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Tataga-Matau "Rediscovered"

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ABSTRACT

Tataga-matau is one of the few Polynesian adze quarries whose name and traditional significance survived into the twentieth century. After Sir Peter Buck's visit in 1927 its location was subsequently only vaguely or inaccurately reported in archaeological surveys. It was relocated with local help in 1985 and a survey revealed a line of three scree slopes quarried for their fine-grained alkali basalt boulders, as well as workshop terraces, terraces (including a stone-edged *tia*) and an elaborate defensive earthwork. A preliminary study of cores, blanks and preforms, coupled with replication experiments, established the main reduction sequences used at the site to manufacture adzes of quadrangular and triangular cross-section, accounting for all but one of the types in the Samoan adze classification.

Keywords: POLYNESIA, SAMOA, QUARRY, ADZE MANUFACTURING, REDUCTION SEQUENCES, REPLICATION, FORTIFICATION.

SIR PETER BUCK AND TATAGA-MATAU

Tataga-matau (Fig. 1) is the name of a basalt adze quarry and manufactory on Tutuila (American Samoa) to which Sir Peter Buck was conducted late in 1927. Buck's special interest in traditional material culture had prompted him to inquire throughout the Samoan islands concerning the whereabouts of "stone quarries", but he had no success until he reached the settlement of Leone. Although it was probably 80 years since the last use of any adze quarry in the Samoan islands, Tataga-matau's reputation was such that the older men knew of its location and former importance, stating "that people came from all parts of Tutuila to obtain stone adzes at Tatanga-matau [sic]" (Buck 1930: 331).

Buck's guides led him up Leafu stream behind Leone to a place named Ologa-to'i where large grindstones with deeply worn concave grinding facets stood in the streambed. Then the track led up a spur, passing a *tia* (described as a pigeon fowling terrace), before ascending a hillside covered in flaking debris to reach a place where the main ridge was cut by a deep circular pit and a broad, angled trench. Buck believed these were extraction pits from which rock had been dug for adze making. As well as describing the manufactory, Buck noted Samoan terms for the basic steps in the manufacturing process, which neatly explained the place names Tataga-matau and Ologa-to'i. *Ta* (to strike) and *taga* (chipping) referred to the percussion techniques used in shaping the preform or *matau*. Only when the preform acquired a ground cutting edge did it take the name *to'i* (adze). The verb *olo* (to rub) gave the name Ologa-to'i for the place where the grindstones were used.

Buck was not the first European to learn of the existence of high quality rock resources on Tutuila. In 1840 an early missionary, T. Heath (cited by Green 1974a: 141), wrote that

> At Tutuila ... is found the hard stone, (Trap,) of which the Polynesian adzes and other tools were made previously to the introduction of iron.

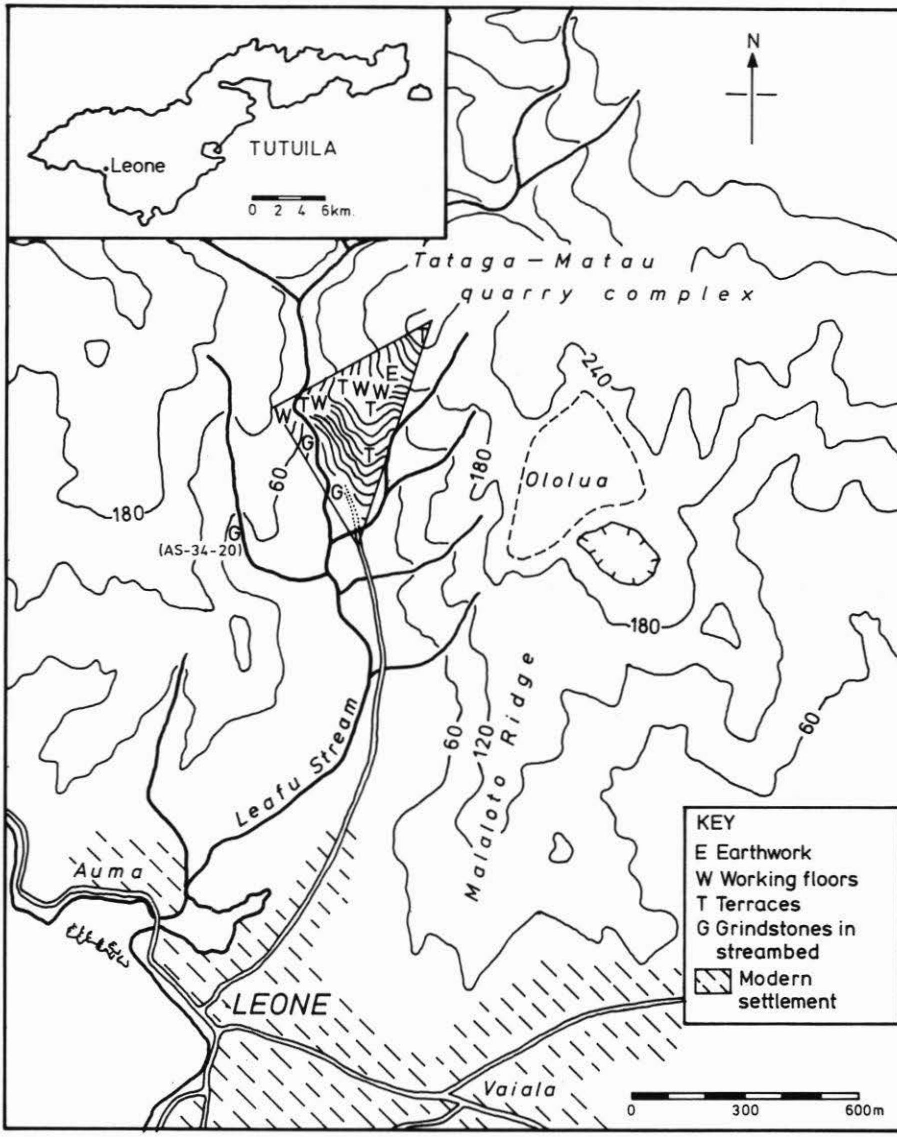

Figure 1: Map of Leone area showing location of Tataga-matau (Tutuila inset).

Elsewhere in Samoa it appears that stone adzes had dropped out of general use by the mid 1830s (Green 1974b: 254). This date is probably applicable to Tutuila as well, since European contact and influence increased greatly with the establishment of John William's mission in 1832. Thus Buck's guides were at least one if not two generations removed from the last stone adze makers.

