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Sāmoan artefact provenance reveals limited artefact transfer within and beyond the archipelago

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ABSTRACT

We summarise previous provenance research of Sāmoan lithic and ceramic artefacts, noting the timing and relative frequency of artefact transfers. Our summary suggests few intra- and extra-archipelago artefact transfers for the first two millennia, but that these modestly increased in the last 800 years of the prehistoric sequence. The late distribution of Sāmoan basalt around the Pacific was spatially expansive, but proportionally small. These results have implications for explaining both the development of Polynesian society and basalt artefact exchange.

Keywords: adzes, ceramics, interaction, Lapita, Polynesia, Sāmoa.

RÉSUMÉ

Nous présentons ici une revue des travaux engagés sur la provenance des artefacts lithiques et céramiques samoans, en insistant sur temporalité et la fréquence relative des transferts d'objets. Notre synthèse suggère assez peu d'échanges dans et hors de l'archipel durant les deux premiers millénaires, mais une augmentation modérée de ces transferts au cours des 800 dernières années de la séquence préhistorique. La distribution tardive des outils de basalte de Samoa apparaît géographiquement étendue dans le Pacifique, mais quantitativement réduite. Ces résultats apportent des éclairages sur le développement de la société polynésienne ainsi que sur les échanges d'outils en basalte.

Mots Clés: herminettes, céramique, interaction, Lapita, Polynésie, Sāmoa.

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INTRODUCTION

Lapita pottery bearing voyagers arrived at the archipelagos of Fiji, Tonga and Sāmoa in approximately 3000–2750 calBP (Sheppard 2011). The similar decorations on Lapita pottery from these islands confirm the cultural relatedness of the colonising populations (Cochrane & Lipo 2010; Green 1995). Also, it has long been suggested that post-Lapita interaction, primarily across the arc of Sāmoa and Tonga, continued for a time at a frequency such that a common ancestral Polynesian language and culture developed there (Kirch & Green 1987), with some bearers of this culture subsequently colonising East Polynesia.

Archaeological evidence of Sāmoa–Tonga interaction is, however, generally lacking until about 800 years ago. This lack of evidence has been noted for some time and it was assumed that such evidence would be forthcoming with more research. Referencing Sāmoa and Tonga, Davidson (1977: 88) wrote, "the evidence of pottery, adzes, and stone such as obsidian and chert should eventually help to document both inter-island contacts within archipelagos, and contacts between archipelagos". Contrary to these expectations, recent artefact provenance studies (e.g. Burley *et al.* 2011; Clark *et al.* 2014) have suggested that for two millennia after Lapita colonisation, interaction between Sāmoa and Tonga may have been rare. With potentially only modest archaeological evidence for contacts between these archipelagos, the hypothesis of early inter-archipelagic development of ancestral Polynesian culture should be further investigated, as there are ramifications for our understanding of the development of Polynesian languages and culture (Addison & Matisoo-Smith 2010; Pawley 2015; Smith 2002).

Within Sāmoa, there may be little archaeological evidence for interaction between local groups (Cochrane

et al. 2013). This, too, is puzzling as the archaeology of nearby Tonga (Burley 1998) and Fiji (Cochrane in press) both suggest intra-archipelago interaction throughout their cultural sequences. As there is comparatively less archaeological evidence of interaction within Sāmoa, explanations of pan-Sāmoan similarities that invoke cultural transmission across the archipelago, such as coordinated ceramic change (Hunt & Erkelens 1993), need to be re-evaluated.

The changing frequency of interaction within Sāmoa, and between Sāmoa and other archipelagos, is still an open question. In this paper, we summarise geochemical and petrographic analyses of lithics and ceramics and the evidence of Sāmoan artefact transfer. Although terms such as "interaction" and "contact" are often used, we want to highlight that we are describing the spatial distribution of artefacts relative to their presumed raw material sources, and thus we present our results in terms of "artefact transfer". At this stage in our understanding of Sāmoan archaeology, we think that concepts such as interaction or interaction sphere might be misread to mean political, economic, ritual or any other interpretation of artefact transfer that is not necessarily supported by current data. Indeed, archaeological studies of interaction often combine all of these possibilities (for prominent examples, see Trigger 2006: 437-40). At least two other issues complicate analyses of artefact transfer. First, describing an artefact as transferred or non-local requires an assessment of the geographical size of its raw material catchment and this is not always straightforward (Bishop *et al.* 1982). We use geochemically distinct Sāmoan quarries (see Best *et al.* 1992; Clark *et al.* 1997; Johnson *et al.* 2007; Moore & Kennedy 1996; Winterhoff *et al.* 2007) and admittedly common-sense distance assessments to identify non-local artefacts. Second, artefact transfer distance is not unambiguously translated into contact between distinct populations. This requires that we conceptualise population boundaries as analytical devices created using variation of interest, such as basalt artefacts, cognate words or haplotypes. For the ancient Pacific, populations are typically defined by islands, but for intra-island or intra-archipelago contexts, relevant population boundaries may not simply correspond to island boundaries. In recognition of this issue, we discuss provenance data in terms of distance and frequency of artefact transfer.

In the following summaries, we highlight analyses of artefact transfer conducted at an assemblage scale, so that we can begin to identify the relative frequency of local and non-local artefacts. We structure this summary around time periods and conclude that there is almost no evidence for artefact transfer between Sāmoa and other archipelagos until the last 800 years. There is limited evidence for artefact transfer within Sāmoa itself beginning sometime between 2750 and 2200 calBP, and this presumably increased in late prehistory.

