NEW ZEALAND JOURNAL OF ARCHAEOLOGY

The Volcanic Outlier of ‘Ata in Tongan Prehistory:
Reconsideration of its Role and Settlement Chronology

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ABSTRACT

A 1977 archaeological survey and test excavation project on ‘Ata, an uninhabited volcanic outlier in far southern Tonga, concluded that the island was first occupied in later prehistory, and that the settlement was isolated and marginal. Additional reconnaissance carried out in 2001 provides new data on which to reconsider these conclusions. Other than the later occupation as reported, surface recovery of Polynesian Plainware ceramics indicates first settlement took place considerably earlier, *ca.* 2200–1800 BP. Adze production debitage in association with these ceramics, as well as widespread evidence for adze preform manufacture during the later period, identifies ‘Ata as a potential source for fine-grained adze basalts throughout its occupation. Because suitable lithics were absent on most of the inhabited islands in Tonga, ‘Ata and other of Tonga’s volcanic islands would have been important and critical resource locales. It is believed that exploitation and export of this material was a probable stimulus for settlement and for continued occupation into later prehistory.

Keywords: ARCHAEOLOGY, TONGA, LITHIC SOURCE, ADZE PRODUCTION.

INTRODUCTION

As one component of the 1977 Royal Society of New Zealand Southwest Pacific Expedition, Anderson conducted an 18 day survey, recording, and test excavation project on the extreme southern Tongan outlier of ‘Ata (Fig. 1). Although abandoned in the early 1860s, ‘Ata represented one of the most isolated of the inhabited islands of the traditional Tongan polity. Anderson’s concerns were with establishing the antiquity of this former population, its relationship to the remainder of the Tongan group, and with gaining some understanding of adaptation and economy in what appeared to be a marginal environment for Polynesian settlement. Recovered data led him to the tentative conclusion that the island was first settled in later prehistory, and that the community was isolated, dependent upon agriculture, and unable to exploit fully the surrounding marine resources (Anderson 1978: 20). His conclusions, however, were tendered with the caveat that a “more comprehensive prehistory of ‘Ata must await further research” (ibid.).

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New Zealand Journal of Archaeology, 2004, Vol. 25 (2003), pp. 89–106.

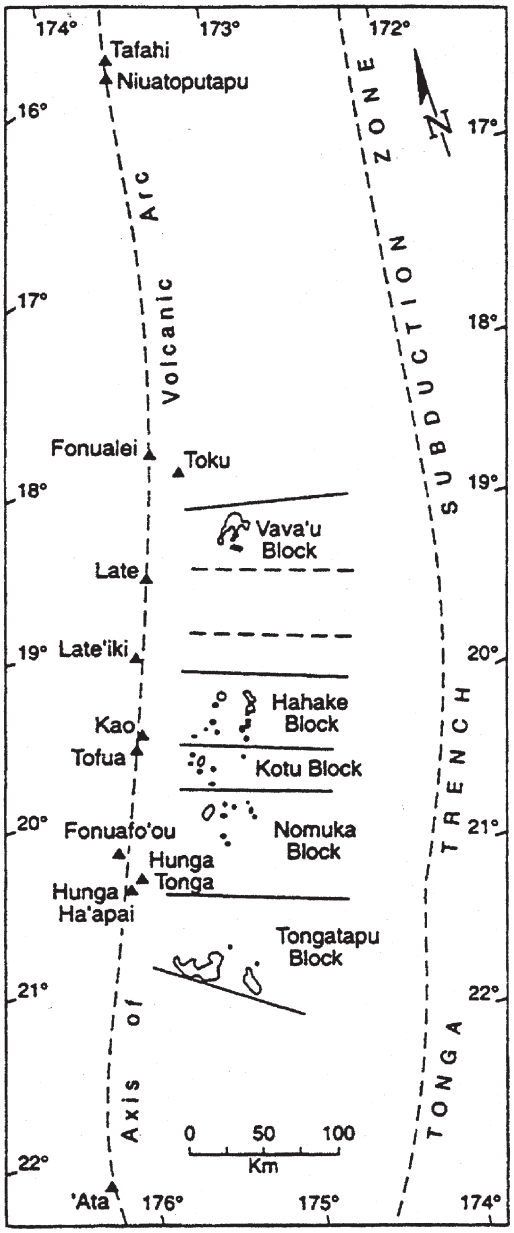

Figure 1: Map of geological features, islands, and trends of the Tongan archipelago, based on Dickinson *et al*. (1999). Volcanic islands indicated by triangles in the west are not to scale. Solid and dashed horizontal lines approximately correspond with the boundaries of forearc blocks created by transverse structural faults.

In August 2001, at the request of the Tongan Prime Minister, an additional archaeological reconnaissance of 'Ata was carried out by Burley and Steadman. At the same time Steadman conducted a preliminary survey of island bird populations, these having flourished since the departure of humans in the 1860s. Both projects were to provide contextual information for consideration of 'Ata as an Ecological Reserve or National Park. While limited in duration, the more recent project builds upon the 1977 study and suggests revision to earlier conclusions. In particular, we now propose that 'Ata was not entirely an economically isolated outlier. Rather, it is believed that the island served as a probable source for fine-grained basalt used in adze manufacture and for other purposes. Newly recovered data suggest this not only was the case in later prehistory and the historic era, but can be extended back as early as the Polynesian Plainware phase of *ca.* 2200–1800 BP. The following paper reports upon the 2001 project, the archaeological data recovered from surface collection and test excavation, and consequential interpretations. Related reports by Weisler (2004, this volume) on XRF characterisation of 'Ata adze basalt, and by Dickinson (2004, this volume) on the petrographic analysis of temper sands in 'Ata ceramic sherds follow. Both document important source materials from which 'Ata-derived artefacts can potentially be identified in West Polynesian prehistory.

Figure 2: The north-eastern 'Ata coastline from the water. The photograph faces the southwest with Bird Rock (see Fig. 3) on the far right.