One of the reasons for their continued knowledge of the site was that it was referred to by name in a local oral tradition which also explained the naming of two springs behind Leone, a reef and an islet in the lagoon (Herman 1970: 94–95). The key figures in the tradition were a Tokelauan family who had sailed to Leone specifically for stone adzes.

Traditions linking this place with other islands of Samoa, Tonga, and Pukapuka (Northern Cooks) are mentioned by Kikuchi (1963: 92) and the Beagleholes (1938: 400).

SUBSEQUENT ARCHAEOLOGICAL SURVEYS

Site surveys conducted on Tutuila over 30 years after Buck's visit failed to locate Tataga-matau accurately. Kikuchi (later joined by Sinoto) visited the area in 1961–2 and described the whetstones in the streambed behind Leone (Emory and Sinoto 1965: 44, Table 2). They also recorded over 100 adzes many of which were "found in the old stream bed of Afu in Leone Valley ... heavily patinated and in rough chipped form" (ibid.: 46).

Kikuchi (1963: 138) referred to the streambed as being "below the adze quarry of Tataga-matau" but he did not visit the quarry and over-estimated its distance from the isolated whetstone (AS-34-20) to which he (and the present authors) were taken by local residents.

Clark expanded Kikuchi's survey in 1980, but with only three weeks for an island-wide reconnaissance, he did not have time to follow up the implications of the quantities of adzes and grindstones in Leafu streambed behind Leone, nor of Buck's precise description. Instead, on the basis of finds of stone flakes and preforms in a large crater on Malaloto Ridge, he listed this site as Tataga-matau but noted that he could not locate the deep pits reported by Buck (Clark 1980: 86).

Growing interest in the development of Polynesian adze technology has been evident since Green published his important papers on the Polynesian adze kit in 1971 and on the significance of the andesite line in 1974. Over the same period archaeologists have developed techniques appropriate to the study of quarry sites and working floors (e.g., Mc-Coy 1977; Leach and Leach 1980; Cleghorn 1982; Jones 1984; Cleghorn *et al.* 1985). The sourcing of rock types used in adze manufacture has also gained momentum (Best 1984; Leach and Davidson n.d.). It was therefore appropriate for recently renewed activity by the Historic Preservation programme in American Samoa to include a survey of the traditionally important Tataga-matau quarry site with the aim of nominating it to the National Register of Historic Places. As well, its position just on the Oceanic basalt side of the andesite line, and the identification from the Lau Islands of adzes mineralogically close to Leafu streambed samples (Best 1984: 402, Appendix L) meant that investigation of Tataga-matau could be expected to provide valuable new information for studies of technological change and patterns of exchange. With these objectives the authors undertook a four week study of Tataga-matau in August 1985, under contract to the American Samoan Government Historic Preservation Office.

RELOCATION OF THE SITE

The first step of this investigation involved relocation of the site. Clark's site in the Malaloto Ridge crater (Ololua) was checked and found not to have the quantity or type of stone debris characteristic of prehistoric quarries in New Zealand or Hawaii. Nor did it match the details of Buck's description, in either orientation or field features. However, following a meeting with the *matai* of Leone, we made contact with Talking Chief Velio Suafo'a (then aged 61) who knew from his grandfather the location of a grindstone called Ologa-to'i and of a ridge called Tataga-matau. We were first taken to the grindstone which was situated in a sidestream on the western side of the valley behind Leone. This turned out to be site T-146 visited by Kikuchi (1963: 154, Fig. 55) and listed by Clark as AS-34-20 (1980: 90). Chief Suafo'a then took us to the base of the waterfall (Leafu) from which the main stream takes its name. He explained that the ridge and adjoining precipitous hillside on the eastern side of the valley overlooking the waterfall was called Tataga-matau. Access was via a side ridge which intersected the valley floor about 370 m downstream from the waterfall.

We climbed a steep, narrow and overgrown path up this ridge until we reached a stone-edged terrace which (without any prompting) our guide described as a *tia* (Fig. 2). It had been used for gardening a few years before and was largely clear of trees. At the back of the *tia* the slope steepened to over 30 degrees and became densely covered with vines which obscured even the large fallen trees lying on the hillside. At this point the ground underfoot changed from soft waterlogged soil to loose screes of brittle stone debris. Close inspection revealed beneath the creepers the presence of dense piles of waste flakes and occasional broken preforms.

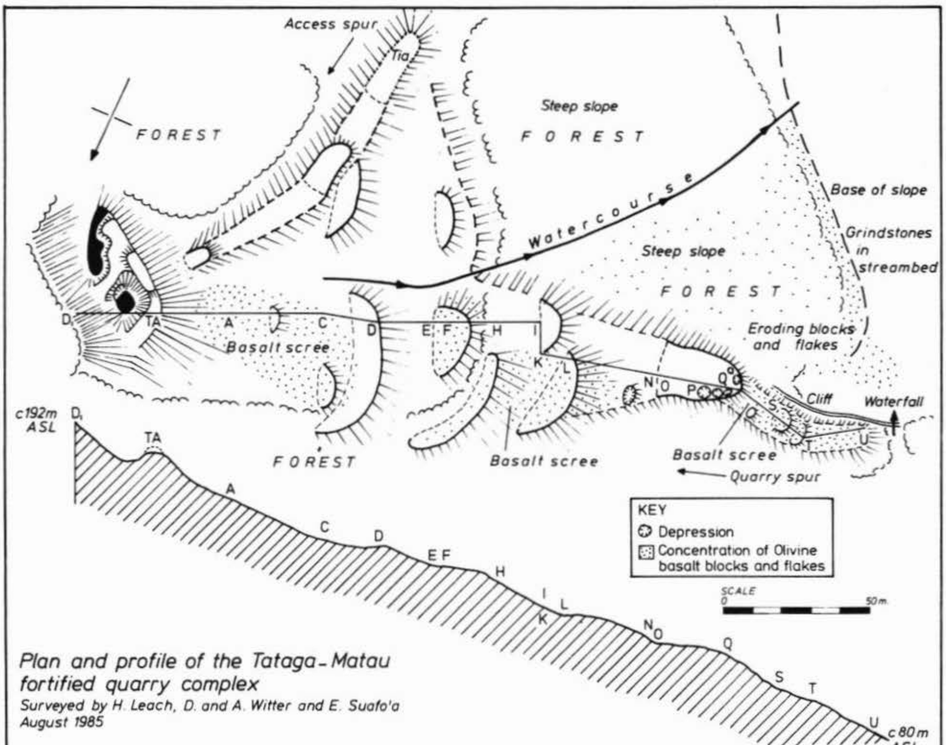

Figure 2: Plan and profile of the Tataga-matau complex.

