8%)	Cleghorn and Shapiro (2000)
Beta-109583	AS-11-1, Fagā	Seaward–inland transect, TU 8, L. VIII	Charcoal	−30.2	1050 ± 60	1090–790	860–1160 AD	Cleghorn and Shapiro (2000)
Beta-132436	AS-11-1, Fagā, Fea. Complex B	TU-12, L. V	Marine shell: Archididae	3.4	1040 ± 50	605–510	1300–1490 AD	Cleghorn and Shapiro (2000))
Beta-38752	AS-11-1, Fagā	Unit 1, L. VII	Charcoal		910 ± 80	960–680	990–1270 AD	Clark (1993a)
Beta-104540	AS-11-1, Fagā, Fea. Complex B	TU 6, L. IV	Charcoal	−25.6	830 ± 50	910–850 (9.4%), 830–670 (86.0%)	1040–1100 AD (9.4%), 1120–1280 AD (86.0%)	Cleghorn and Shapiro (2000)
Beta-109584	AS-11-1, Fagā, Fea. Complex B	TU-12, L. V	Charcoal	−29.0	700 ± 50	730–620 (66.7%), 610–550 (28.7%)	1220–1330 AD (66.7%), 1340–1400 AD (28.7%)	Cleghorn and Shapiro (2000)
Beta-124604	AS-11-1, Fagā	Test Unit 17, L. II	Charcoal	−17.8	520 ± 60	660–480	1290–1470 AD	McGerty et al. (2002)
Beta-154149	AS-11-1, Fagā	L. III, associated with Burial 4	Charcoal	−25.9	510 ± 50	650–580 (23.4%), 570–480 (72.0%)	1300–1370 AD (23.4%), 1380–1470 AD (72.0%)	Shapiro and Cleghorn (2002)
Beta-104535	AS-11-1, Fagā	Seaward–inland transect, TU 1, L. III	Charcoal	−27.9	420 ± 50	540–420 (70.2%), 400–310 (25.2%)	1410–1530 AD (70.2%), 1550–1640 AD (25.2%)	Cleghorn and Shapiro (2000)
Beta-82354	AS-11-73	Unit 73/1, *umu* feature	Charcoal	−27.8	380 ± 90	650–250 (93.8%), 200–150 (1.6%)	1300–1700 AD (93.8%), 1750–1800 AD (1.6%)	Herdrich et al. (1996)
Beta-104537	AS-11-1, Fagā	Seaward–inland transect, TU 2, L. V, Sfea. 5	Charcoal	−27.2	350 ± 50	500–300	1450–1650 AD	Cleghorn and Shapiro (2000)
Beta-154146	AS-11-1, Fagā	L. V, beneath Burial 6	Charcoal	−24.9	330 ± 40	490–300	1460–1650 AD	Shapiro and Cleghorn (2002)
Beta-124503	AS-11-1, Fagā	Test Unit 17, L. I	Charcoal	−22.0	350 ± 50	500–300	1450–1650 AD	McGerty et al. (2002)
Beta-124605	AS-11-1, Fagā	Test Unit 15, L. I	Charcoal	−20.8	190 ± 50	310 to −11	1640–1960 AD	McGerty et al. (2002)
Beta-104538	AS-11-1, Fagā, Fea. Complex S, Fea. S-3	TU 5, L. I	Charcoal	−28.8	170 ± 50	300 to −11	1650–1960 AD	Cleghorn and Shapiro (2000)
Beta-154148	AS-11-1, Fagā	L. II, at and below Burial 3	Charcoal	−24.8	160 ± 40	290–60 (78.2%), 50–11 (17.2%)	1660–1890 AD (78.2%), 1900–1960 AD (17.2%)	Shapiro and Cleghorn (2002)

Sāmoan islands falls within these centuries (Table 7), but we find only 12 acceptable dates from six sites on the islands of Tutuila, Ofu, Ta'ū, 'Upolu, and Savai'i (Fig. 10).

5.1. Accepted early dates

In the assemblage of accepted dates, the earliest deposit, based on chronology and artifacts, is the submarine Lapita site at Mulifanua. Petchey (2001) has suggested that occupation at Mulifanua occurred around 2880–2750 cal BP. One accepted date from Mulifanua (NZA-5800; 2970–2640 cal BP) supports Petchey's suggestion.[3]

After Mulifanua, To'aga provides the earliest acceptable dates, extending from ca. 2700 to 2000 cal BP. The earliest

[3] The possibility that the dating of "old wood" has created anomalously early dates for any of these deposits is unknown because no wood charcoal identifications were completed.

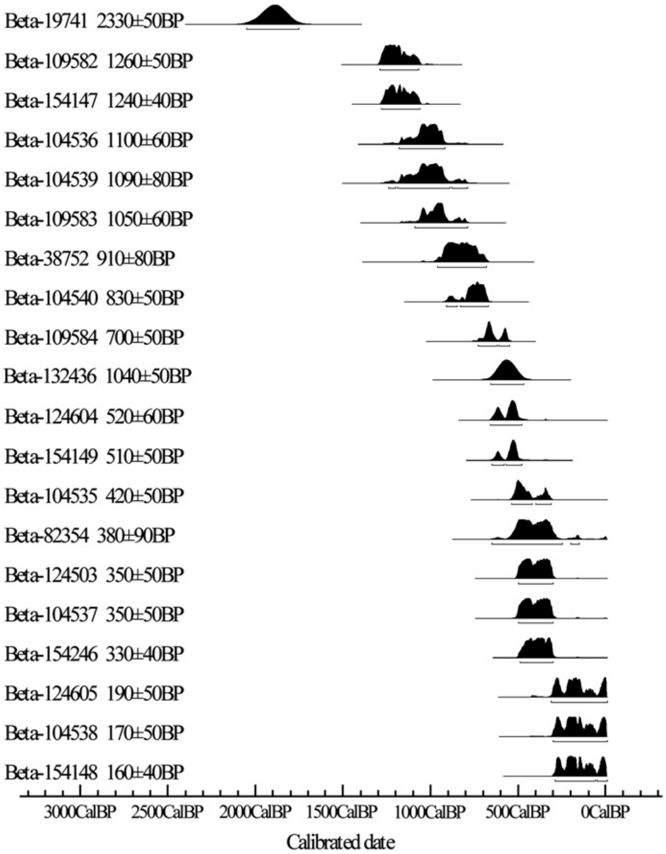

Fig. 6. Probability distributions of accepted radiocarbon dates from Ta'ū. Atmospheric data from Reimer et al. (2004); OxCalv3.10 Bronk Ramsey (2005); cub r.5 sd:2 prob usp[chron].