HISTORICAL AND ARCHAEOLOGICAL CONTEXTS FOR ‘Ata

‘Ata is a volcanic high island remnant on the southern end of the Tofua Volcanic Arc (Bryan *et al*. 1972; Johnstone 1978) (Fig. 1). Located 140 km south-south-west of Tongatapu, its present land surface of 1.8 km^2 is largely bordered by steep sea cliffs without beach or protective reef (Figs 2 and 3). The island can be accessed only along its northern coast, where an intermittent cobbled beach stretches for a distance of 1.5 km (Fig. 4). A limited lagoon and incipient reef complex (200 x 50 m) occur at the eastern end of this beach. Here also is the only trail leading to the upper plateau, a tableland that is now covered in a dense canopy of mixed forest. The upper plateau slopes from east to west, eventually rising to twin peaks of over 300 m elevation on ‘Ata’s western side (Fig. 3).

The first European explorer to comment upon ‘Ata was Abel Tasman in January, 1643. Naming the island Hooge Pijlstaertz (high tropic bird island), he did not sight evidence for human habitation (Anderson 1978: 1). ‘Ata was renamed La Sola in 1781 by Maurelle, while in 1791, Edwards of the British ship *Pandora*, reported the island to be occupied (Gifford 1929: 278). ‘Ata’s most significant encounter with Europeans came about in 1860, when Peruvian blackbirders, in collusion with an ‘Ata resident, kidnapped several men

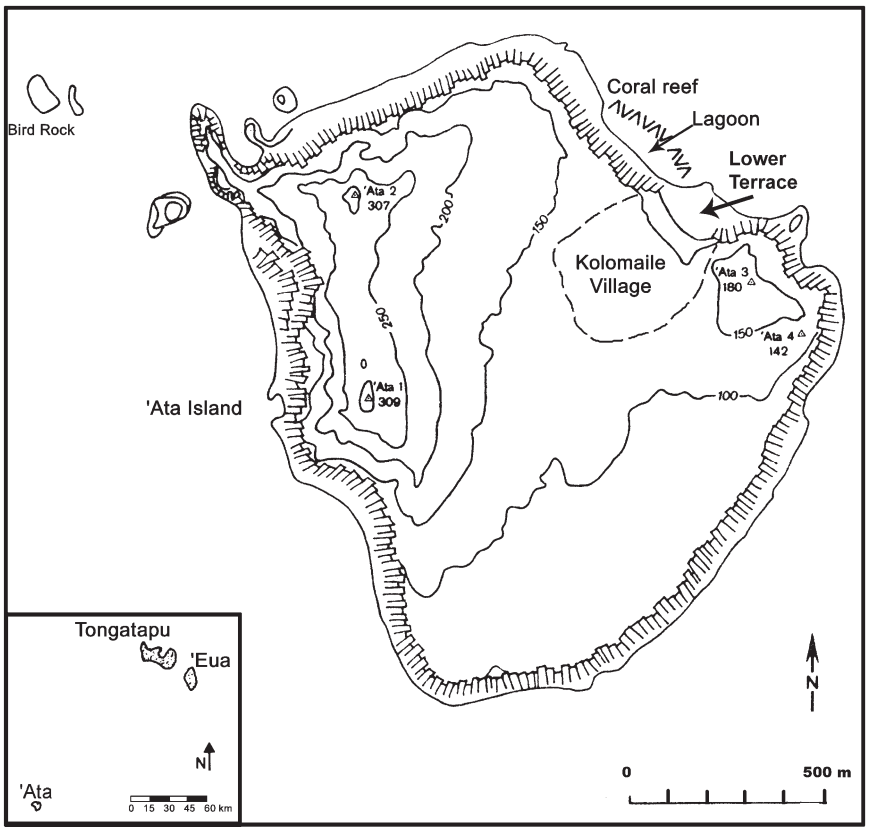

Figure 3: Topographic map of ‘Ata and location of Kolomaile and lower terrace.

Figure 4: Photograph of cobbled beach mixed with cliff fall on ʻAta's north central coast. The photograph faces west-south-west.

(ibid.: 283). This event led King Taufaʻahau Tupou I to order and implement an evacuation of the remaining populace to ʻEua. Save for the occasional castaway, ʻAta has remained abandoned since. In 1920/1921, Gifford (ibid.: 278–283) interviewed several former residents, gathering traditional history, genealogical data, and other information. Oral traditions recounted that the nineteenth century community owed its founding to a chief, Motuapuaka, who after eloping with Tapuosi, a daughter of the Tuʻi Tonga, sought refuge here. According to the same traditions, Motuapuaka had to defeat an earlier group of 'aborigines', whose bones presumably could still be seen in a cave on the island. Using genealogical data, Gifford (ibid.: Table 15) was able to identify seven generations between Motuapuaka and the 1920 population of ʻEua, thus estimating an early eighteenth century origin for the evacuated community.

At the time of its removal to ʻEua, the population of ʻAta was estimated to be about 200, with approximately 100 of these being children (Gifford 1929: 283). In contrast to the traditional Tongan settlement pattern where families are dispersed over chiefly land holdings, ʻAta people lived in a single village, Kolomaile, that was situated on the western edge of the upper plateau. As described to Gifford (ibid.: 279):

> It was divided into three sections: Hihifo (the west end), Auloto, and Pea. Pea was apparently named after the village of Pea on Tongatapu… . Each of these three divisions of the town had a district of its own for farming. Whether or not each district was divided into individual family holdings could not be determined.

By 1860, the ‘Ata population had become Christian, and a school was present in the village (ibid.: 283).