Above this face we reached a platform running at right angles to the ridge, behind which lay a deep pit. The bottom of the pit was 4.3 m below the surface of the platform and it had several mature trees growing from its sides. One was identified as the slow growing *ma'ali* (*Canarium samoense*). Across a narrow causeway (4 m wide) leading from the platform to the scarp on the uphill side, another deep cut had been made into the ridge. This took the form of a trench which angled around the foot of the rear scarp before running out on to a near vertical hillside.

There was no doubt that these features were precisely those visited by Buck 58 years before our "rediscovery". Their order and orientation matched his published description very closely. But rather more important than our claimed rediscovery is the fact that to certain *matai* of Leone the location of Tataga-matau, its original purpose, and the presence of a *tia* on its access route have never been in doubt!

SURVEY OF THE FEATURES

The second stage of our investigations involved a survey of the hillside to determine the boundaries of the quarry, workshops, and associated features (Figs 2 and 3). The work was done with tapes and geological compasses using a base line and offsets marked by string. Only essential clearing was carried out with a bush knife. It quickly became evident just how vulnerable the site was to erosion and other forms of physical damage, especially on the steep quarry slopes where every step dislodged flakes and preforms, abraded their edges and shifted them as much as 30 cm downhill. Earlier tree felling below the platform had already caused major disruption to the deposits, and we did not wish to accelerate this by unnecessary clearing. Fortunately the northern half of the site is covered with mature forest which offers greater protection through its interlocking roots. Although technically speaking this forest is secondary regrowth, in species composition it seems little different from primary ridge forest (Amerson *et al.* 1982: 1, 39–40).

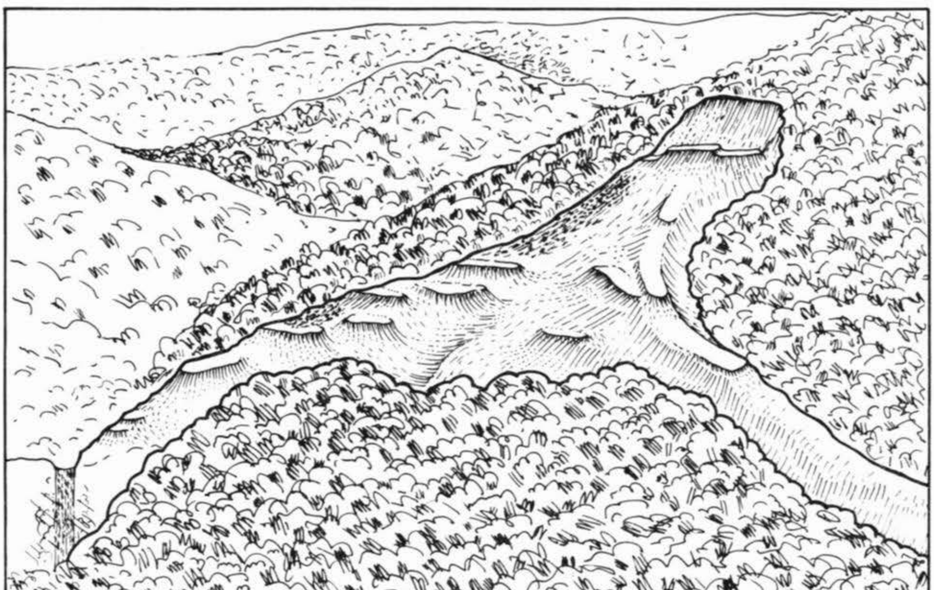

Figure 3: Sketch of Tataga-matau as it might appear cleared (H. Leach).

The survey revealed that Tataga-matau occupies a triangle of hillside with its apex on a ridge, the adjacent sides represented by bifurcating spurs, and its base formed by the junction of the hillside and alluvial valley floor. At the top of the ridge where it levels out at about 240 m ASL, several bush-covered terraces and a masonry-edged platform were found late in the survey. There was insufficient time to plot these and because they are 60 m above the quarry complex and were without surface evidence of adze manufacturing, we cannot be sure whether they are outworks of the main complex or a separate site unrelated to the quarry. Their location is marked by the uppermost T on Figure 1.

THE UPPER EARTHWORKS

Closer examination of the platform-pit-trench area at 180 m ASL revealed artificial terracing flanking both ends of the platform, but no sign of a smaller pit described by Buck. Buck had been under the impression that the pit and trench had been formed during the extraction of rock for adze manufacture, although he admitted that "there was no clean-cut face of rock visible" (Buck 1930: 330). On investigation we found that both had been cut into heavily weathered soft volcanic deposits. A few basalt flakes were present but these had eroded or been dumped into the depressions from the terraces above.

If these were not extraction pits what other function could they have served? By themselves large pits in various parts of Polynesia have been associated with food preservation (in the tropics) or root crop storage (in New Zealand). But if one suggests that the deep circular pit of Tataga-matau is a *lua masi* (breadfruit fermentation pit) then additional explanation is required for the angled trench right beside it and the platform and terraces in front of it. The pit itself accumulates run-off from the steep scarp behind it and obviously holds water in its present condition. If filled with *masi*, waterlogging would have been a major problem unless a now hidden drainage tunnel is invoked. We preferred to interpret the complex of platform-terraces-pit-trench as a defensive earthwork.

Viewed from the steep scarp on the uphill side, it presented the characteristic appearance of a ditch and bank fortification. Several others are known from the Samoan group, especially on Upolu. Most of these were designed to prevent access from the coast (Davidson 1974a: 240). The Tataga-matau example joins the few which prevented access down the ridge from the centre of the island. In its discontinuous ditch consisting of a pit-trench combination, it has parallels at Mafafa (Golson 1969: 17–18) and Luatuanu'u (Davidson 1969: Fig. 78, 203; Scott and Green 1969: 205).

The close proximity of the high quality olivine basalt to the platform edge (only 10 m beyond and 8 m below) suggests that the fortification was designed to protect the stone resource from incursions down the ridge. Certainly the presence of patches of waste flakes on the terraces and platform indicate that the fortification was built before stone working ceased. It is tempting to see in the amount of labour invested in the earthworks some indication of the value of the asset they protected.