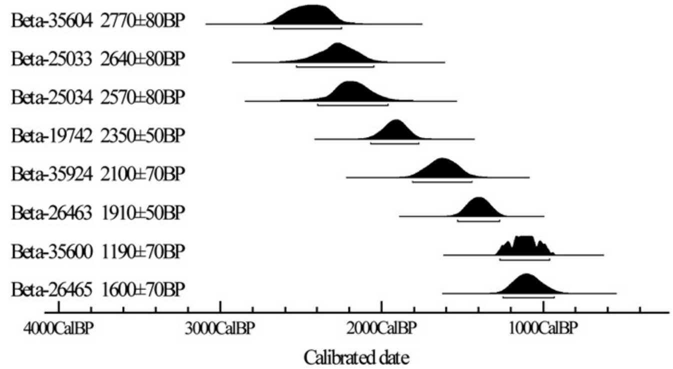

Fig. 7. Probability distributions of accepted radiocarbon dates from Ofu. Atmospheric data from Reimer et al. (2004); OxCalv3.10 Bronk Ramsey (2005); cub r.5 sd:2 prob usp[chron].

date, sample Beta-35604 (2670–2250 cal BP), overlaps slightly with the accepted date from Mulifanua. This approximate contemporaneity with Mulifanua may be challenged based on ceramic evidence and with reference to the suite of other dates from To'aga. No dentate-stamped ceramics have been found at To'aga, but the assumption of geographic homogeneity in the dentate decoration of early ceramics may be potentially misleading (see Kirch and Rosendahl, 1973 and Kirch and Yen, 1982 for examples from Anuta and Tikopia). However, the highest probability for this date (Beta-35604) falls within ca. 2500–2400 cal BP, which is comparable to the other dates in the radiocarbon corpus from To'aga. Therefore, it is probable that occupation at To'aga begins at ca. 2500 cal BP. This in turn indicates a possible gap in the radiocarbon sequence for the archipelago of approximately 500–200 cal years between Mulifanua and subsequent evidence for human occupation.

Two additional early dates from To'aga, Beta-25033 (2530–2050 cal BP) and Beta-25034 (2400–1960 cal BP), provide dates for the same primary cultural deposit. These dates overlap at two standard deviations indicating at the earliest a date of ca. 2500–2400 cal BP for initial occupation of this area of the coastal flat. Kirch and Hunt (1993b: p. 89) suggest that these two dates, along with two younger dates from other portions of the coastal flat (samples Beta-19742 and Beta-35924), indicate a span from ca. 2400 to 1500 cal BP for the use of thick Polynesian Plainware pottery at To'aga. Sample Beta-35604 is associated with thin ware pottery, shell

Table 5
Accepted radiocarbon dates from Ofu

Sample No.	Site	Provenience	Sample material	$^{13}C/^{12}C$ ratio	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Reference
Beta-35604	AS-13-1, To'aga	Transect 9, Unit 23, L. IIIB	Marine shell	1.7	2770 ± 80	2670–2250	720–300 BC	Kirch (1993b)
Beta-25033	AS-13-1, To'aga	Unit 6, L. IIA-1	*Turbo* sp.	2.3	2640 ± 80	2530–2050	580–100 BC	Kirch (1993b) and Kirch et al. (1989)
Beta-25034	AS-13-1, To'aga	Unit 6, L. IIB	*Turbo* sp.	2.5	2570 ± 80	2400–1960	450–10 BC	Kirch (1993b) and Kirch et al. (1989)
Beta-19742	AS-13-1, To'aga	TU 1, L. II	*Turbo* sp.	2.9	2350 ± 50	2070–1770	120 BC–180 AD	Hunt and Kirch (1987, 1988)
Beta-35924	AS-13-1, To'aga	Transect 5, Unit 15, L. II	Marine shell	2.7	2100 ± 70	1810–1440	140–510 AD	Kirch (1993b)
Beta-26463	AS-13-1, To'aga	Unit 3, L. II	*Turbo* sp.	2.5	1910 ± 50	1530–1270	420–680 AD	Kirch (1993b) and Kirch et al. (1989)
Beta-26465	AS-13-1, To'aga	Unit 13, L. IB*	*Turbo* sp.	2.0	1600 ± 70	1250–930	700–1020 AD	Kirch (1993b) and Kirch et al. (1989)
Beta-35600	AS-13-1, To'aga	Transect 5, Unit 17, L. IIIB	Charcoal and ash	−26.1	1190 ± 70	1270–960	680–990 AD	Kirch (1993b)

Asterisk denotes discrepancy in the provenience information.

Table 6
Accepted radiocarbon dates from Olosega

Sample No.	Site	Provenience	Sample material	$^{13}C/^{12}C$ ratio	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Reference
Beta-098749	AS-12-18, Sili village	Backhoe Pit 2, L. V, Fea. 18:5c	Charcoal silt		990 ± 60	1060–1030 (2.9%), 1010–760 (92.5%)	890–920 AD (2.9%), 940–1190 AD (92.5%)	Moore and Kennedy (1997)
Beta-098750	AS-12-18, Sili village	TU 1, L. VI, Fea. 18:5d	Charcoal		820 ± 80	930–650	1020–1300 AD	Moore and Kennedy (1997)
Beta-098748	AS-12-18, Sili village	Backhoe Pit 2, L. I, Fea. 18:5a	Charcoal		400 ± 50	530–310	1420–1640 AD	Moore and Kennedy (1997)

fishhooks, and other artifacts and midden. The ceramic assemblages associated with both sets of radiocarbon dates include both thin and thick ware pottery, however, in different proportions. The near contemporaneity of these three early dates from To'aga raises questions with regard to this change in early plainware ceramic assemblages.