Anderson’s (1978) archaeological study of ‘Ata in 1977 documented a wide range of features associated with the village, as well as others occurring on a lower terrace along the access trail. Features included an abundance of large diameter (3–5 m) pits, some with internal stone facing, a variety of large and small upright stones, several different forms of stone alignments, curbings and boundary lines, a small number of stone bowls and perforated stones, as well as a ring-ditch fortification with an open side formed by the plateau rim. Most features were mapped in plan view, two of the pits were given test excavations to assess function, and test excavation and surface collection was undertaken on the lower terrace. Three burials and a funerary-related adze cache were found eroding from the plateau rim, and these also were excavated. Three radiocarbon dates, nitrogen levels of the human bone, and the various occupation features suggested “a late Tongan village” dating between the sixteenth and nineteenth centuries (ibid.: 18). At the same time, there was tantalising evidence to suggest an earlier occupation, not the least being the recovery of earlier-appearing adze types and three plain, earthenware ceramic sherds. Faunal remains were limited and suggested a subsistence economy without intensive marine resource exploitation.

THE 2001 ‘ATA PROJECT OBJECTIVES

The duration of the 2001 ‘Ata project was defined by logistics, in so far as the field crew was dropped off and picked up by a Tongan naval vessel during its southern patrol of the Minerva reef. After transport of field equipment and supplies from the drop-off point to the base camp on the lower terrace below Kolomaile, there were but two days remaining (August 10–11) to initiate a project. Archaeological objectives, thus, were limited, and oriented toward a furthering of information gained in the 1977 study. These objectives included three tasks:

1) Because ceramic sherds had been recovered from the lower terrace below the village in 1977, the 2001 project was to explore further the archaeological context of this terrace, and the possible presence of an earlier Polynesian Plainware phase occupation.

2) While conducting bird survey on the upper plateau using regularly spaced counting stations along an east/west transect, Steadman was to survey this transect for archaeological features or exposures not recorded in 1977.

3) Samples of adze production materials (adzes, preforms, flakes) from the surface or test excavations were to be collected for XRF source characterisation.

The 1977 map and feature investigations of Kolomaile were taken to be reasonably complete, and these provided associated materials for preparation of a report to the Tongan government on ‘Ata archaeology.

LOWER TERRACE: A LATE PREHISTORIC/HISTORIC ADZE WORKSHOP AND MIDDEN

The lower terrace occurs at approximately 10 m elevation above the beach and *ca.* 90 m below the upper plateau rim (Fig. 3). It includes an area 75 x 20 m, with the long axis paralleling the beach (Fig. 5). The access trail to Kolomaile runs along its southern

perimeter, while a densely packed rock wall, up to 1 m high and 2 m across at the base, was laid down across its middle. To the south of this wall is a gradually sloped terrain, without rock concentrations or features. This area has been interpreted as a garden (Anderson 1978: 4), an inference supported by the nearby presence of the only remaining coconut palms on the terrace. To the north of the wall are a variety of surface remains, including rock alignments and levelled features suggestive of habitation and other activities. Scattered exposures of midden, fire-broken rock, and basalt flakes occur in several different areas. Survey upslope and behind the terrace found further remnants of artificial terracing. Scatters of shellfish and the occasional flake of worked basalt were noted on their surfaces. Intermediate between the lower terrace and the beach is a series of large angular boulders (Fig. 5). During the 1977 project, concentrations of adze preforms and flakes were recorded in spaces between the rocks, leading the area to be designated as a workshop (ibid.: 14). Adze preforms and debitage were noted here again in 2001, and two specimens were collected (see Table 1). Finally, scattered shellfish and other materials occur along the access trail to the plateau rim. A single undecorated earthenware sherd and an adze production flake in proximity were recovered approximately mid-slope.

The 1977 investigations included excavation of two test units north of the stone wall (Fig. 5). These documented an accumulation of midden remains on the lower terrace while one also incorporated two undecorated earthenware ceramic sherds. A third sherd was collected from the surface nearby. To further test the habitation area in 2001, two shovel probes (30 x 30 cm), one on the terrace edge to the extreme north and the other more centrally located, were expediently dug (Fig. 5). The northern probe indicated that the midden deposit here extended to a depth of greater than 75 cm. A 1 x 1 m unit was subsequently excavated adjacent to the probe to record the deposit's context and chronology more fully. The unit included four discernible strata over an excavated depth of 88 cm. The upper Stratum (0–30) is loose, pebbly brown silt interpreted to be a post-occupation slope wash across the terrace. It incorporates the occasional redeposited basalt flake (n=7) or shell fragment, but otherwise

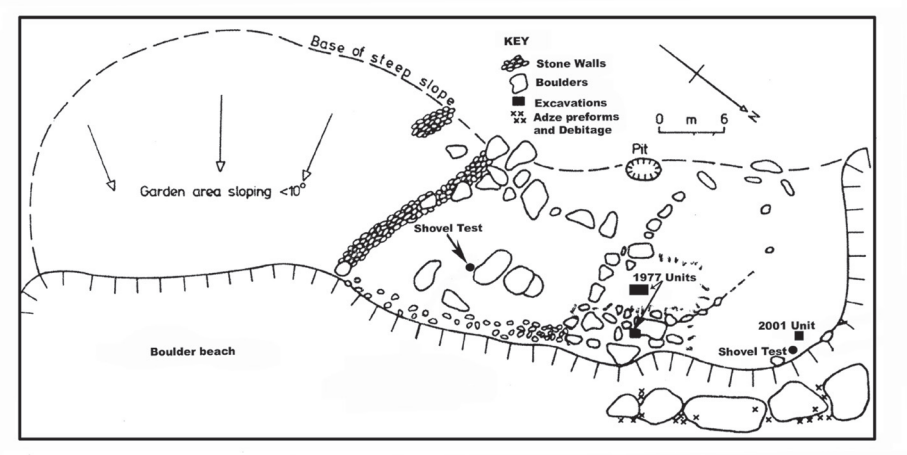

Figure 5: Map of lower terrace features and excavation units, adapted from map in Anderson (1978).

is sterile. Stratum II (30–60) is brown silty clay with whole and fragmented shell, fauna, basalt flakes (n=72), a hammerstone, and a mineralised tridacna shell adze preform (Fig. 6). Also recovered were three fragments of a European clay pipe (2 bowl, 1 stem), identifying a historic age for the stratum. Stratum III (60–85) is a very dark brown to black silt-clay loam. It includes whole and broken shellfish, other fauna, and basalt flakes (n=33). This stratum is interpreted as the original soil surface over which the upper midden deposit formed. Stratum IV is an orange-brown andesitic tephra subsoil without cultural material.