THE QUARRY SLOPES

Only 8 m below the earthworks begins a steep scree of high quality alkali basalt blocks, intermixed with innumerable flakes and cores showing by their percussion bulbs and scars that they are the product of human activity. The uppermost scree occupies a steep slope (greater than 30 degrees at the top) and is about 56 m long and 30 m wide. Rock debris has built up at the base where the slope angle decreases and although this is covered in vegetation there is very little soil matrix. Further downhill a large semi-circular terrace and well-forested slope intervene before the next talus deposit appears. This exposure is 40 m long and 28 m wide. The lowest talus occupies the steep, narrow ridge above the waterfall. It is about 50 m long and 12 m wide with a sheer cliff marking its seaward edge.

The distribution of the basalt screes is remarkably linear which lends support to the view that the adze-quality material occurs as an intrusive body or dyke rather than as a flow. Indeed the cliff face at the waterfall reveals that identical rock to that forming the screes on the ridge provided a barrier to progressive erosion of the streambed and thereby created the waterfall. This face was probably also the original point at which early stone workers discovered the source of the fine-grained basalt evident in the lower reaches of the stream.

Apart from the waterfall cliff face, Tataga-matau has no obvious outcrops or bedrock exposures. Its upper quarry faces provided a scree of blocks of manageable size naturally weathered from the underlying dyke. By separating out along the curvilinear thermal fracture lines produced when the lava cooled, many of the blocks have the added advantage of natural ridges and surface angles highly suitable for striking off large flakes and blades which could then be transformed into adzes. It is difficult to assess how much of the worked material was simply gathered by sorting through talus debris and how much was prised out of subsurface deposits. However from changes in the slope of the dyke ridge, it would appear that many tonnes of stone have been shifted.

THE TERRACES

Apart from the terraces associated with the upper earthworks, there are at least 12 other terraces in the Tataga-matau complex, five on or adjacent to the access spur on the eastern side of the site, and seven cut into the quarry spur. Only one terrace on the access spur is covered with stone flakes and able to be described as a working floor. It is only 7 m from the top of the uppermost scree and enabled adze makers to work on a solid, near-level surface rather than the precipitous boulder-strewn talus. The remaining terraces associated with this eastern spur are larger and have no surface evidence of stone tool manufacturing. This is not surprising for they are more than 40 m from the nearest talus.

The lowest terrace on the access spur is clearly Buck's *tia* and that term was used for it by our informant. It occupies a promontory of land with steep sides and a panoramic view of the valley and coastline. A masonry wall consisting of 1–4 courses of stone is clearly visible on the point and continues for about 20 m on each side. Although the word *tia* now commonly refers to a grave or tomb (Milner 1966: 263), in Pratt's dictionary (1893: 308) the word was defined as "a place in the bush from which trees and underwood are cleared for the purpose of pigeon-catching by means of decoy birds". Davidson (1974b: 205–209, 1974a: 227–232) has dealt in some detail with the problems posed by applying the functional name *tia* to specific archaeological field features. In this case we do not know if Buck's (or our own) local informants called this terrace a *tia* because it was known to have been used for pigeon catching, or because of its stone retaining wall, platform-like appearance, and steep bush setting. It is apparent that there has been a considerable shift in the meaning of *tia* over the past 150 years, both in the Samoan-speaking population and among visiting ethnologists and archaeologists. Archaeologically this type of terrace is known sporadically from inland areas throughout Samoa.

The terraces on the quarry spur can be divided into four obvious stone working floors and three terraces without stone-covered surfaces. The latter are unexpectedly clean in view of their close proximity to quarry faces. The lowest clean terrace, which occupies a ridge top position above the waterfall, has five irregular pits around its outer edge. As with the stone-free terraces themselves, excavation is the only means of throwing light on their origin or purpose.

THE WATERFALL BASIN

The land drops off sharply below the terraced area of Tataga-matau, and the hillside, though forested, is an unstable mixture of soil, eroded basalt blocks and adze manufacturing debris. At its base just below the waterfall, periodic flooding has cut into this material and redistributed it downstream. It is highly likely that adze manufacture also took place beside the stream and in its bed. Suitable blocks are regularly supplied by rockfalls from the waterfall cliff, and they could also have been dug out of the eroding hillside. The difficulty for the archaeologist lies in separating *in situ* from redeposited material. Artefacts constantly erode from the river bank and a local resident found a very large hammerstone (Fig. 4) suitable for detaching large primary flakes from natural basalt blocks.

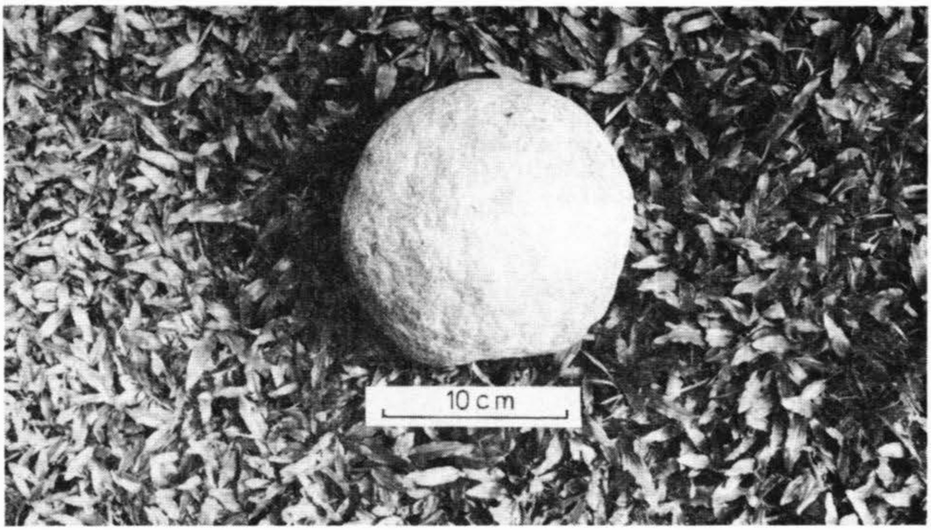

Figure 4: Large hammerstone found in stream bank below waterfall (in possession of Mr T. Willis).