The proposed age range for initial settlement at To'aga is similar to the earliest date for occupation at Utumea, Tutuila (ca. 2500–2100 cal BP) (Moore and Kennedy, 1999a), and overlaps with the earliest dated deposits at Jane's Camp, 'Upolu (ca. 2300–2000 cal BP) (Jennings and Holmer, 1980c). Much less is known about the deposit(s) at Utumea, although Polynesian Plainware pottery was recovered from excavations (Moore and Kennedy, 1999a). The ceramic assemblage from Jane's Camp, which is one of the largest assemblages from Sāmoa, was analyzed by Holmer (1980c), and was grouped into seven typological categories. Holmer (1980c) identified temporal trends in the changing percentages of these types, but these results require re-examination through a classificatory approach to better document variation through time. By ca. 2100 cal BP, the early settlement in the Pulemelei area, Savai'i (ca. 2100–1800 cal BP; Martinsson-Wallin et al., 2005), and Ta'ū Village, Ta'ū (ca. 2100–1800 cal BP; Hunt and Kirch, 1988) were occupied. All of these deposits contained some amount of Polynesian Plainware pottery. Thus, within 800–600 cal years of a Lapita occupation at Mulifanua, settlements occur on nearly every Sāmoan island.

Additional deposits at Aganoa, Tutuila Island (Moore and Kennedy, 1999a), Leuluasi (Davidson and Fagan, 1974), Vailele (Green and Davidson, 1974b), and Luatuanu'u (Peters, 1969), 'Upolu Island, and Potusā (Jennings and Holmer, 1980c) and Falemoa (Lohse, 1980) on Manono Island, have produced early dates ranging between ca. 2700 and 2100 cal BP with plainware ceramics. Although we exclude the radiocarbon dates associated with these deposits for various criteria (criteria A, B, D,

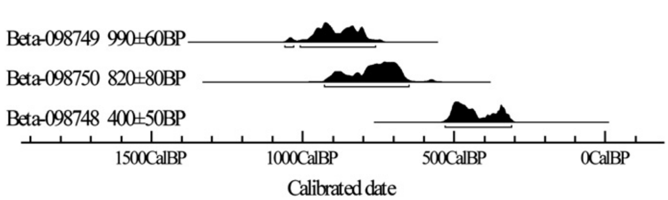

Fig. 8. Probability distributions of accepted radiocarbon dates from Olosega. Atmospheric data from Reimer et al. (2004); OxCalv3.10 Bronk Ramsey (2005); cub r.5 sd:2 prob usp[chron].

and F), their ages and associated cultural material indicate early deposits. Further testing and dating of these deposits is necessary to understand their chronology and relationship with other early deposits in Sāmoa.

Two other suites of early dates, those from 'Aoa and To'aga, require additional discussion because of the impact they have had on our understanding of Sāmoan prehistory. Although the chronometrically "clean" pool of dates does not include the eight earliest dated samples from 'Aoa and To'aga, these dates have conventionally been viewed as the oldest Polynesian Plainware deposits in Sāmoa. These dates (Beta-25035, Beta-25673, Beta-26464, Beta-35601, Beta-35602, Beta-35603, Beta-48049, and Beta-48911) have individual calibrated age distributions spanning ca. 500–800 cal years. With such large probability distributions, they do not allow the precision necessary for identification of initial colonization. Additionally, these dates either pre-date, or are contemporaneous with Mulifanua at the earlier end of their probability distributions. Such contemporaneity is not supported by their ceramic assemblages, which lack dentate-stamping, if assumptions of geographic homogeneity in this decoration are correct.[4] Additional dating of these deposits is necessary, as exclusion of these dates changes the settlement chronology for Sāmoa.

6. The "Dark Ages," ca. 1500–1000 cal BP

The compilation of radiocarbon dates from the archipelago also allows examination of a later period in Sāmoan prehistory, which has not garnered as much research to date. Approximately 1400 cal years after initial colonization and settlement in the Sāmoan archipelago, the period from ca. 1500 to 1000 cal BP has been noted by archaeologists as a poorly understood Dark Age with little associated cultural material (Davidson, 1979: pp. 94–95; see also Poulsen, 1974 for Tonga). Presumably, it was during these centuries that demographic and social changes took place, reflected in the archaeological record dating to ca. 1000 cal BP. In the conventional culture history, this Dark Age succeeds the Ancestral Polynesian Society providing an intermediate period before

[4] Although it is commonly accepted that the loss of dentate-stamping and associated vessel types occurred within 1–2 centuries in Sāmoa, contemporaneous Lapita and plainware deposits are a possibility that can be elucidated with further well-dated ceramic assemblages.

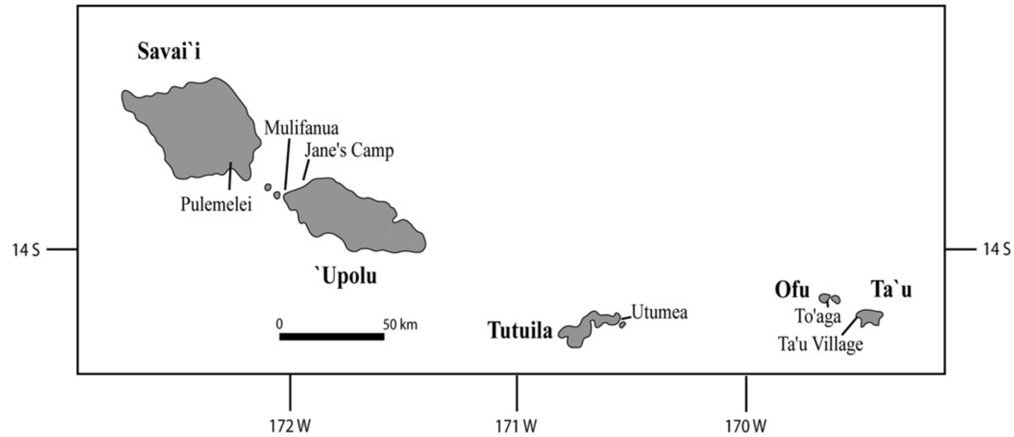

Fig. 9. Map of Sāmoa showing sites with accepted pre-2000 cal BP dates.

development of hierarchical social stratification and expansive settlements documented by monumental architecture and large villages (Burley and Clark, 2003; Green, 2002).