Despite a clear break in stratigraphy between Stratum II and III, the archaeological remains in the test pit appear homogeneous, and representative of a single continuous deposition. A previous radiocarbon age of 270 ± 70 BP (R. No. 5542/2[4]) was acquired from the base of "Layer 1" in one of the units (IV) excavated in 1977 (ibid.: 16). Layer 1 "… comprised a 12 cm deep friable black soil containing dense shell midden and occasional bones and basalt flakes" (ibid. 12). Although the excavation unit is in a different part of the terrace, and it is difficult to cross-correlate stratigraphic contexts, we believe that the date generally equates with the Stratum II/III break as described. Cultural remains from the 2001 excavation unit as a whole, thus, are thought to fall conservatively within the interval *ca.* 350 to 150 BP.

The 2001 excavation unit resulted in the recovery of what we interpret to be adze preform production flakes (n=112) as well as the hammerstone and tridacna adze blank (Table 1). Specimens under 30 mm in length dominate the flake assemblage, and many of the pieces are shatter produced by hard hammer percussion blows. None have retouch or other modifications indicating expedient use as tools. Eleven specimens retain water-tumbled surface features that identify beach cobbles as the source of raw material. Based on specimens recovered from the workshop area below the lower terrace in 1977, Anderson (ibid.: 14) inferred a preform production sequence as follows:

TABLE 1
Adze production debitage and preforms recovered from 'Ata 2001

Large flakes are defined as having a maximum length longer than 30 mm. Cumulative weight in grams is included in parenthesis.

	Plainware Upper	**Test Unit Lower**	**Shovel Tests Lower**	**Surface Lower**	**Total**
Small flake	3 (11.9)	93 (136.1)	2 (36)	-	98 (151.6)
Large flake	14 (306.9)	8 (82.9)	2 (47.8)	2 (73.7)	26 (511.3)
Angular surface	3 (41.1)	-	-	-	3 (41.1)
Cobble surface	3 (20.0)	11 (53.9)	-	1 (161.7)	15 (235.6)
Preform	3 (296.0)	-	-	4 (1534.7)	7 (1830.7)
TOTAL	**26 (675.9)**	**112 (272.9)**	**4 (51.4)**	**7 (1770.1)**	**149 (2770.3)**

[4]Editor's note: The correct laboratory number of this date is NZ4475. The Rafter Laboratory (Institute of Geological and Nuclear Sciences) data base gives the CRA as 212 ± 66, with a $\delta^{13}C$ value of -24.8.

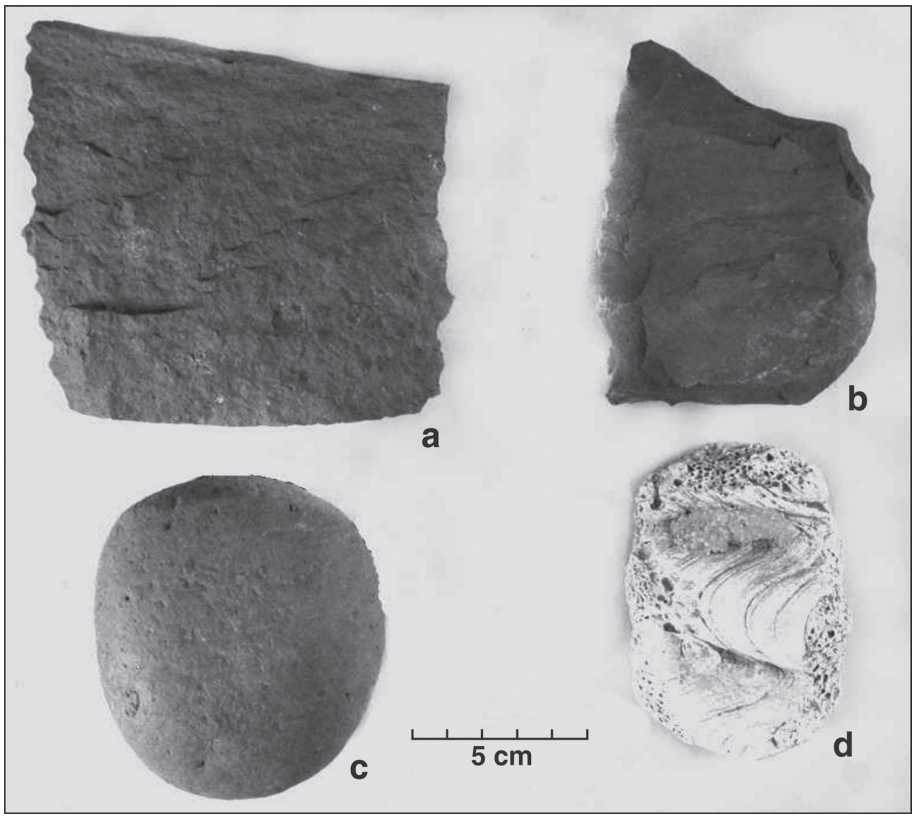

Figure 6: Adze preforms (a, b), hammerstone (c) and tridacna adze preform (d) from lower terrace. The preforms were both recovered from surface collection.

> …the basic technology consisted of the smashing of unprepared beach rolled stones, the selection of pieces with one water-smoothed plane surface, and the trimming of these to a preform of ovoid to rectangular plan and plano-convex cross section. On this basic shape adzes of plano-convex, triangular, trapezoidal or quadrangular cross-section could be made by varying the emphasis of flaking and bruising of the ventral surfaces and sides.