LITHIC ARTEFACT TRANSFER

Sourcing and the distribution of Sāmoan basalt and volcanic glass artefacts

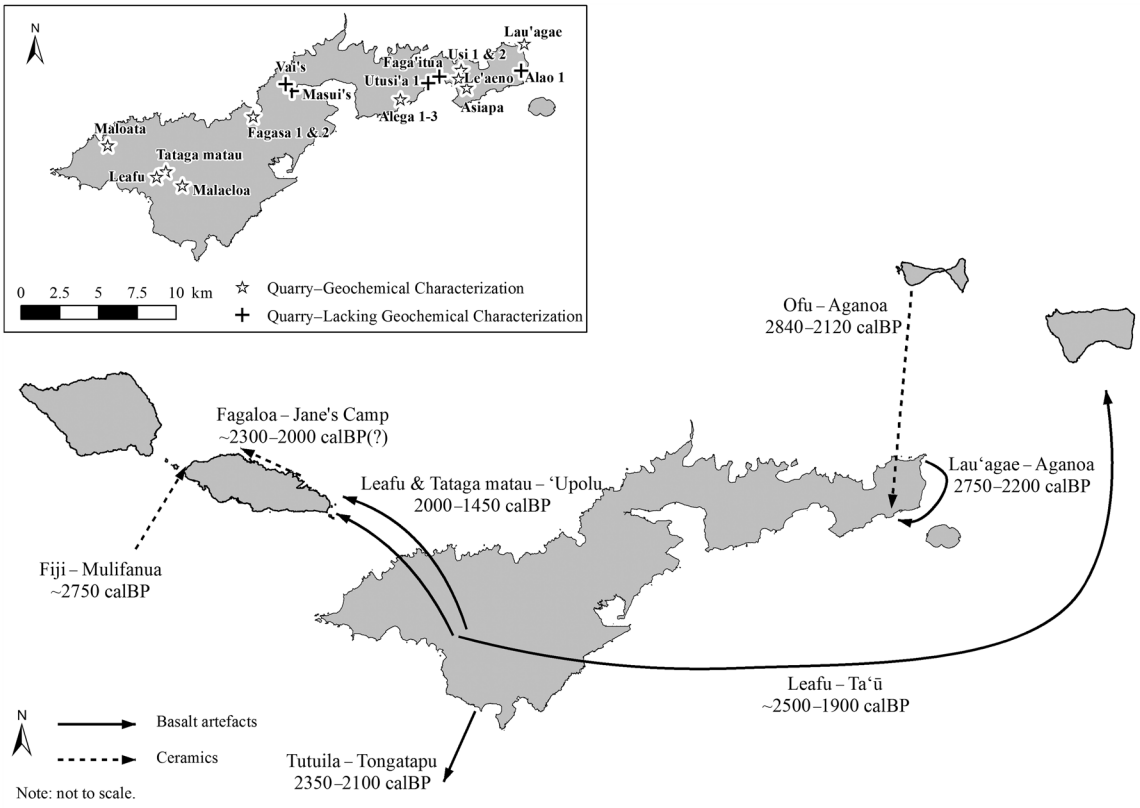
Although studies of volcanic glass have found it difficult to differentiate Sāmoan sources (Clark & Wright 1995; Sheppard *et al.* 1989), researchers have successfully documented the movement of basalt artefacts across Sāmoa and thousands of kilometres within the central Pacific (e.g. Best *et al.* 1992; Weisler & Kirch 1996). While studies have sometimes produced contradictory results in assigning artefacts to quarries (Clark *et al.* 1997: 77, 79), the differentiation of Tutuila Island basalts from other Oceanic sources has been consistently recognised. Recent investigations (Johnson *et al.* 2007; Winterhoff *et al.* 2007) have been able to show that geochemical variation across the major volcanic provinces of Tutuila, and also within particular valleys, can be distinguished. To synthesise current knowledge of Sāmoan basalt and volcanic glass artefact transfers, we have compiled data from published and unpublished sources (Supplemental Data Online). To increase the reliability of our results, we have excluded studies that relied solely on morphological characteristics of artefacts to attribute their origin to Sāmoa.

Figure 1 displays the locations of the known basalt quarries on Tutuila (no volcanic glass quarries are known). The quarries were identified as extraction locales by the original investigators (Addison 2010; Best *et al.* 1989, 1992; Clark 1989, 1992; Clark *et al.* 1997; Leach & Witter 1987), with two exceptions. Malaeloa and Maloata Valleys have multiple lithic debitage scatters, but primary extraction areas have not been identified. However, basalt tools originating from these valleys have been documented at intra-island, intra-archipelago and extra-archipelago locations, demonstrating that unidentified quarries must be present (Winterhoff *et al.* 2007).

Two caveats are necessary, since we are dealing with data generated by numerous researchers over several decades. First, many of the chronologies for quarry use and the distribution of stones and tools are moderately to poorly developed. Most radiocarbon determinations have been obtained from unidentified wood charcoal, which may include an unquantified inbuilt age. Additionally, bridging arguments linking the radiocarbon events with archaeological events of interest are usually unstated. With these issues in mind, we present the ages obtained by the original researchers with the understanding that many of these should be considered *terminus post quem* estimates for the movement of Sāmoan lithic artefacts.