Thirteen sites from the islands of Savai‘i, ‘Upolu, Tutuila, Ofu, and Ta‘ū, have yielded acceptable radiocarbon dates ($n = 28$, 18.9% of the accepted suite of dates) falling within this period (Table 8, Fig. 11). Seven attributes were recorded for each deposit: location, architectural features, ceramics, lithic artifacts, shell and/or coral artifacts, faunal remains, and other associated features (Table 9). We selected these attributes to provide a general characterization of resource use, economics, and settlement during these centuries.

The Dark Age period has been given considerable socio-cultural significance that presently has little basis in the archaeological record (see also Smith, 2002). Burley and Clark (2003: p. 240) state that "it was here [during this period] that the foundations for late prehistoric Polynesian polities were forged." Because of its formative significance, they suggest that evidence for increased political hierarchy, group divisions, and competition should be archaeologically detectable. Green (2002: p. 140) is wary of terming this a "formative" period for later socio-cultural developments, but postulates that there was a general continuity within Sāmoan culture with an expanded settlement and use of the landscape.

Smith's (2002) review of the West Polynesian archaeological record pre-dating ca. 1000 BP identified the loss of dentate-stamped decoration and complex vessel forms (e.g., Lapita ceramics) as the primary change in material culture during approximately 2000 years. Her results suggest general continuity in the archaeological record preceding construction of large field monuments beginning ca. 1000 BP.

In terms of the archaeological record, this period is bracketed at one end by cultural deposits most often characterized by their pottery and at another end by later monumental architecture and expansive settlements. Archaeologists have noted that an absence of pottery has made identification of these deposits difficult (Burley and Clark, 2003: p. 240; Green, 2002: p. 140), while also noting that little research has been tailored specifically to deposits of this period (Burley, 1998: pp. 380–381; Burley and Clark, 2003: p. 240; see Spennemann, 1986 for an exception from Tonga).

General observations and patterning of the archaeological record are suggested by the data summarized in Table 9. Coastal and inland locations were occupied during this period, and may include a variety of architectural features. Lithic artifacts are present, although at a lower frequency than may be expected, with well-dated major lithic manufacture (e.g., basalt quarrying and adze manufacturing) coming only after the Dark Ages. Pottery is rare in these deposits, and occurs only at the earliest end. Invertebrate and vertebrate midden has been recorded from some deposits, although few detailed analyses have been conducted.

With respect to location, these sites represent a variety of locales glossed by their categorization as "coastal" or "inland." However, using these general categories, coastal sites are found on Ofu and Ta‘ū, with inland sites on Savai‘i and ‘Upolu. Both coastal and inland sites have been recorded on Tutuila.

The dates from Savai‘i and ‘Upolu, and several dates from Tutuila and Ta‘ū, provide *terminus post quem* dates for different surface architectural features (terraces, stone platforms, stone paving, star mound, and large stone mound), but they do not provide direct chronological information regarding architecture during the period ca. 1500–1000 cal BP. In this case, To‘aga provides the most closely associated date with an architectural feature at ca. 1300–1000 cal BP for a gravel paving.

Surprisingly, only four cultural deposits at SU-17-91 (Tulaga Fale), AS-25-062 (Fatu ma Futi), AS-34-34 (Maloata), and AS-11-1 (Fagā) include lithic artifact assemblages. Shell artifacts and faunal remains have been recorded at Fatu ma Futi, To‘aga, and Fagā. The most common associated features are earth ovens and burials.

The ceramic evidence gathered in this review has implications for the chronology of pottery production and use in Sāmoa. Only two of these 12 sites contained primary ceramic deposits. One of these deposits, AS-31-171 (Pava‘ia‘i), is on Tutuila, while the other is the To‘aga site on Ofu. Chronologically, the dates from both deposits significantly overlap with