The smaller size of recently excavated specimens is more characteristic of secondary preform reduction than of initial smashing. It is also noteworthy that completely flaked adze preforms, including one quite large specimen (Fig. 6a), are present on the surface of the lower terrace. We now expect that once the cobble or boulder had been smashed on the beach, the knapper selected pieces with convenient shapes and surface attributes for preform/adze manufacture, some including weathered and water-rolled surfaces but others without.

The excavated debitage, as well as the hammerstone, suggests that the area was a workshop where adze preforms were being reduced. If this unit were even remotely representative of surrounding archaeological deposits in the northeast corner of the terrace,

a 10 x 10 m block excavation would have recovered well over 25 kg of basalt flakes (see Table 1). In 1977, Anderson (1978: 17) similarly found considerable evidence for adze manufacture, selectively retaining 15 adzes or adze fragments of basalt as well as another 11 preforms. Some were from the workshop area below the lower terrace, some came from the funerary cache, but various concentrations of "basalt flakes, preforms, adzes and adze fragments" were also in direct association with structural features in the village on the upper plateau (ibid.: 7). To this we add the scattered presence of basalt flakes on the access trail and side-slope terraces. Even within the highly limited scales of 1977 and 2001 investigations, it is apparent that adze production materials dominate the late prehistoric archaeological record of ʻAta. Speculatively, therefore, we suggest the remains of this industry go beyond local need and that the villagers of Kolomaile may have been preparing at least a component of this material for export and exchange. This interpretation is supported in part by the small size of the historic population, and the likelihood that it was even smaller in preceding generations (see Gifford 1929: Table 15). It is also interesting to note that adze manufacture continued well into the historic era, as indicated by the association of clay pipe fragments with adze flakes on the lower terrace.

To claim that ʻAta residents may have been exporting adze preforms or adzes to islands further north in Tonga in later prehistory necessarily calls into question earlier interpretations of extreme isolation. The ethnographic accounts collected by Gifford imply that ʻAta was neither on a mainstream travel corridor nor frequented on a very regular basis. At the same time, it is apparent that ʻAta residents were fully integrated into the Tongan chiefdom and that inter-island voyages did take place. Gifford (ibid.) indirectly documents this in his genealogical chart, where many of the ʻAta marriages in the generations following Motuapuaka involved a partner from outside ʻAta. He (ibid.: 280) also reports oral accounts of additional immigration to the island in the latter part of the eighteenth century, by a group from Tungua, in Haʻapai, and by people from the island of ʻAtatā off northwest Tongatapu. The presence of a church, a school, and scattered historic artefacts along the plateau rim (Anderson 1978: 18) further document ties to the north, and an exchange network that brought European goods to ʻAta. The simple fact that the Kolomaile people constructed a ring ditch fortification securely attests to their knowledge of Tongan politics and warfare in the first half of the nineteenth century (see Burley 1998: 378–379), as also their concern about possible incursion. Based on these considerations, ʻAta does not appear as isolated as its geography might imply.

UPPER PLATEAU: A POLYNESIAN PLAINWARE ADZE PRODUCTION LOCALE

To sample the upper plateau systematically for bird population estimates, Steadman followed an east/west transect from the plateau rim north of the village to the steeper slope along the western perimeter. Bird counts were taken at 50 m intervals, and the transect course was surveyed for archaeological remains. Approximately 300 m inland of the plateau edge, an intermixed scatter of adze production flakes (n=23), preforms (n=3), and earthenware ceramics (n=38) was discovered (Figs 7 and 8, Tables 1 and 2). These were concentrated in an area approximately 3 x 3 m on the floor of a mixed-forest canopy. No additional features or adjacent specimens were observed, and time did not allow even expedient testing of the site.

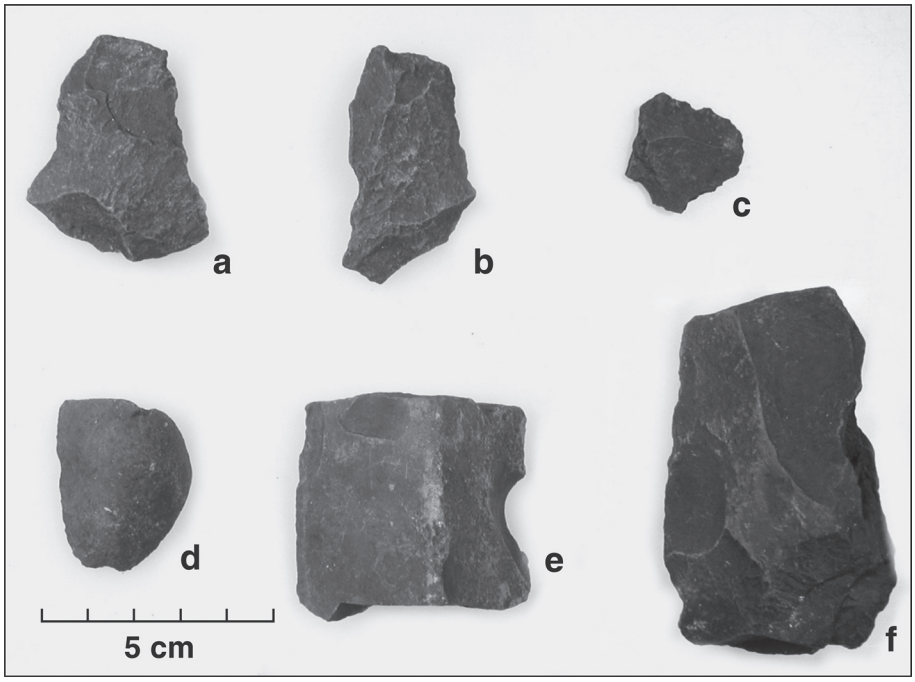

Figure 7: Adze production flakes (a–d) and preforms (e, f) from the upper terrace.