This location was also used for the last stage of adze manufacture: the grinding of the bevel, front and sides of the preform. One massive basalt boulder in the streambed displays five deeply dished grinding facets (Fig. 5). There are several other smaller facetted grindstones (*foaga*) along the 420 m stretch of streambed between the waterfall and the first tributary, including one tipped on its side close to where Buck would have turned off to climb the access spur. He recorded the term Olonga-to'i (grinding of adzes) as the place name of this locality. However our informant took us to another place with this name, on a tributary of Leafu (Fig. 1). Needless to say this was another *in situ foaga*, previously visited by Kikuchi and recorded by Clark (AS-34-20) (Fig. 6). Clearly, Ologa-to'i is not a unique place name but the widely used term for large dished grindstones (whetstones) traditionally associated with adze finishing and probably routine sharpening.

TATAGA-MATAU AND SAMOAN ADZE TECHNOLOGY

Previous experience has demonstrated the value of a combined approach to the study of Polynesian adze manufacture, beginning with the careful analysis of preform flake scars

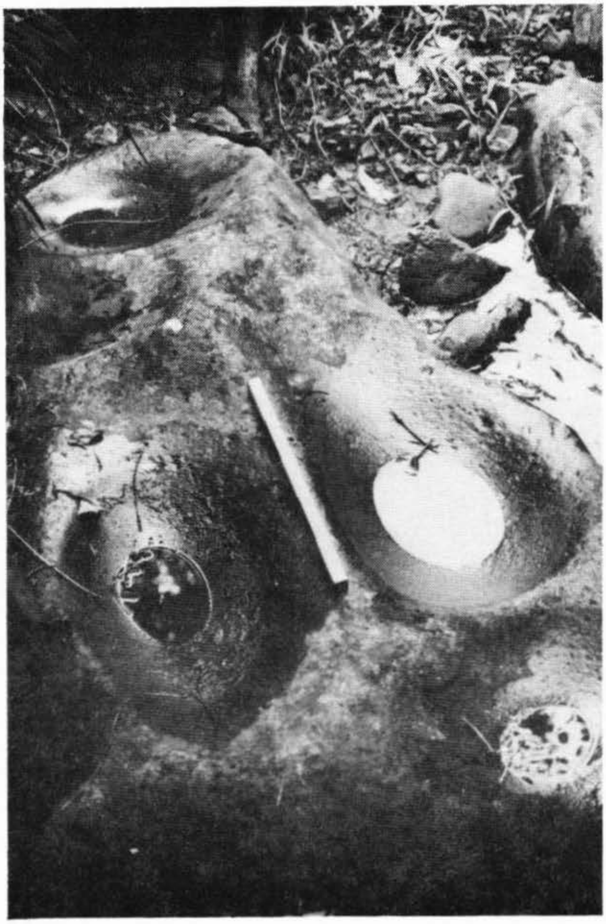

Figure 5: Dished *foaga* in Leafu streambed just below waterfall.

to generate hypotheses about technological processes followed by the testing of these hypotheses by replication trials or refitting. Since refitting jigsaw-style (Leach 1984) is only possible in a laboratory situation with cleaned, excavated material, we used informal replication trials (undertaken by Dan Witter, an experienced knapper) employing fresh basalt recently dislodged from the waterfall cliff. Mineralogically it is very similar to material from the upper quarry faces. Our preform sample was based on artefacts in the Jean P. Haydon Museum (Pago Pago) and on items examined *in situ* on working floors and quarry faces on the site.

CORES USED FOR BLANK PRODUCTION (FIG. 7)

Starting from angular blocks selected from the scree or prised out of the subsoil, the preferred technique was to strike off large flakes to be used as blanks, rather than to reduce the block itself into a preform. The simplest procedure was to strike the edge of a block to

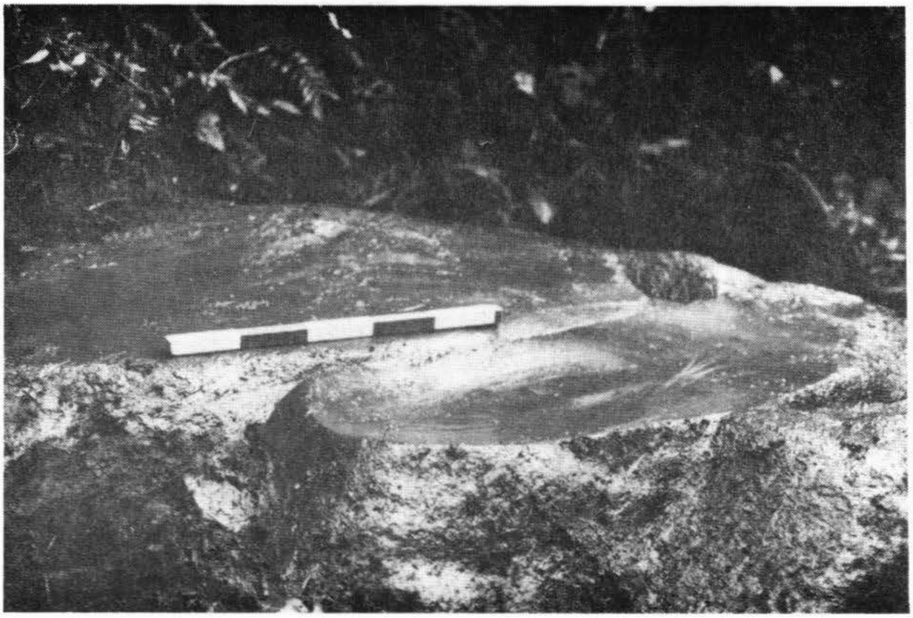

Figure 6: Shallow *foaga* known as Ologa-to'i, AS-34-20.

detach a spall from its side. Such spalls were usually flat on the dorsal side, and due to the considerable force required, had a pronounced ventral bulb. They also tended to be broad flakes with thick platforms and were often wider than they were long.

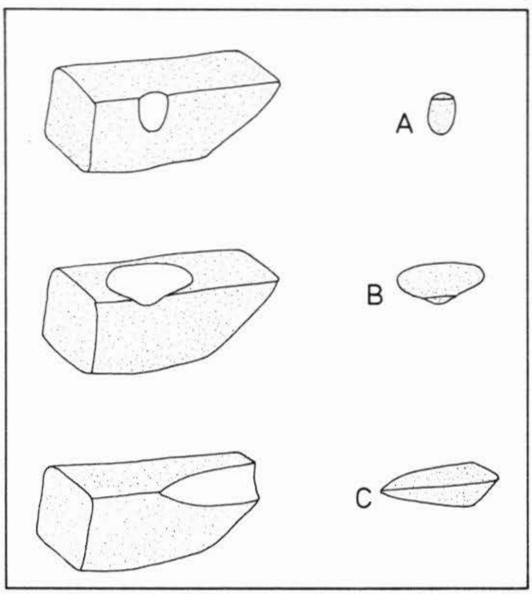

Figure 7: Blank types A, B and C.