Table 7
Pre-2000 cal BP radiocarbon dates from Sāmoa

Sample No.	Island	Site	Provenience	Sample material	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Criteria	Reference
UGa-1671	Savai'i	SS-13-85, Sapapali'i	Earth oven	Charcoal	14,920 ± 175	18,750−17,550	16,800−15,600 BC	B	Jennings and Holmer (1980c)
Beta-25035	Ofu	AS-13-1, To'aga	Unit 6, L. V	*Asaphis violascens* and *Turbo (Lunella) cinereus*	3820 ± 70	3920−3510	1970−1560 BC	F	Kirch (1993b)
Beta-25673	Ofu	AS-13-1, To'aga	Unit 1, L. V	*Phalium* sp.	3620 ± 80	3680−3270	1730−1320 BC	F	Kirch (1993b)
NZ-1958B	'Upolu	SU-17-1, Mulifanua	Dredging spoils	Marine shell	3251 ± 155	3400−2650	1450−700 BC	B	Leach and Green (1989)
RL-479	'Upolu	SU-18-1,SU-F1-1, Jane's Camp	Test 1, Stratum II	Marine shell	3220 ± 130	3850−3050	1900−1100 BC	B, D	Jennings and Holmer (1980c) and Smith (1976)
NZA-5800	'Upolu	SU-17-1, Mulifanua	Dredging spoils	Turtle bone collagen	3062 ± 66	2970−2640	1020−690 BC	H	Petchey (2001)
Beta-35601	Ofu	AS-13-1, To'aga	Transect 5, Unit 28, L. II (base)	Charcoal	2900 ± 110	3350−2750	1400 BC−800 BC	B	Kirch (1993b)
Beta-48049	Tutuila	AS-21-5, 'Aoa	Locality 2, XU 7, L. VII	Charcoal	2890 ± 140	3400−2750	1450−800 BC	B	Clark (1993a,b) and Clark and Michlovic (1996)
NZA-4780	'Upolu	SU-17-1, Mulifanua	Dredging spoils	Marine shell	2788 ± 67	2660−2280	710−330 BC	E	Petchey (2001)
Beta-35604	Ofu	AS-13-1, To'aga	Transect 9, Unit 23, L. IIIB	*Tridacna maxima*	2770 ± 80	2670−2250	720−300 BC	+	Kirch (1993b)
Beta-25033	Ofu	AS-13-1, To'aga	Unit 6, L. IIA-1	*Turbo setosus*	2640 ± 80	2530−2050	580−100 BC	+	Kirch (1993b)
Beta-35602	Ofu	AS-13-1, To'aga	Transect 9, Unit 23, earth oven cut from L. IIIA into L. IIIB	Charcoal	2630 ± 100	3000−2350	1050 BC−400 BC	B	Kirch (1993b)
Beta-26464	Ofu	AS-13-1, To'aga	Unit 10, L. IIB	Charcoal	2620 ± 140	3100−2300	1150 BC−350 BC	B	Kirch (1993b)
Beta-35603	Ofu	AS-13-1, To'aga	Transect 9, Unit 23, L. IIIB (base)	Charcoal	2600 ± 170	3200−2300	1250 BC−350 BC	B	Kirch (1993b)
NZ-2728B	'Upolu	SU-18-1,SU-F1-1, Jane's Camp	Test 1, Stratum I	*Tridacna* sp.	2590 ± 40	2320−2080	370−130 BC	+	Jennings and Holmer (1980c)
Beta-25034	Ofu	AS-13-1, To'aga	Unit 6, L. IIB	*Turbo setosus*	2570 ± 80	2400−1960	450−10 BC	+	Kirch (1993b)
Gak-4289	Tutuila	Tulotu	Structure 11, Trench 4, L. II	Charcoal	2560 ± 140	3000−2300	1050−350 BC	A, B	Frost (1978)
NZ-2727B	'Upolu	SU-18-1,SU-F1-1, Jane's Camp	Test 1, Stratum I	*Tridacna* sp.	2550 ± 50	2300−2020	350−70 BC	+	Jennings and Holmer (1980c)
NZ-4343B	Manono	SM-17-2, Falemoa	Stratum II	*Tridacna* sp.	2540 ± 40	2290−2030	340−80 BC	D, possibly F	Jennings and Holmer (1980c) and Lohse (1980)
RL-477	'Upolu	SU-18-1,SU-F1-1, Jane's Camp	Test 2, Stratum IV	Marine shell	2510 ± 120	2450−1800	500 BC−150 AD	B	Jennings and Holmer (1980c) and Smith (1976)
NZ-2726B	'Upolu	SU-18-1, SU-F1-1, Jane's Camp	Test 1, Stratum I	*Tridacna* sp.	2510 ± 60	2280−1950	330 BC−0 AD	+	Jennings and Holmer (1980c) and Smith (1976)
NZ-1959	'Upolu	SU-17-1, Mulifanua	Dredging spoils	Coralline crust cement	2475 ± 63	2260−1900	310−50 BC	E	Green and Richards (1975) and Petchey (2001)

(continued on next page)

Table 7 (*continued*)

Sample No.	Island	Site	Provenience	Sample material	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Criteria	Reference
Beta-48911	Tutuila	AS-21-5, ‘Aoa	Locality 2, XU 8, L. VII	Charcoal	2460 ± 110	2800–2300	850–350 BC	B	Clark (1993a,b) and Clark and Michlovic (1996)
Beta-120571	Tutuila	AS-22-43, Aganoa	Fea. 4, TU AG/5, L. III/1	Charcoal	2400 ± 110	2750–2150	800–200 BC	B	Moore and Kennedy (1999a)
Beta-19742	Ofu	AS-13-1, To‘aga	TU 1, L. II	*Turbo setosus*	2350 ± 50	2070–1770	120 BC–180 AD	+	Hunt and Kirch (1987, 1988)
Beta-19741	Ta‘ū	AS-11-51, Ta‘ū village	Unit 1	Marine shell	2330 ± 50	2050–1750	100 BC–200 AD	H	Hunt and Kirch (1988)
Beta-120575	Tutuila	AS-22-44, Utumea	TU UT/3, L. IIb	Charcoal	2310 ± 50	2470–2290 (61.6%), 2280–2150 (33.8%)	520–340 BC (61.6%), 330–200 BC (33.8%)	H	Moore and Kennedy (1999a)
RL-481	‘Upolu	SU-18-1,SU-F1-1, Jane’s Camp	Test 2, Stratum IV	Marine shell	2220 ± 120	2100–1450	150 BC–500 AD	B	Jennings and Holmer (1980c)
UGa-1484	Manono	SM-17-2, Falemoa	Stratum II	*Tridacna* sp.	2260 ± 65	1990–1630	40 BC–320 AD	D, possibly F	Jennings and Holmer (1980c) and Lohse (1980)
RL-464	‘Upolu	SU-18-1,SU-F1-1, Jane’s Camp	Test 1, Stratum I	*Tridacna* sp.	2220 ± 110	2050–1450	100 BC–500 AD	B	Jennings and Holmer (1980c) and Smith (1976)
Gak-1444	‘Upolu	SU-Le-12, Leuluasi	Pit feature, L. 5b, Sq. F-7	Charcoal	2210 ± 100	2500–1900	550 BC–50 AD	A, B	Davidson and Fagan (1974) and Green and Davidson (1974b)
Gak-1339	‘Upolu	SU-Lu-53, Luatuanu‘u	Firepit, L. 1; under terrace	Charcoal	2170 ± 100	2360–1920	410 BC–30 AD	A, B	Green and Davidson (1974b) and Peters (1969)
Gak-1194	‘Upolu	SU-Va-4, Vailele	Hearth Horizon, Sq. N-2	Charcoal	2150 ± 100	2350–1920	400 BC–30 AD	A, B	Green and Davidson (1974b)
RL-478	‘Upolu	SU-18-1,SU-F1-1, Jane’s Camp	Test 1, Stratum III	Marine shell	2130 ± 130	2500–1700	550–250 BC	B	Jennings and Holmer (1980c) and Smith (1976)
Beta-120576	Tutuila	AS-22-44, Utumea	TU UT/5, L. II/9	Charcoal	2110 ± 100	2340–1880	390 BC–70 AD	B	Moore and Kennedy (1999a)
WK-15501	Savai‘i	Pulemelei-early settlement	Trench 9, earth oven	Charcoal	2058 ± 38	2130–1920	180 BC–30 AD	+	Martinsson-Wallin et al. (2005)
WK-13868	Savai‘i	Pulemelei-early settlement	Trench 7, earth oven	Charcoal	1993 ± 55	2110–2080 (3.3%), 2070–1820 (92.1%)	160 BC–130 BC (3.3%), 120 BC–130 AD (92.1%)	+	Martinsson-Wallin et al. (2005)