TABLE 2
Polynesian Plainware sherd types and thicknesses recovered from the upper plateau on 'Ata 2001. Cumulative weight in grams is included in parenthesis.

	4–6 mm	**7–9 mm**	**10–14 mm**	**Total**
Rim	2 (7.8)	1 (7.7)	-	3 (15.5)
Neck/Shoulder	-	2 (18.8)	-	2 (18.8)
Body	6 (21.3)	23 (160.7)	4 (48.6)	33 (230.6)
TOTAL	**8 (29.1)**	**26 (187.2)**	**4 (48.6)**	**38 (264.9)**

The ceramics are from plain earthenware vessels with lithic tempers (see Dickinson 2004, this volume). Despite their exposed occurrence, there was only a small degree of surface weathering and degradation. The majority (n=16) of the body sherds are relatively large, between 30 and 60 mm across, and of a consistent 7–9 mm thickness (Table 2). Rim sherds from three different vessels are present, including a subglobular jar with slightly inverted rim and flat lip, a sub-globular jar with inverted expanded rim and rounded lip, and a bowl with straight to slightly inverted rim and flat lip (Fig. 7). A neck sherd from a jar, and a rounded shoulder are the remaining two diagnostic pieces collected. Although small, this assemblage is indistinguishable from Polynesian Plainware ceramics recovered elsewhere in Tonga dating between 2650 and 1550 BP (Burley 1998: 359–360). The combination of

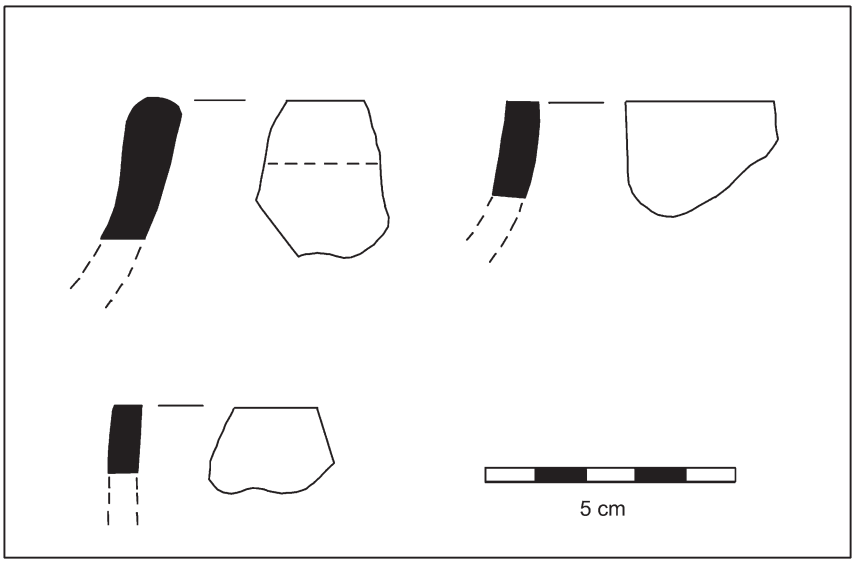

Figure 8: Rim profiles of Polynesian Plainware vessels from ‘Ata.

vessel forms, however, suggests a temporal range toward the mid part of the Plainware sequence and *ca.* 2200 to 1800 BP is taken as an approximate age. As Dickinson (2004, this volume) also reports, the tempers are almost certainly of local derivation, meaning the pots were manufactured on ‘Ata, most probably by a resident group.

The adze production flakes and preforms (Table 1, Fig. 7) are in direct association with the ceramics. The flakes range widely in characteristics with some specimens including well defined or remnant bulbs of percussion while others are no more than shatter. They also range in size, with lengths between 20 and 80 mm, and have individual weights between 3.5 and 70 g. All of the material comes from visually similar basaltic andesites that are largely indistinguishable from specimens excavated from the lower terrace (see Weisler 2004, this volume). The presence of flakes with water-rolled surface features identifies beach cobbles as a principal source of this material. Three pieces with flat angular weathered surfaces may suggest a bedrock source as well. The most complete of the three preforms (71 x 46 x 35 mm) has a lenticular cross-section and a fully formed body created by hard hammer percussion blows to the perimeter and across its surface (Fig. 7f).

Because it is an expediently collected surface assemblage without additional investigation, a context for the upper plateau Plainware scatter can be no more than a matter of conjecture. The presence of sherds with local tempers from multiple vessels suggests they derive from a buried deposit in the immediate vicinity. The association of adze production debitage and preforms is also indicative of a workshop. Furthermore, the occurrence of Polynesian Plainware pottery adds a significant degree of antiquity to ‘Ata prehistory beyond what was concluded in 1977. It also associates the island’s settlement with “Ancestral Polynesian Society”, as it has been reconstructed by Kirch and Green (2001). The archaeological

framework for a Polynesian Plainware phase in different areas of Tonga is not well reported. What can be said with certainty is that after 2500 BP major population growth occurred, agricultural intensification took place, and both processes facilitated settlement expansion to the interior of major islands and on to more marginal offshore islands (Burley 1998: 363; also Spennemann 1989, 2002). The Plainware settlement of 'Ata in the far south, as also the far northern outlier of Tafahi (Dye 1988: 287) now indicates a full exploration and probable exploitation of resources across the archipelago. Tafahi is similar in that it has a difficult access by water and is rugged and not easily settled, but it is a major source of volcanic glass (Best 1984; Kirch 1988). For archaeological considerations of Ancestral Polynesian Society, this expansion and infilling of the Tongan landscape is of some importance; beyond all else, it serves as the presage and precursor for the initial colonisation of Eastern Polynesia.