If the original platform angle was low to start with, it was possible to strike off a series of such flakes. The deep negative bulb produced by flake removal on one side of a core also presented a favourable platform angle for the removal of another flake blank on the adjoining side. The result was a blank core with a bifacial edge, examples of which were seen at the quarry and produced by replication. Waste flakes from this process were mostly thin platey fragments rather than flakes with well-defined platforms.

The curvilinear fractures which occurred in Tataga-matau basalt as it cooled often produced a block with a low platform angle at one end and one or more longitudinal ridges on the sides (Fig. 8). These blocks served as ready-made blade cores with a suitable natural platform and corner ridge to guide the first spall into blade form (Leach 1981: 174, 176). A number of triangular cross-sectioned preforms were observed which were made from such corner blades and had the weathered surface of the original block on the dorsal side.

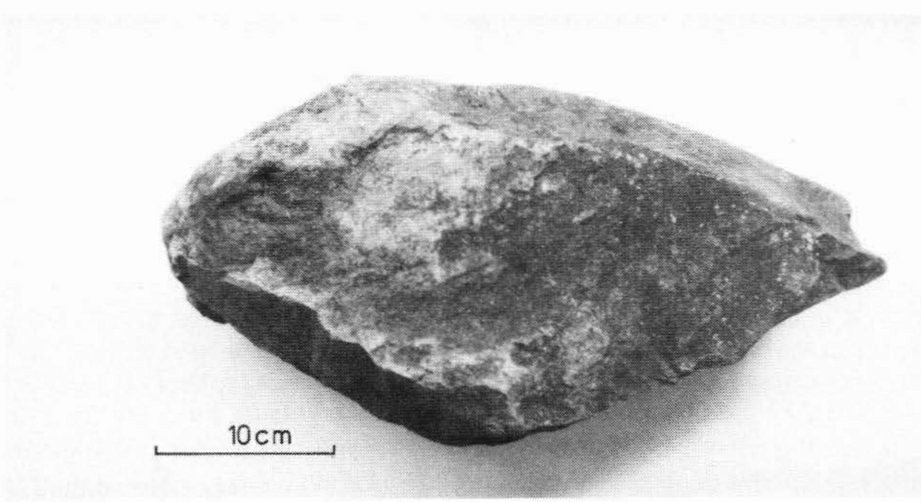

Figure 8: Natural block from quarry slope with angles suited to blade production.

Some of the blade cores on the site showed evidence of platform preparation by flaking a facet across the top. A few had had a series of blades removed (Fig. 9). Certain blade preforms had flake scars at right angles to the dorsal ridge indicative of straightening this ridge before detaching the blade. The replication experiments suggested that both block on block (i.e., the core being struck on the anvil) and hammerstone techniques were involved in blade production. The largest corner blade produced experimentally was 20.3×7.6×2.9 cm (cf. prehistoric examples from 10 to 40 cm long).

HAMMERSTONES AND THEIR EFFECTS

The basalt hammerstones were probably originally rounded stream cobbles. So far two have been found at the quarry: the larger (15 cm diameter—Fig. 4) would have required two hands to operate; the smaller is half spherical in shape and extensively bruised on its

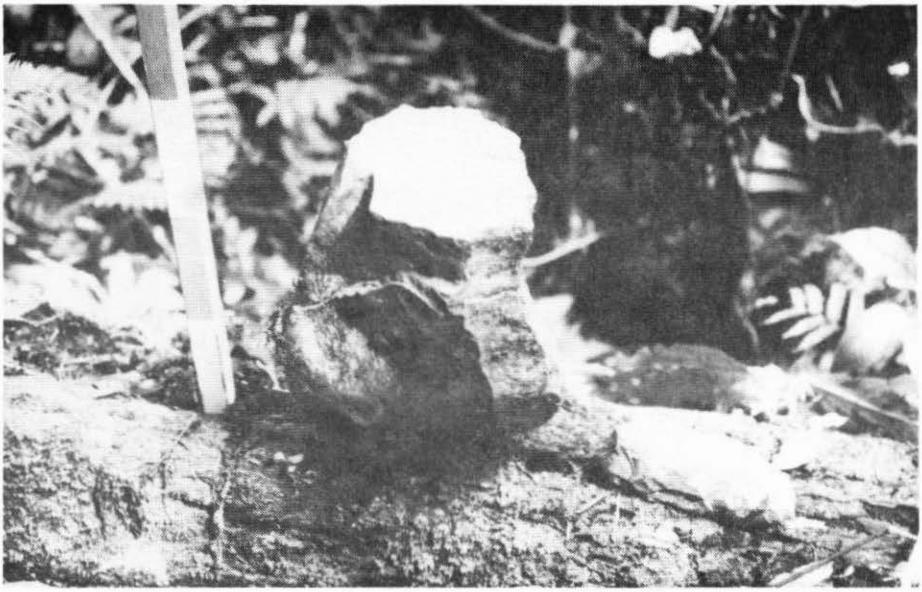

Figure 9: Worked blade core found on terrace at F (preform on right).

outer rounded surface. It is 11.6×9.8×7.0 cm and weighs 1.15 kg in its discarded state—a large spall has broken away from the main use facet.

The risk of the basalt hammerstone itself flaking, instead of the core, necessitated the choice of hammers with blunt or rounded surface geometry and a large impact area. If the hammer impact fell too close to the platform edge it produced a thin spall remarkably flat on both sides and of small dimensions. Larger flakes resulted from hammer impact further back from the edge but this in turn made the platform area of the flake wider than desirable to the knapper, especially where the flaked surface is flat and without a marked vertical ridge. Another effect of using such hammers with large impact area may have been to spread the force so that it did not travel far down the flaked surface. Thus many flakes tended to be short on the longitudinal axis but broad laterally. A high level of effort was needed to detach basalt flakes using hammers of the same density and this produced flakes with pronounced percussion bulbs. In preliminary replication attempts flake blanks of this type were made as large as 23.7 × 15.3 × 2.7 cm. The thick bulb required special attention during the reduction stages and it usually meant that cores had to be discarded after only one or two flake blanks had been removed.