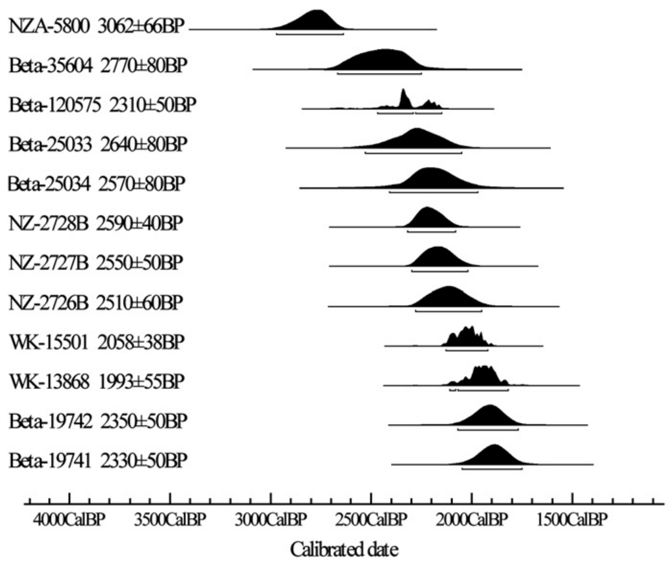

Fig. 10. Accepted pre-2000 cal BP radiocarbon dates from Sāmoa. Atmospheric data from Reimer et al. (2004); OxCalv3.10 Bronk Ramsey (2005); cub r.5 sd:2 prob usp[chron].

the To‘aga date slightly earlier at ca. 1800–1450 cal BP followed by AS-31-171 at ca. 1700–1400 cal BP. Clark (1996: p. 451) proposed that "pottery was widely used in Sāmoa through the first half of the first millennium AD [and during] the next few centuries pottery use declined, even disappeared at some locations," although it may have continued up to 1300–1600 AD The present data suggest a limited distribution of pottery by ca. 1500 cal BP and from ca. 1400 to 1000 cal BP pottery is absent from the present assemblage of known cultural deposits, which accords with the earlier proposals by Green and Davidson (1974a), Green (1974a) and Kirch and Hunt (1993a).

Although little detailed information from most of the ca. 1500–1000 cal BP cultural deposits has been reported, the data from To‘aga and Fagā are important exceptions. Comparison of the results of the analyses from the To‘aga and Fagā assemblages demonstrates a significant degree of spatial variability between nearly contemporaneous deposits within the small, closely grouped islands of Manu‘a. The To‘aga deposits from this interval begin with pottery, which quickly drops out of the sequence, and contain abundant vertebrate and invertebrate faunal remains, some non-lithic artifacts, and no lithic artifacts. In contrast, the deposits from Fagā have produced numerous basalt artifacts including formal tools, retouched and polished flakes, and manufacturing flakes along with invertebrate and vertebrate midden. Future comparisons between the assemblages throughout the archipelago are needed to explain changes in Sāmoan culture during this time.

Our current knowledge of the archaeological record in Sāmoa during the period ca. 1500–1000 cal BP is limited, yet it offers minimal support for the "formative" characteristics hypothesized by Burley and Clark (2003: p. 240). Barring two primary pottery-bearing deposits, pottery is absent from most locales, suggesting that it is during these centuries that its production ceases in many, if not all, communities across the archipelago. Identifying changes in associated or contemporaneous material culture during this period requires further analysis. For the two sites that do have an appreciable amount of analyzed cultural material dating to this time, To‘aga and Fagā, there exists significant variability in these assemblages. Comparable data sets are needed from across the island group to expand our understanding of group interaction, lithic/bone/shell/coral artifact technologies, subsistence strategies, and settlement-community organization. Although presently painted in broad-brush strokes, a methodology that documents variability in the archaeological record, at a number of scales, will be necessary to analyze change in material culture through time and space. It is only with such data that we can begin to explain processes of culture change and complexity.

7. Conclusions

Archaeological research in Sāmoa was pioneered by a program of extensive survey and excavation in Western Sāmoa, which established a culture historical framework that archaeologists continued to follow (Green and Davidson, 1969a, 1974a; Jennings et al., 1976; Jennings and Holmer, 1980a). The majority of the more recent research in the archipelago has centered on cultural resource management projects in American Sāmoa (Addison et al., 2006; Carson, 2005; Cleghorn and Shapiro, 2000; Cochrane et al., 2004; Moore and Kennedy, 1996, 1997), the data from which have often remained poorly known, relegated to a largely inaccessible "grey literature." Forty years after the seminal research on ‘Upolu and Savai‘i, it is necessary to assess the chronology of Sāmoa by compiling the available radiocarbon dates.