DISCUSSION AND CONCLUSION

Absolute evidence that 'Ata served as a source for export of adze basalt ultimately requires 'Ata specimens to be identified elsewhere in the archipelago. This unfortunately has not yet been done, nor is it easy to do with existing data. With the exception of the following report by Weisler (2004, this volume), Tongan basalts with secure source origin data have yet to be subjected to XRF characterisation. There has, however, been geochemical analysis of three adzes excavated from the Tongatapu site of To 6 by Poulsen (1987). Best *et al*. (1992: 74) incorporated these in a wide-ranging characterisation and comparative study of adze materials from Samoa. Two of the three, both from Lapita/Plainware deposits, were petrographically studied by White (1987: 280) who suggested their origins lay in Samoa, 'Uvea, or further to the west in island Melanesia. In the analysis by Best *et al*. (1992: 55), both were found to have high silica and low titanium contents, making them distinctively different from the Oceanic basalt lavas characteristic of Samoa. A consistent signal of island arc lavas (basalts as well as andesites) such as occur in Tonga is low titanium, and they also tend to be largely more silicic (Dickinson 2003, per. com.). Accordingly we suspect the specimens to be from a Tongan volcanic source. The third specimen, an adze dating to within the last 300 years, was found to have a Samoan origin, the Tataga Matau quarry on Tutuila (Best *et al*. 1992: 65).

Despite our absence of absolute proof, we continue to propose 'Ata as a probable export source for Tongan basalt with roots going back to the Polynesian Plainware phase. In part we base this on our speculative case for adze production beyond local need in later prehistory. In equal measure, it is based on the logistical circumstances of Tongan geology. The Tongan archipelago consists of two roughly parallel chains of geologically different islands stretching along a linear distance of approximately 800 km. Islands such as 'Ata, Tofua, Kao, the Hungas, Late, Niuatoputapu and Tafahi form a high island volcanic western chain that in part comprises the Tofua Volcanic Arc (see Fig. 1). The eastern chain sits atop the forearc platform of the submerged Tonga Ridge and includes an abundant series of coral limestone islands and sand cays that are incorporated within a resource-rich labyrinth of coral reefs. Because of the latter, the larger coral limestone islands have been the focus for human habitation in the Tongan past. These islands, however, are devoid of volcanic stone, the only exception being 'Eua where Eocene bedrock of the Tonga Ridge is exposed. From the time of first Lapita colonisation, large segments of the Tongan populace became reliant upon the importation of volcanic stone, not only for adzes but for oven stones, mauls,

weaving weights and the like. Here it also is worth emphasising that in previous excavations of multiple Lapita, Plainware and later period sites in Haʻapai and on Tongatapu, Burley (see Burley *et al*. 2001) recovered less flaked basalt debitage cumulatively than occurred in the single Polynesian Plainware surface scatter on the upper plateau of ʻAta. These people not only were importing volcanic stone from external sources, but in the case of basalt adzes, they appear to have been importing them in finished or largely finished form.

Historically, and in prehistory, the islands of Tofua and Kao with easier access from the Haʻapai group are identified as pivotal sources for much of this imported material, at least for the peoples of central and southern Tonga (e.g., Cook, as cited in Ferdon 1987: 111–112; White 1987: 279). These islands continue today to provide a steady flow of volcanic cobbles for use as kava pounders, oven stones and *kilikili*, small black pebbles that are oiled and placed on graves as decoration. Yet others of the volcanic islands could provide petrographically identical types of rock of the calc-alkalic series (Ewart *et al.* 1973). Most of the key islands are dominated by basaltic andesite, grading into basalt at lower silica contents, and andesite at higher silica contents (Dickinson 2003, pers. com.). These islands also are characterised by cobble packed beaches from which appropriate adze quality stone could potentially be identified, cracked open, sorted, and collected. Several also include bedrock exposures that similarly might be exploited. Adze preform production sites, beyond that on ʻAta, have yet to be reported. At least in the case of Tofua and Late, with well-documented historic settlements, we expect them to be present. We also anticipate a similar situation on Niuatoputapu, where Dye (cited in Kirch 1988: 192) reports a fine-grained basalt source, and Kirch (1988: 213) recovered at least limited evidence for basalt preform reduction from excavations at three sites spanning early Lapita to later Plainware periods.

We end our discussion of ʻAta as a potential source for adze basalts and preforms by emphasising the presence of highly complex networks of exchange and redistribution within Tonga, and between Tonga, Fiji and Samoa in later prehistory (Davidson 1977; Kirch 1984; among several). Patterns of exchange, and the acquisition of exchange commodities, were in fact critical to the maintenance of the traditional Tongan polity through support of professional craftsman, through provision of prestige goods for the elite, and for the acquisition of high-ranking marriage partners (e.g., Kaeppler 1978). This resulted in a succession of long distance voyages and inter-archipelagic interactions for which Tonga became renowned. By comparison, ʻAta's geographic isolation appears minimal. This exchange system, according to Weisler (1997: 9) was the only major formalised network east of Melanesia. Exchange transactions involved a range of commodities from red feathers to sailing vessels, but notably included adzes from Samoa (Kirch 1984; Best *et al*. 1992). Such adzes, as Clark (2002: 234) recently concluded, became highly valued prestige commodities in their own right. We cannot say what the value of an adze from ʻAta may have been, but there is no inherent reason to believe that this value, as a functional tool type, or as an exchange item, would be different from ones derived from Tofua, Late, Niuatoputapu, or even Samoa. At this stage, we are uncertain whether XRF geochemical characterisation will be able to source Tongan volcanics reliably to specific islands of the Tofua volcanic arc. Given what this might add to our understanding of exchange processes in prehistory, and their relationship to the emergence of a complex Tongan polity, further research is clearly needed.