Second, several researchers (e.g. Clark *et al.* 1997; Winterhoff *et al.* 2007) have relied on Best *et al.*'s 1992 geochemical data or have re-analysed samples included in that study. In some cases, this has resulted in revised determinations for the sources of particular artefacts. However, it is often unclear which specific artefacts have been reassigned, thus resulting in double-counting of these

Figure 1. Patterns of early period Sāmoan basalt and ceramic artefact transfer. Quarry locations in inset. Islands and distances not to scale.



items. We have done our best to identify overlap, but recognise that a few artefacts may be attributed to different sources by different researchers.

What follows is a chronological overview focused on the movement of Tutuila basalt and volcanic glass during three periods: early, middle and late. These do not precisely match cultural historical periods occasionally used (Rieth & Addison 2008), but are based on the available radiocarbon determinations associated with artefacts included in the provenance studies.

Early period, 2750–1550 calBP

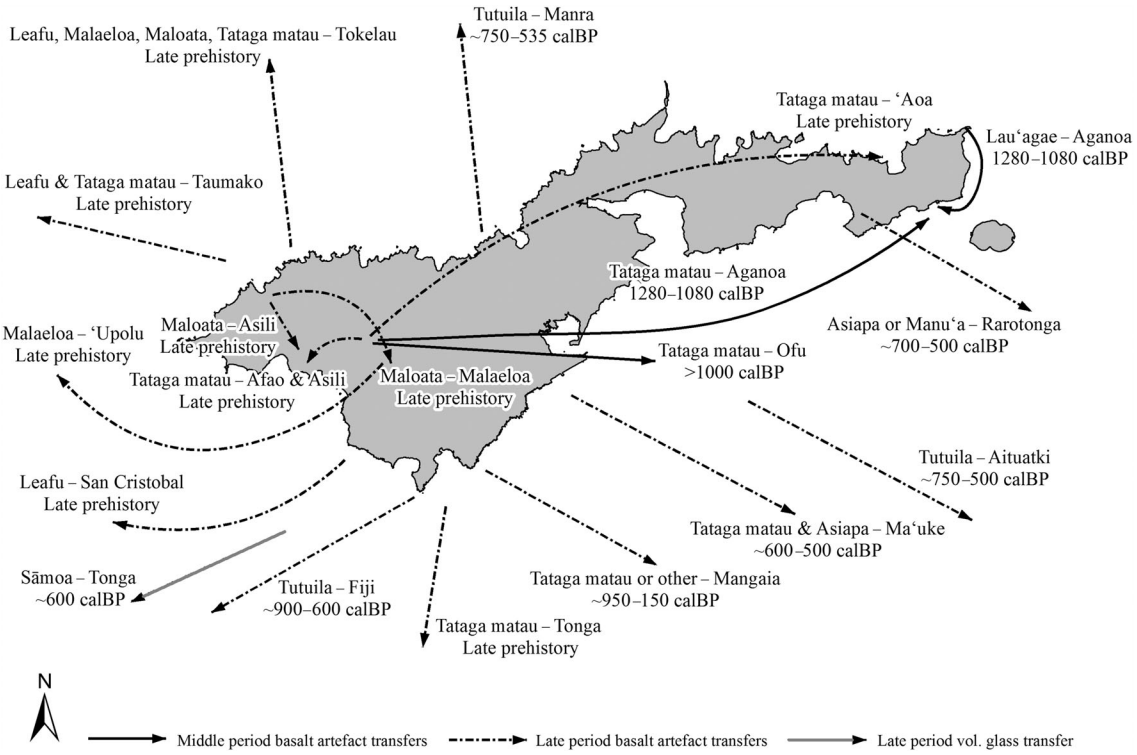
This temporal period is broad, spanning the first 1200 years of Sāmoan prehistory. Lau'agae basalt flakes and adze fragments in Aganoa deposits (Crews 2008) dating sometime between 2750 and 2200 calBP (Pearl & Sauck 2014) are the earliest evidence for the movement of basalt in the archipelago (Figure 1). This represents an intra-island transfer of roughly 4 km, and Lau'agae basalts comprise 23% of 31 analysed pieces associated with the early period at Aganoa. Within several centuries, basalt from Leafu was reaching the Manu'a group, approximately 120 km away, and material from Leafu, Tataga-matau and/or Malealoa was transported 100 km to 'Upolu (Best *et al.* 1992; Winterhoff *et al.* 2007). Stone from Tataga-matau may have moved to Ofu during these early centuries, but the date range associated with these artefacts extends to approximately 1000 calBP (Kirch 1993; Weisler & Kirch 1996). There are no data, however, on proportions of non-local and local basalt in these early Manu'a or 'Upolu deposits. The earliest extra-archipelago basalt artefact transfer is recorded by an adze from the upper portion of the ceramic deposit at Site TO.6 on Tongatapu, dated to 2300–2050 calBP. This adze is sourced to Tutuila and accounts for less than 1% of the adze assemblage at the site; an additional 15 adzes from subsurface contexts were analysed and sourced to Tonga or Fiji (Clark *et al.* 2014).

Volcanic glass artefacts from early period deposits at five sites across 'Upolu's north coast (Sasoa'a and Vailele) and eastern Tutuila (Aganoa, Tula and 'Aoa) have been geochemically analysed using different techniques, and with sample sizes ranging from 1 to 14 (see Supplemental Data Online). For each study, the original analysts interpret all the volcanic glass artefacts to be local, although Clark and Wright (1995: 256) argue that the 'Upolu artefacts analysed by Sheppard *et al.* (1989) derive from a Tutuila source.