TYPES OF ADZE BLANKS (Fig. 7)

Owing to the constraints imposed by the hammerstones and by the flaking properties of Tataga-matau basalt, the types of blanks most often produced on the site were limited to three (Table 1).

A few preforms in the Jean P. Haydon Museum were made from a fourth type of blank: an elongated, relatively thick flake with a dorsal ridge. Experimentally these resulted from fore-shortened flakes accidentally produced when Type C or blade blanks were intended.

TABLE 1
TYPES OF BLANKS PRODUCED AT TATAGA-MATAU

	MAXIMUM LENGTH	MAXIMUM WIDTH	MAXIMUM THICKNESS
TYPE A BLANK			
small flat thin fragments or flakes	60–100mm	30–80mm	5–10mm
TYPE B BLANK			
large flakes with prominent bulbs and no dorsal ridge	100–300mm	50–200mm	15–40mm
TYPE C BLANK			
corner blades, or blades struck from prepared core	100–400mm	30–100mm	20–80mm

Other preforms had utilised natural fragments or stream cobbles of suitable shape. These had a variety of thick rectangular, lenticular or triangular cross sections.

REDUCTION OF THE BLANK TO THE PREFORM

The morphology of the blank was a major factor in determining the eventual shape of the preform. Within the limitations imposed by the blank there were certain decisions which had to be made before the flaking began. These concerned the bevel, butt, and the initial flaking platform. In relation to the bevel, there had to be sufficient thickness to supply a platform from which the bevel could be flaked, but not too much mass to increase the risk of end-shock during its removal. The width and angle of the bevel had to be matched to the intended function. At the two extremes the broad flat cutting edge with low edge angle was suited to adzing flat surfaces with the grain, while the narrow, gouge-like bevel of high angle was useful for punching out wood in a confined space, against the grain (Best 1977). Cross section imposed certain limits on bevel type in so far as a narrow triangular-sectioned blade blank could obviously not be shaped into a broad-bevelled adze.

Consideration had to be given to which end was most suitable for the butt. It is not always the case that the butt is by default formed on the end opposite the bevel, for in untanged adzes (especially those operated with a low angle of attack) the butt must slope back from the frontal plane so that the haft lashings clear the surface being worked (Best 1977). Samoan adzes often used the natural curve of the flake blank to achieve an offset butt.

The selection of the surface to serve as the initial flaking platform had important implications once the reduction process began. If the blank was a thick flake or had a strong dorsal ridge, then the ventral (bulbar) surface was necessarily the best starting platform. However blanks which were flat on the dorsal surface, as was frequent in Samoa, were most readily worked with the dorsal surface as the initial platform.

REDUCTION OF THE TYPE A BLANK (Fig. 10)

These small, flat flakes were too thin to flake freehand without frequent transverse breakage. An anvil with convex surface provided the necessary support. The blank shown in Figure 10 was oriented so that the platform end became the bevel (a). A series of anvil backing flakes were removed along each side with a small, light hammer (b). For each blow the blank was positioned so that the impact area and anvil were in direct line. Usually the dorsal surface provided the best striking platform. As the sides of the preform were reduced, the butt end was made narrower than the bevel (c). The bevel was set so that the side opposite, the adze front, was the smoothest (d). Normally this was the ventral surface of the original blank.

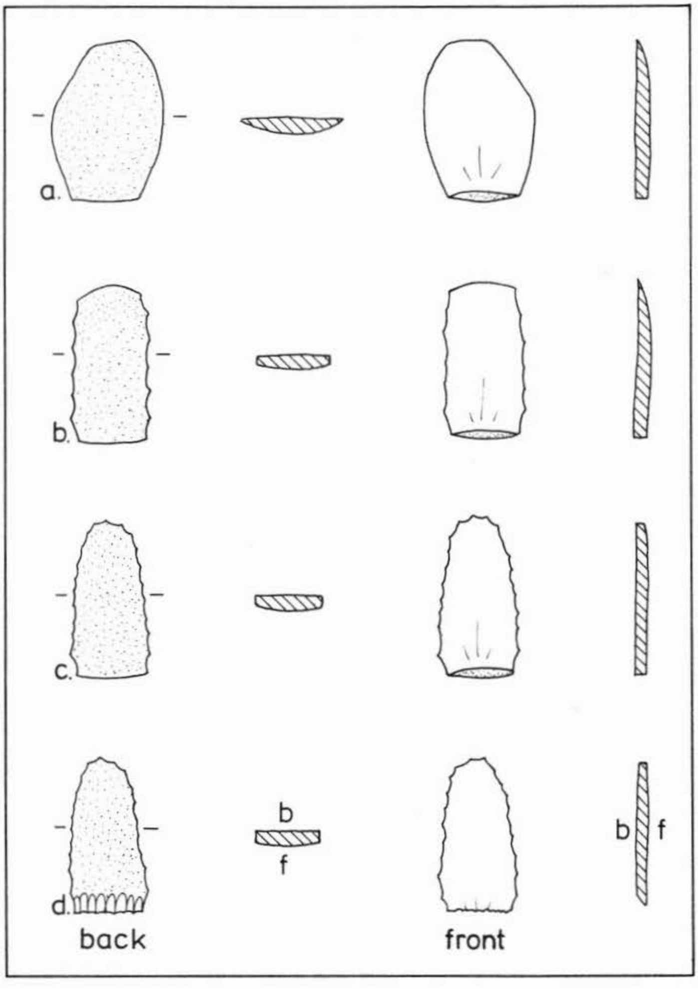

Figure 10: Reduction of the type A blank.

After grinding, often extensive on this type, the finished adze appeared flat-faced and thin in cross section; the sides were at 90 degrees and straight because of the anvil backing technique. In outline the adzes were trapezoidal or tapering in shape with wide cutting edges. They correspond to Green and Davidson's Type III adze (Green and Davidson 1969: 23–4).

REDUCTION OF THE TYPE B BLANK (Fig. 11)

These blanks were large flat flakes with no dorsal ridge and with a pronounced percussion bulb. The dorsal side often showed traces of weathering (cortex). Although they have sufficient mass to be flaked free-hand they proved liable to transverse breaks or a collapsed edge unless supported by the fingers below the point of impact. From our in-field and experimental observations it appeared that the most common orientation of the blank was transverse, i.e., the flake was rotated 90 degrees so that one lateral flake edge became the bevel and the other the butt of the preform. The platform and distal edge of the flake then became the preform sides (a).