We have examined 236 dates in this paper, and assessed their validity using a chronometric hygiene protocol. This is a classificatory method designed to produce a group of dates with secure depositional context that provides the chronological accuracy and precision necessary to answer a variety of archaeological questions. Through the application of this protocol, 147 dates were included for further analysis. We excluded a majority ($n = 88$) on just two criteria: dating by the Gakushuin Laboratory and CRA standard deviations $\geq$100 years.

Using this corpus of dates, we have examined two periods of Sāmoan prehistory: initial colonization prior to 2000 cal BP and the Dark Ages from ca. 1500 to 1000 cal BP. Based on Lapita decorated ceramics and radiocarbon dates, the submarine site of Mulifanua remains the earliest evidence for human colonization. Mulifanua has an age range from ca. 2900 to 2700 cal BP and represents the only dentate-stamped Lapita ceramic deposit in the archipelago. This deposit is separated by ca. 300 cal years from the next earliest occupations at To‘aga, Ofu Island, and at Utumea, Tutuila Island. By ca. 2100 cal BP, settlements appear throughout the archipelago. Our analysis challenges the validity of the earliest dates from ‘Aoa and To‘aga, which pre-date and/or are contemporaneous with Mulifanua.

A review of the Dark Ages reveals that although 13 sites have produced 28 radiocarbon dates calibrated to ca.

Table 8
Cultural deposits dating between 1500 and 1000 cal BP

Lab No.	Site	Provenience	Conventional age	Calibrated age BP (2σ)	Calibrated age BC/AD (2σ)	Reference
Savai'i						
WK-13869	Pulemelei	Trench 3, earth oven	1157 ± 44	1180–960	770–990 AD	Martinsson-Wallin et al. (2005)
WK-15502	Pulemelei	Trench 13, charcoal concentration	1134 ± 37	1180–960	770–990 AD	Martinsson-Wallin et al. (2005)
'Upolu						
UGa-1985	SU-17-91, Tulaga Fale	Pit A	1115 ± 75	1260–1200 (4.4%), 1190–910 (91.0%)	690–750 AD (4.4%), 760–1040 AD (91.0%)	Hewitt (1980a) and Jennings and Holmer (1980c)
UGa-1990	SU-17-483, Apulu HHU	Base of pit	1205 ± 70	1280–970	670–980 AD	Holmer (1980b) and Jennings and Holmer (1980c)
UGa-1991	SU-17-552, Ten Points	Base of star mound	1620 ± 65	1700–1370	250–580 AD	Hewitt (1980a) and Jennings and Holmer (1980c)
Tutuila						
Beta-193878	AS-25-062, Fatu ma Futi village	Unit 5, L. IV, Fea. 7	1340 ± 40	1300–1120 (92.5%), 1110–1080 (2.9%)	650–830 AD (92.5%), 840–870 AD (2.9%)	Kailihiwa et al. (2005)
Beta-193875	AS-25-062, Fatu ma Futi village	Unit 3, L. IV, Fea. 4	1230 ± 40	1230–1200 (2.6%), 1180–970 (92.8%)	720–750 AD (2.6%), 770–980 AD (92.8%)	Kailihiwa et al. (2005)
Beta-195725	AS-25-062, Fatu ma Futi village	Unit 2, L. IV, Fea. 6	1190 ± 40	1180–960	770–990 AD	Kailihiwa et al. (2005)
Wk-13050	AS-31-116, Pava'ia'i	Fea. 253, TU 2, L. I/2	1584 ± 44	1570–1370	380–580 AD	Carson (2005)
Wk-13049	AS-31-116, Pava'ia'i	Fea. 253, TU 2, L. I/2	1564 ± 41	1540–1360	410–590 AD	Carson (2005)
Tutuila						
Wk-14532	AS-31-171, Pava'ia'i	Location 3, L. III	1657 ± 58	1700–1410	250–540 AD	Addison et al. (2006)
Wk-15844	AS-31-171, Pava'ia'i	Location 1, L. III	1561 ± 32	1530–1380	420–570 AD	Addison et al. (2006)
Wk-15842	AS-31-171, Pava'ia'i	Location 2, L. IV	1512 ± 31	1520–1320	430–630 AD	Addison et al. (2006)
Wk-16246	AS-31-171, Pava'ia'i	Location 2, L. II	1066 ± 35	1060–920	890–1030 AD	Addison et al. (2006)
Beta-152732	AS-31-131, Faleniu	Fea. 40, STP 27/28, L. II, charcoal subfeature	1050 ± 40	1060–910	890–1040 AD	Cochrane et al. (2004)
Beta-165151	AS-31-131, Faleniu	Fea. 106, TU 1, L. II/1	1020 ± 50	1060–790	890–1160 AD	Carson (2005)
Beta-15019	AS-34-34, Maloata	TP 1, L. IV	1240 ± 80	1300–980	650–970 AD	Ayres and Eisler (1987)
Beta-82503	Amaua	Section C, Stratum F, L. V, Burial	1070 ± 60	1170–900 (92.2%), 860–800 (3.2%)	780–1050 AD (92.2%), 1090–1150 AD (3.2%)	Eisler (1995)
Beta-94528	Malaeimi	Unit 7 W, Stratum III	1200 ± 80	1290–960	660–990 AD	Suafo'a (1998)
Ofu						
Beta-35924	AS-13-1, To'aga	Transect 5, Unit 15, L. II	2100 ± 70	1810–1440	140–510 AD	Kirch (1993b)
Beta-26463	AS-13-1, To'aga	Unit 3, L. II	1910 ± 50	1530–1270	420–680 AD	Kirch (1993b) and Kirch et al. (1989)
Beta-26465	AS-13-1, To'aga	Unit 13, L. IB	1600 ± 70	1250–930	700–1020 AD	Kirch (1993b) and Kirch et al. (1989)
Beta-35600	AS-13-1, To'aga	Transect 5, Unit 17, L. IIIB	1190 ± 70	1270–960	680–990 AD	Kirch (1993b)
Ta'ū						
Beta-154147	AS-11-1, Fagā	L. V, beneath Burial 5	1240 ± 40	1280–1060	670–890 AD	Shapiro and Cleghorn (2002)
Beta-104536	AS-11-1, Fagā	Seaward–inland transect, TU 1, L. VIII	1100 ± 60	1180–920	770–1030 AD	Cleghorn and Shapiro (2000)
Beta-109583	AS-11-1, Fagā	Seaward–inland transect, TU 8, L. VIII	1050 ± 60	1090–790	860–1160 AD	Cleghorn and Shapiro (2000)
Beta-109582	AS-11-1, Fagā, Fea. Complex L	TU 9, L. IV	1260 ± 50	1290–1070	660–880 AD	Cleghorn and Shapiro (2000)
Beta-104539	AS-11-1, Fagā, Fea. Complex S	TU 5, L. II	1090 ± 80	1240–1200 (1.6%), 1190–890 (88.0%), 880–790 (5.8%)	710–750 AD (1.6%), 760–1060 AD (88.0%), 1070–1160 AD (5.8%)	Cleghorn and Shapiro (2000)