Middle period, 1550–950 calBP

By the latter part of the first millennium AD, a single Tataga-matau basalt artefact reached Aganoa, approximately 22 km to the east (Figure 2), accounting for about 3.5% of Aganoa's basalt artefact assemblage for this time period; another 24 artefacts from the Aganoa deposit are sourced to Lau'agae, with four additional artefacts

Figure 2. Patterns of middle and late period Sāmoan basalt and volcanic glass artefact transfer. Islands and distances not to scale.



originating from an unknown source (Crews 2008). As noted above, the Tataga-matau basalt found on Ofu may have been transported during this period (Weisler & Kirch 1996). Many of the basalt artefacts found in the Manuʻa group are surface collected; thus it is difficult to examine change in artefact transfers over time, but 24% of the 38 basalt artefacts on Ofu and Taʻū examined by Weisler (1993) are sourced to Tataga-matau. Four volcanic glass artefacts were recovered from the topmost layer of a site at Fagasa, central north-coast Tutuila, dating to the middle period. Two of these artefacts were geochemically analysed and determined to be most probably local, and distinct from a third volcanic glass artefact from the eastern Tutuila site of Tula (early period), analysed as part of the same study (Rieth and Cochrane 2012; and see Supplemental Data Online).

Later period, post 950 calBP

After approximately 1000 calBP, Tutuila basalt reaches its greatest geographical extent (see Figure 2). During this period, basalt from multiple Tutuila sources reached islands over 1000 km distant. Movement of basalt to several of the Cook Islands during the thirteenth to fifteenth centuries AD is well documented. Basalt from Tutuila sources reached the Ureia and Moturakau sites on Aitutaki, accounting for less than 5% of analysed artefacts by weight at the Ureia site, with the contribution to the Moturakau assemblage unquantified (Allen & Johnson 1997: fig. 7.8). The Ngati Tiare cache of six adzes on Rarotonga is possibly sourced to Manuʻa or Asiapa based on the single adze analysed (Sheppard *et al.* 1997; Walter & Sheppard 1996). Asiapa and Tataga-matau basalt is found on Maʻuke, 1600 km to the south-east (Walter 1990; Walter & Sheppard 1996), but the proportion of local to non-local artefacts is unclear. Between approximately 950 and 150 calBP, Tataga-matau basalt or that from another Tutuila source was transferred to Mangaia, 1700 km distant. The non-local Sāmoan basalt accounts for about 6% of the 69 analysed Mangaian artefacts (Weisler & Kirch 1996).

Sāmoan basalt was transported 1100 km to Manra Island, Phoenix Group, between 750 and 535 calBP. Manra is a coral atoll, so all basalt is non-local and the analysed lithics consist of two cores from Tutuila with four macroscopically similar flakes (Di Piazza & Pearthree 2001), but these flakes could derive from other island sources. Sāmoan basalt was also transported to eastern Fiji sometime between 900 and 600 calBP, based on two flakes from two sites analysed by Best 1984. Best *et al.* (1992: 66) suggest that most adzes recovered in Fiji sourced to Leafu, about 1000 km distant, date to approximately 900 years ago. Clark *et al.* 2014 link 24 of 44 adzes from Tongan royal tombs at Lapaha, built as early as 600 calBP, to Sāmoan, primarily Tutuila, sources.

Undated, but presumably late prehistoric intra-archipelago basalt transfers involve three source areas (Winterhoff *et al.* 2007). Within Tutuila, Tataga-matau basalt moved to Afao, Asili and ʻAoa. Maloata basalt was transported to Malaeloa and Asili. With the exception of ʻAoa, which is approximately 20 km ENE of Tataga-matau, these are 2–5 km transfers across western Tutuila.

Many artefacts found outside Sāmoa sourced to Tutuila are surface finds and are considered to date to late prehistory, but this is uncertain. Other basalt artefacts recovered from undated subsurface contexts are often also considered to date to the last 900 years or less based on stratigraphy. Together, these undated artefacts from Tutuila are found in Fiji, Tokelau, Taumako, San Cristobal (Makira), Tonga, Pukapuka and Rarotonga (see Supplemental Data Online). Although Tataga-matau has received the greatest attention, at least four other Tutuila sources have contributed to the distribution of Sāmoan basalt during this period, with a fifth unknown source from the island and a possible unknown Manu‘a source also providing artefacts.

A single Sāmoan volcanic glass artefact dating to the late period has been found outside the archipelago. Burley *et al.* 2011 analysed 68 volcanic glass artefacts from across Tonga and from different time periods. Of four artefacts at the Vuna site in a deposit dating to approximately 600 calBP, one was assigned to a Sāmoan source and the other three were assigned to a northern Tonga source.