The difficulties of living on an isolated volcanic island without protective fringing reef such as ʻAta were made abundantly clear to Anderson, even before his research project had begun in 1977. In the face of high pounding surf, nearly all of his survey and archaeological

field equipment was lost on landing. In 2001, we similarly experienced this problem, losing half of the project's water supply in our attempts to unload in a similar type of sea. These experiences obviously colour one's interpretations, calling into question the viability of inter-island voyages for exchange, the nature of the 'Ata economy, and the degree to which 'Ata may have been isolated in prehistory and the historic period. At the same time, we cannot over-emphasise the importance and value of volcanic stone for adzes and other uses throughout Tongan prehistory. Just how important this may have been was again made obvious by experience as we attempted to depart from 'Ata in 2001. After gear and people had been loaded into a wildly pitching Zodiac caught in the continuous back draw of 1–2 m high waves, our Tongan field assistant willingly risked his life to load 50 kg sacks of oven stones, with the full complicity of our naval boatman. This situation, we suggest, not only parallels events in 'Ata's past, but represents a striking continuum in a pattern of exploitation begun some two millennia earlier by Ancestral Polynesian Society.

ACKNOWLEDGEMENTS

We thank Tongan Prime Minister 'Ulukalala Lavaka Ata for his invitation to undertake the 2001 'Ata reconnaissance and for his provision of Naval transport and a radio operator while on-shore. In addition, we thank Lofia Matavelea, Tongan Wildlife Centre, who accompanied Steadman for bird survey but who also assisted with archaeological fieldwork. Alice Story, Jessi Witt and Andrew Barton of Simon Fraser University facilitated production of the graphics. Finally, Professor Peter White and three anonymous reviewers made useful comments, criticisms and recommendations on earlier drafts of the paper. Hopefully we have met at least some of their concerns in the final version. Funding for archaeological fieldwork in Tonga by Burley has had on-going support of the Social Sciences and Humanities Research Council of Canada.

REFERENCES

Anderson, A. 1978. Archaeological explorations on 'Ata island, Tonga. *Royal Society of New Zealand Bulletin* 17: 1–21.

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

Best, S.B., Sheppard, P., Green, R. and Parker, R. 1992. Necromancing the stone: archaeologists and adzes in Samoa. *Journal of the Polynesian Society* 101 (1): 45–85.

Bryan, W.B., Stice, G.D. and Ewart, A. 1972. Geology, petrography, and geochemistry of the volcanic islands of Tonga. *Journal of Geophysical Research* 77: 1566–1585.

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

Burley, D.V., Dickinson, W.R., Barton, A. and Shutler Jr, R. 2001. Lapita on the periphery: new data on old problems in the Kingdom of Tonga. *Archaeology in Oceania* 34: 59–72.

Clark, G. 2002. Adzes of interaction: Samoan basalt artefacts in Fiji. *In* S. Bedford, C. Sand and D. Burley (eds), *Fifty Years in the Field: Essays in Honour and Celebration of Richard Shutler Jr's Archaeological Career*, pp. 227–238. New Zealand Archaeological Association Monograph 25, Auckland.

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

Dickinson, W.R. 2004. Petrography of Polynesian Plainware from 'Ata, Tonga. *New Zealand Journal of Archaeology*, 25 (2003): 107–111.

Dickinson, W.R., Burley, D.V. and Shutler Jr, R. 1999. Holocene paleoshoreline record in Tonga: Geomorphic features and archaeological implications. *Journal of Coastal Research* 15 (3): 682–700.

Dye, T.S. 1988. Appendix C: Archaeological investigations on Tafahi island. *In* P.V. Kirch, *Niuatoputapu: The Prehistory of a Polynesian Chiefdom*, pp. 278–287. Thomas Burke Memorial Washington State Museum Publication, Monograph 5, Seattle.

Ewart, A., Bryan, W.B. and Gill, J.B. 1973. Mineralogy and geochemistry of the younger volcanic islands of Tonga, S.W. Pacific. *Journal of Petrology* 14: 429–465.

Ferdon, E.N. 1987. *Early Tonga As the Explorers Saw It, 1616–1810*. University of Arizona Press, Tucson.

Gifford, E.W. 1929. *Tongan Society*. Bernice P. Bishop Museum Bulletin 61, Honolulu.

Johnstone, R.D. 1978. 'Ata, the most southerly volcanic island in Tonga. *Royal Society of New Zealand Bulletin* 17: 154–164.

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

Kirch, P.V. 1984. *The Evolution of the Polynesian Chiefdoms.* Cambridge University Press, Cambridge.

Kirch, P.V. 1988. *Niuatoputapu: The Prehistory of a Polynesian Chiefdom*. Thomas Burke Memorial Washington State Museum Publication, Monograph 5, Seattle.

Kirch, P.V. and Green, R.C. 2001. *Hawaiiki, Ancestral Polynesia: An Essay in Historical Anthropology.* Cambridge University Press, Cambridge.

Poulsen, J. 1987. *The Prehistory of the Tongan Islands*. Terra Australis 12, Canberra (2 vols).

Spennemann, D.H.R. 1989. 'Ata 'a Tonga mo 'Ata 'o Tonga: Early and Later Prehistory of the Tongan Islands. Ph.D. dissertation, Australian National University, Canberra.

Spennemann, D.H.R. 2002. Late Lapita colonisation of a high island in Western Polynesia: The case of 'Eua Island, Tonga. *The Artefact* 25 (1): 26–32.

Weisler, M. 1997. Introduction. *In* M. Weisler (ed.), *Prehistoric Long Distance Interaction in Oceania: An Interdisciplinary Approach,* pp.7–18. New Zealand Archaeological Association Monograph 21, Auckland.

Weisler, M.I. 2004. A stone tool basalt source on 'Ata, Southern Tonga. *New Zealand Journal of Archaeology* 25 (2003): 113–120.

White, A.J.R. 1987. Appendix 7: Petrography of some stone adzes from Tongatapu, Tonga Group. *In* J. Poulsen, *The Prehistory of the Tongan Islands*, pp. 279–281. Terra Australis 12, Canberra (2 vols).

Received 25 March 2003
Accepted 14 August 2003