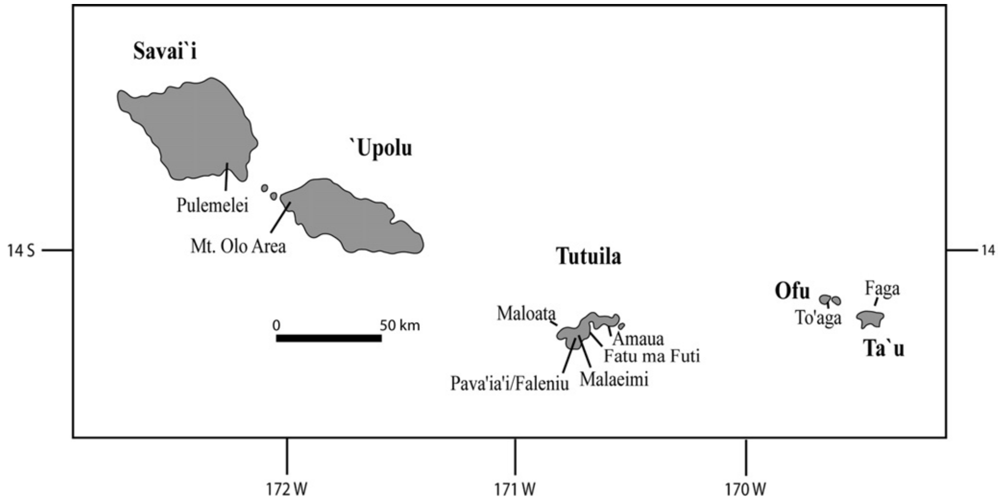

Fig. 11. Map of Sāmoa showing sites dating to the Dark Ages, ca. 1500-1000 cal BP.

1500–1000 BP, our understanding of this period is still poor. But two general trends are apparent. Only two deposits dated to this period contain pottery, and in both cases the ceramics are restricted to the early end of this range. Second, the largest reported assemblages from this period on Ofu and Ta‘ū in the Manu‘a Group suggest significant variability in cultural material. These deposits have nearly contemporaneous dates and are in close proximity. Although the data are limited, there are no clear indications of the archaeological signatures expected for a ‘‘formative’’ period, where researchers have posited increased competition and social stratification. Gaining a greater knowledge of the Sāmoan archaeological record during these centuries is also of importance in advancing understanding of the colonization of East Polynesia from West Polynesia during this time. Comparisons of contemporaneous West Polynesian and early East Polynesian assemblages are needed.

Although the current state of archaeological research in Sāmoa is promising, many questions remain unanswered. Applying a chronometric hygiene protocol has allowed us to evaluate the first several centuries of human occupation in the archipelago as well as the later Dark Ages. Our analysis has shown the limitations of current data, and has also demonstrated the need for a more rigorous procedure for using radiocarbon dating in our research. Only then will we be able to generate dates with the necessary precision and accuracy to begin filling in the gaps in our knowledge of Sāmoan prehistory.

Table 9
Attributes of cultural deposits dating from ca. 1500 to 1000 cal BP

Provenience	Location	Architecture	Ceramics	Lithic artifacts	Shell and/or coral artifacts	Faunal remains	Other associated features
Savai‘i							
Pulemelei	Inland	– (Pre-dates mound)	?	?	?	?	Earth oven
‘Upolu							
SU-17-91, Tulaga Fale	Inland	– (Pre-dates stone platform)	–	+	–	–	Probable earth oven
SU-17-483, Apulu HHU	Inland	– (Pre-dates stone platform)	–	–	–	–	Large oval pit feature
SU-17-552, Ten Points	Inland	– (Pre-dates star mound)	–	?	–	–	–
Tutuila							
AS-25-062, Fatu ma Futi	Coastal	–	–	+	+	+	Hearth
AS-31-116, Pava‘ia‘i	Inland	– (Pre-dates terrace)	Secondary deposit?	–	–	–	–
AS-31-171, Pava‘ia‘i	Inland	–	+	–	–	–	–
AS-31-131, Faleniu	Inland	– (Pre-dates terrace)	–	–	–	–	–
AS-34-34, Maloata	Coastal	–	–	+	–	–	–
Amaua	Coastal	–	–	–	–	–	–
Malaeimi	Inland	–	?	?	–	–	–
Ofu							
AS-13-1, To‘aga	Coastal	+	+	–	+	+	–
Ta‘ū							
AS-11-1, Fagā	Coastal	– (Pre-date paving and platform)	–	+	+	+	–

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jas.2007.12.001.

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