Patterns of basalt and volcanic glass artefact transfer

Analyses of volcanic glass artefacts suggest that these are all procured locally in Sāmoa (cf. Clark & Wright 1995), with a single flake of Sāmoan material recovered from Tonga in a late period context. The designation of local geographical ranges for volcanic glass may become more precise with future geological and archaeological chemical analyses. In contrast to our current understanding of volcanic glass, for most of Sāmoan prehistory small amounts of basalt were transferred within the archipelago. During the early period, basalt was transferred rarely and in small proportions relative to local stone resources. In the middle period, for two areas with frequency data, the Manu‘a group and Aganoa on Tutuila, approximately one quarter of the basalts analysed derive from sources approximately 130 or 22 km distant, respectively. If these observations are representative of Sāmoa, then they suggest that the majority of basalt artefacts in deposits derive from local sources (see Supplemental Data Online), but there is an increasing spatial scale of basalt artefact transfer within the archipelago over time. Due to the paucity of well-dated and adequately sampled deposits, it is difficult to identify the rate of change in artefact transfer frequency. However, it is plausible that the increased spatial scale of artefact transfer within Sāmoa is explained by the same, possibly punctuational, process leading to the extra-archipelago movement of Sāmoan basalts beginning 2000 years after colonisation.

By the second millennium AD, Sāmoan basalt artefacts were transferred across the Pacific, from the Cooks in the east to the Solmons in the west. Wherever the data are available, the proportion of Sāmoan basalts in non-Sāmoan assemblages is never more than about 10%, with the single exception of Lapaha in Tonga, suggesting that while the spatial distribution of Sāmoan basalts was extensive, the relative contribution of Sāmoan sources to lithic assemblages was very small.

CERAMIC ARTEFACT TRANSFER

Sourcing and the distribution of Sāmoan ceramic artefacts

Bill (W.R.) Dickinson has been the primary contributor to Sāmoan ceramic provenance research over the past 45 years and therefore many data derive from his petrographic analyses. Geochemical analyses employing LA–ICP–MS and SEM–EDS have also been undertaken, but with possibly less accurate results relative to assigning local or non-local status to ceramics. The same caveat about dating applies here: chronologies of ceramic deposition are moderately to poorly developed. Our chronological review of ceramics follows the same periods for lithics and the individual analyses are summarised in the Supplemental Data Online.

Early period, 2750–1550 calBP

The Sāmoan ceramics for which provenance analyses have been undertaken derive from the first millennium of Sāmoan prehistory (see Figure 1). Mulifanua, ‘Upolu island, is the oldest ceramic assemblage in Sāmoa, dated to approximately 2750 calBP (Rieth & Hunt 2008) and the only one with dentate Lapita ceramics. The assemblage contains a single sherd of probable Fijian origin amongst a total of 48 sherds from the site that have undergone petrographic analysis (Dickinson 1974; Petchey 1995). The remaining sherds are considered to be locally made.

Early ceramic assemblages, but without dentate Lapita decorations and probably deposited after Mulifanua, are found across the archipelago during the first several hundred years of the cultural sequence. Eckert and James 2011 examined 170 sherds from ‘Upolu, Tutuila and Ofu islands, deposited between 2840 and 2120 calBP. Based on LA–ICP–MS of sherd clays (no temper analysed), they identified a single sherd representing artefact transfer from Ofu to Tutuila. Hunt and Erkelens 1993 also examined sherd geochemistry, but using SEM–EDS, on 29 sherds from the Manu‘a group. Sherds were grouped in time periods between 2700 and 1700 BP, with the analysed sherds, out of 2434 total sherds, determined to be locally made. Sherds from the To‘aga site in the Manu‘a group were also petrographically examined and similarly determined to be manufactured locally (Dickinson 1993). At the Tula site on eastern Tutuila, Dickinson analysed 39 sherds deposited between 2550–2195 and 2260–1876 calBP. All sherds analysed, out of a total of 233 sherds greater than 1 cm in the longest dimension, were considered to be locally manufactured based on their temper constituents (Cochrane *et al.* 2013). At the nearby site of Aganoa, possibly occupied in the centuries after Mulifanua (Pearl & Sauck 2014), Eckert 2006 examined all 895 sherds through either petrography (23 sherds) or optical microscopy (872 sherds). Her results indicate that all ceramics were locally manufactured.

A few ceramic provenance studies examine assemblages representing shorter temporal ranges, but still within the first millennium of Sāmoan settlement. Dickinson's (2006: table 7, 32-7) compilation of ceramic petrographic data indicates that two sherds from Jane's Camp on north-west 'Upolu probably derive from the trachytes near Fagaloa, 40 km to the east. These sherds probably date between 2300 and 2000 calBP. Four undated sherds from Vailele, 20 km along the coast from Fagaloa, are also from this source. In these assemblages, the total number of similarly dated sherds for comparison is not clear, but it is likely that the proportion of ceramics representing artefact transfer is small. Two final studies, one by Dickinson 1969 and another by Bartek 2009, use petrography and LA–ICP–MS, respectively, and identify presumed local manufacture for all sherds analysed. Dickinson examined 27 sherds from sites along the central north coast of 'Upolu dating to approximately 1800 calBP. Bartek examined 64 of 92 sherds recovered from upland sites in west Tutuila, all dating to approximately 2200 calBP.

Patterns of ceramic artefact transfer

Patterns of ceramic transfer for the first 1000 years of Sāmoan prehistory are clear. There is almost no transfer of ceramics for the first 500 years of settlement in the archipelago. By approximately 2300 calBP, there is evidence for small amounts of ceramic transfer occurring over intra-island distances up to 40 km. There are no available analyses of ceramic transfer based on sherd paste constituents for assemblages dating more recently than about 1800 calBP.

DISCUSSION AND CONCLUSION

To the degree allowed by sampling and dating procedures, our review demonstrates that lithic artefacts were transferred rarely and in very small proportions within Sāmoa or beyond the archipelago for the first 1500 years of prehistory. Ceramic transfers follow a similar pattern, but there are no data on ceramic transfers after about 1800 calBP. Beginning about 1200 calBP, intra-archipelago transfers of basalts increase slightly in frequency and in distance, and after another 300–400 years, basalts from Sāmoa, particularly Tutuila, are transferred across the central and south-west Pacific, although they never comprise more than about 10% of a lithic assemblage, except at Lapaha, Tonga.

These findings are relevant to at least two research topics. First, without corroboration from artefact transfers, the evidence for common development of ancestral Polynesian society across archipelagos about 2300 calBP is largely confined to historical linguistics (Pawley 2015). We might ask if some of the artefact similarities used to infer common development – ceramics, for example (Cochrane *et al.* 2013) – are analogous, resulting from similar processes in separate populations, and not homologous. More research on artefact transfers in West Polynesia, and more archaeological work in Sāmoa, should help to confirm the changing frequency of artefact transfer in the region.

Second, several authors have described the inter-archipelago transfer of Sāmoan basalt artefacts in late prehistory as an "export industry" (Addison 2010), and evidence that Sāmoa was a "major supplier of basalt" (Clark 1996), or an "industrial center of basalt tool manufacture for the purpose of exchange" (Johnson *et al.* 2007: 1078). While there is ample evidence for basalt extraction and tool manufacture in Sāmoa, and Sāmoan basalts were widely distributed beginning in the last millennium, there is little evidence that Sāmoan basalt makes up even a modest proportion of assemblages outside of Sāmoa, except for the unique situation at Lapaha. Thus, we question the explanatory usefulness of labels such as "export industry" and the like. Instead, we think it is important to consider that the increasing spatial distribution of Sāmoan basalt might not be related to the superior characteristics of Tutuila stone, but that these artefacts simply track changes in the spatial scale of cultural transmission that might be explained by other processes such as climate-influenced voyaging (Anderson *et al.* 2006) and competition (Aswani & Graves 1998; Clark *et al.* 2014).

Finally, we return to the relatively infrequent transfer of artefacts within Sāmoa until the second millennium AD, and even then only a small proportion of artefacts are moved. If this is related to general frequencies of cultural transmission, Sāmoa is radically different to its neighbours. In Fiji, and to a lesser extent, Tonga, there is ample archaeological evidence from artefact provenance (Clark 2000; Cochrane & Neff 2006; Dickinson 2006) and stylistic similarities (Burley 1998; Cochrane in press) for consistent and widespread cultural transmission. Archaeological data are not the only observations relevant to cultural transmission studies, as both ethnographic (e.g. Kaeppler 1978) and oral historical (e.g. Barnes & Hunt 2005) research documents (probably late prehistoric) transmission between Fijian, Sāmoan and Tongan populations, However, we propose that the archaeological evidence of infrequent artefact transfer within Sāmoa for the first two millennia of prehistory is indeed related to a relative lack of cultural transmission between Sāmoan populations (Cochrane *et al.* 2013).

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REFERENCES

Addison, D.J. 2010. The Tutuila basalt export industry and the 5600 km distribution of Samoan adzes at ~700–600 BP. In P.

Wallin and H. Martinsson-Walin (eds), *The Gotland Papers: Selected Papers from the VII International Conference on Easter Island and the Pacific: Migration, Identity, and Cultural Heritage*, 347–358. Gotland University Press, Gotland.

Addison, D.J. and Matisoo-Smith, E. 2010. Rethinking Polynesians origins: A West-Polynesia Triple-I Model. *Archaeology in Oceania* 45: 1–12.

Allen, M.S. and Johnson, K.T. 1997. Tracking ancient patterns of interaction: Recent geochemical studies in the southern Cook Islands. In M.I. Weisler (ed.), *Prehistoric Long-Distance Interaction in Oceania: An Interdisciplinary Approach*, 111–133. New Zealand Archaeological Association, Auckland.

Anderson, A., Chappell, J., Gagan, M. and Grove, R. 2006. Prehistoric maritime migration in the Pacific islands: An hypothesis of ENSO forcing. *The Holocene* 16: 1–6.

Aswani, S. and Graves, M.W. 1998. Tongan sociopolitical evolution. *Asian Perspectives* 37: 135–164.

Barnes, S.S. and Hunt, T.L. 2005. Samoa's pre-contact connections in West Polynesia and beyond. *Journal of the Polynesian Society* 114: 227–266.

Bartek, C.L. 2009. Ancestral Polynesian Pottery Production and Exchange Analysis Using LA–ICP–MS. Research Scholar thesis, Texas A & M University, College Station, TX.

Best, S. 1984. Lakeba: The Prehistory of a Fijian Island. Unpublished PhD thesis, The University of Auckland, Auckland.

Best, S., Leach, H. and Witter, D. 1989. Report on the Second Phase of Fieldwork at the Tataga-matau site, American Samoa, July August. Working Papers in Anthropology, Archaeology, Linguistics and Maori Studies 83. Department of Anthropology, The University of Auckland, Auckland.

Best, S., Sheppard, P., Green, R. and Parker, R. 1992. Necromancing the stone: Archaeologists and adzes in Samoa. *Journal of the Polynesian Society* 101: 45–85.

Bishop, R.L., Rands, R.L. and Holley, G.R. 1982. Ceramic compositional analysis in archaeological perspective. In M.B. Schiffer (ed.), *Advances in Archaeological Method and Theory*, 275–330. Academic Press, New York.

Burley D.V. 1998. Tongan archaeology and the Tongan past, 2850–150 B.P. *Journal of World Prehistory* 12: 337–392.

Burley, D.V., Sheppard, P.J. and Simonin, M. 2011. Tongan and Samoan volcanic glass: pXRF analysis and implications for constructs of ancestral Polynesian society. *Journal of Archaeological Science* 38: 2625–2632.

Clark, G.R. 2000. Post-Lapita Fiji: Cultural Transformation in the Mid-sequence. Unpublished PhD thesis, The Australian National University, Canberra.

Clark, G.R., Reepmeyer, C., Melekiola, N., Woodhead, J., Dickinson, W.R. and Martinsson-Wallin, H. 2014. Stone tools from the ancient Tongan state reveal prehistoric interaction centers in the Central Pacific. *Proceedings of the National Academy of Sciences* 111: 10491–10496.

Clark, J.T. 1989. The Eastern Tutuila Archaeological Project, 1988, Final Report. On file at the American Sāmoa Historic Preservation Office, Pago Pago.

Clark, J.T. 1992. The Archaeology of Alega Valley: Residence and Small Industry in Prehistoric Samoa. Report on file at the American Samoa Historic Preservation Office, Pago Pago.

Clark, J.T. 1996. Samoan prehistory in review. In J. Davidson, G. Irwin, F. Leach, A.K. Pawley and D. Brown (eds), *Oceanic Culture History: Essays in Honour of Roger Green*, 445–460. New Zealand Archaeological Association, Dunedin.

Clark, J.T. and Wright, E. 1995. Volcanic glass in Samoa: A technological and geochemical study. *The Journal of the Polynesian Society* 104: 239–266.

Clark, J.T., Wright, E. and Herdrich, D.J. 1997. Interactions within and beyond the Samoan Archipelago: Evidence from basaltic rock geochemistry. In M.I. Weisler (ed.), *Prehistoric Long-Distance Interaction in Oceania: An Interdisciplinary Approach*, 68–84. New Zealand Archaeological Association, Auckland.

Cochrane, E.E., in press. Ancient Fiji: Melting pot of the Southwest Pacific. In E.E. Cochrane and T.L. Hunt (eds), *The Oxford Handbook of Prehistoric Oceania*. Oxford University Press, New York.

Cochrane, E.E. and Lipo, C.P. 2010. Phylogenetic analyses of Lapita decoration do not support branching evolution or regional population structure during colonization of Remote Oceania. *Philosophical Transactions of the Royal Society B: Biological Sciences* 365: 3889–3902.

Cochrane, E.E. and Neff, H. 2006. Investigating compositional diversity among Fijian ceramics with laser ablation – inductively coupled plasma – mass spectrometry (LA–ICP–MS): Implications for interaction studies on geologically similar islands. *Journal of Archaeological Science* 33: 378–390.

Cochrane, E.E., Rieth, T.M. and Dickinson WR 2013. Plainware ceramics from Sāmoa: Insights into ceramic chronology, cultural transmission, and selection among colonizing populations. *Journal of Anthropological Archaeology* 32: 499–510.

Crews, C.T. 2008. *The Lithics of Aganoa Village (AS-22-43), American Samoa: A Test of Chemical Characterization and Sourcing Tutuilan Tool-Stone*. Unpublished Master's thesis, Texas A&M University, College Station.

Davidson, J.M. 1977. Western Polynesia and Fiji: Prehistoric contact, diffusion, and differentiation in adjacent archipelagos. *World Archaeology* 9: 82–94.

Di Piazza, A. and Pearthree, E. 2001. Voyaging and basalt exchange in the Phoenix and Line archipelagoes: The viewpoint from three mystery islands. *Archaeology in Oceania* 36: 146–152.

Dickinson, W.R. 1969. Temper sands in prehistoric potsherds from Vailelel and Falefa, Upolu. In R.C. Green and J.M. Davidson (eds), *Archaeology in Western Samoa*, 271–273. The Auckland Institute and Museum, Auckland.

Dickinson, W.R. 1974. Temper sands in sherds from Mulifanua and comparison with similar tempers at Vailele and Sasoa'a. In R.C. Green and J.M. Davidson (eds), *Archaeology in Western Samoa*, 179–180. Auckland Institute and Museum, Auckland.

Dickinson, W.R. 1993. Sand temper in prehistoric potsherds from the To'aga site. In P.V. Kirch and T.L. Hunt (eds), *The To'aga Site: Three Millennia of Polynesian Occupation in the Manu'a Islands, American Samoa*, 151–156. University of California Press, Berkeley, CA.

Dickinson, W.R. 2006. Temper sands in prehistoric Oceanian pottery: Geotectonics, sedimentology, petrography, and provenance. Special Paper 406. Geological Society of America, Boulder, CO.

Eckert, S.L. 2006. Ancestral Polynesian plain ware production and technological style: A view from Aganoa, Tutuila Island, American Sāmoa. *The Journal of Sāmoan Studies* 2: 65–73.

Eckert, S.L. and James, W.D. 2011. Investigating the production and distribution of plain ware pottery in the Samoan archipelago with laser ablation – inductively coupled plasma – mass spectrometry (LA–ICP–MS). *Journal of Archaeological Science* 38: 2155–2170.

Green, R.C. 1995. Linguistic, biological, and cultural origins of the original inhabitants of Remote Oceania. *New Zealand Journal of Archaeology* 17: 5–27.

Hunt, T.L. and Erkelens, C. 1993. The To'aga ceramics. In P.V. Kirch and T.L. Hunt (eds), *The To'aga Site: Three Millennia of Polynesian Occupation in the Manu'a Islands, American Samoa*, 123–150. University of California Press, Berkeley, CA.

Johnson, P.R., Pearl, F.B., Eckert, S.L. and James, W.D. 2007. INAA of pre-contact basalt quarries on the Samoan Island of Tutuila: A preliminary baseline for an artifact-centered provenance study. *Journal of Archaeological Science* 34: 1078–1087.

Kaeppler, A.L. 1978. Exchange patterns in goods and spouses: Fiji, Tonga and Samoa. *Mankind* 11: 246–252.

Kirch, P.V. 1993. Radiocarbon chronology of the To'aga site. In P.V. Kirch and T.L. Hunt (eds), *The To'aga Site: Three Millennia of Polynesian Occupation in the Manu'a Islands, American Samoa*, 85–92. University of California Press, Berkeley, CA.

Kirch, P.V. and Green, R.C. 1987. History, phylogeny, and evolution in Polynesia. *Current Anthropology* 28: 431–456.

Leach, H. and Witter, D. 1987. Tataga-matau "rediscovered". *New Zealand Journal of Archaeology* 9: 33–54.

Moore, J.R. and Kennedy, J. 1996. Archaeological Resources on Lau'agae Ridge: A Phase II Cultural Resource Evaluation of Site AS-21-100 (The Lau'agae Ridge Quarry) for Phase III of the Onenoa Road Project Located in East Vaifanua County, Tutuila Island, American Samoa. On file at the American Sāmoa Historic Preservation Office, Pago Pago.

Pawley, A. 2015. Linguistic evidence as a window into the prehistory of Oceania. In E.E. Cochrane and T.L. Hunt (eds), *The Oxford Handbook of Prehistoric Oceania*. Oxford University Press, New York.

Pearl, F.B. and Sauck, W.A. 2014. Geophysical and geoarchaeological investigations at Aganoa Beach, American Samoa: An early archaeological site in Western Polynesia. *Geoarchaeology* 29: 462–476.

Petchey, F.J. 1995. The Archaeology of Kudon: Archaeological Analysis of Lapita Ceramics from Mulifanua, Samoa and Sigatoka, Fiji. Unpublished Master's thesis, The University of Auckland, Auckland.

Rieth, T.M. and Addison, D.J. 2008. How dark are they? The Sāmoan Dark Ages, ~1500–1000 BP. In D.J. Addison and C. Sand (eds), *Recent Advances in the Archaeology of the Fiji/West-Polynesia Region*, 87–96. University of Otago, Dunedin.

Rieth, T.M. and Hunt, T.L. 2008. A radiocarbon chronology for Samoan prehistory. *Journal of Archaeological Science* 35: 1901–1927.

Sheppard, P. 2011. Lapita colonization across the Near/Remote Oceania Boundary. *Current Anthropology* 52: 799–840.

Sheppard, P., Walter, R. and Parker, R.J. 1997. Basalt sourcing and the development of Cook Island exchange systems. In M.I. Weisler (ed.), *Prehistoric Long-Distance Interaction in Oceania: An Interdisciplinary Approach*, 85–110. New Zealand Archaeological Association, Auckland.

Sheppard, P.J., Hancock, R.G.V., Pavlish, L.A. and Parker, R. 1989. Samoan volcanic glass. *Archaeology in Oceania* 24: 70–74.

Smith, A. 2002. *An Archaeology of West Polynesian Prehistory*. Pandanus Books, Sydney.

Trigger, B.G. 2006. *A History of Archaeological Thought*, 2nd edn. Cambridge University Press, Cambridge.

Ward, G.K. 1974. An investigation of the source of the obsidian flakes from two Samoan sites. In R.C. Green and J.M. Davidson (eds), *Archaeology in Western Samoa*, 167–169. The Auckland Institute and Museum, Auckland.

Walter, R. 1990. The Southern Cook Islands in Eastern Polynesian Prehistory. Unpublished PhD thesis, The University of Auckland, Auckland.

Walter, R. and Sheppard, P.J. 1996. The Ngati Tiare adze cache: Further evidence of prehistoric contact between West Polynesia and the Southern Cook Islands. *Archaeology in Oceania* 31: 33–39.

Weisler, M.I. 1993. Chemical characterization and provenance of Manu'a adz material using non-destructive X-ray fluorescence technique. In P.V. Kirch and T.L. Hunt (eds), *The To'aga Site: Three Millennia of Polynesian Occupation in the Manu'a Islands, American Samoa*, 167–187. University of California Press, Berkeley, CA.

Weisler, M.I. and Kirch, P.V. 1996. Interisland and interarchipelago transfer of stone tools in prehistoric Polynesia. *Proceedings of the National Academy of Sciences* 93: 1381–1385.

Winterhoff, E.Q., Wozniak, J.A., Ayres, W.S. and Lash, E. 2007. Intra-island source variability on Tutuila, American Samoa and prehistoric basalt adze exchange in Western Polynesia – Island Melanesia. *Archaeology in Oceania* 42, 65–71.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this paper at the publisher's website:

Supplemental Data. Provenance Data for lithic and ceramic artefacts associated with Sāmoan contexts or sources.