The starting platform was usually the flat dorsal side of the flake blank. From this platform large flakes were detached as far across the ventral surface as possible (b). Because of high platform angles the most difficult zone to flake was that of the original platform and bulb. Once this was successfully reduced the opposite side was quickly trimmed to a straight edge (c). The force of each blow had to be judged within narrow limits to suit the differing flake thickness and angles. If too hard, transverse breaks or collapsed edges resulted; if too light only small flakes were detached, the platform angle became too high, and a persisting mass (or intractable knob of rock) developed.

The platform was then changed so that the newly produced flake scars on the ventral side faced the hammer. In other words, the preform was turned upside down. A new series of flakes were removed from the old dorsal surface (d). This produced a bifacial effect. If these scars met in the middle, the result was a flat face and a thinner preform, but if they stopped short with step fractures, a pronounced central ridge appeared, a remnant of the original dorsal surface.

Owing to the transverse orientation the butt end had a tendency to be too thin. At this stage it was sometimes shortened until it was sufficiently thick and strong (e). The bevel was flaked from a platform on the ventral side so that it formed on the old dorsal side (f). Thus the least irregular surface (the ventral side) became the front of the adze and the curve provided by the percussion bulb resulted in a slightly offset butt. This choice of the smoothest side as the front reduced the amount of time spent on grinding. In Samoan adzes the front is the most extensive surface to be ground, followed by the bevel and lateral sides.

The effect of the change of platforms during this reduction sequence was to make the back of the adze wider than the front, a characteristic of several Samoan adze types. Where the dorsal ridge remained, the preform gave rise to the Samoan Type II adze. Where the back was flaked flat, Types I, IX and X could have resulted.

REDUCTION OF THE TYPE C BLANK (Fig. 12)

Cores for manufacturing blade blanks were found on the quarry, while preforms from blade blanks occurred both on workshop terraces and in the Museum collection. The reduction sequence of the thick three-sided blade blank (a) began with a narrowing of the sides using the ventral surface (bulbar side) as the starting platform. Large flakes had to be detached and it was important to the shaping process that they travelled right down the sides to the dorsal ridge (b). Since such flakes leave deep bulbar scars, the platform probably required overhang removal to prevent platform collapse resulting in excessively high platform angle and a persisting mass (cf. Leach and Leach 1980: 113).

The next series of flakes, directed from one or both of the newly flaked sides, removed irregularities from the ventral surface, in particular the percussion bulb (c). Occasionally

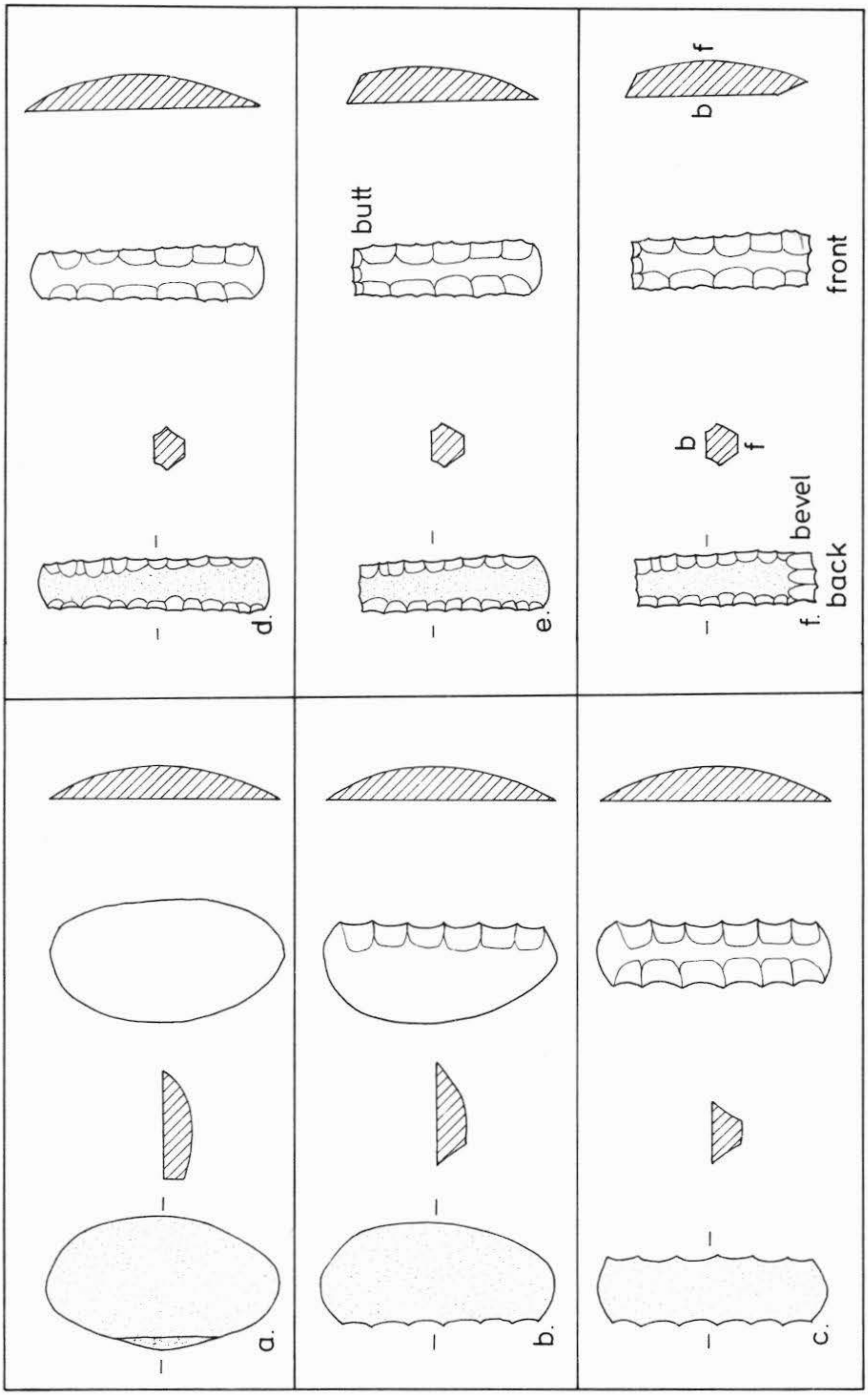

Figure 11: Reduction of the type B blank.

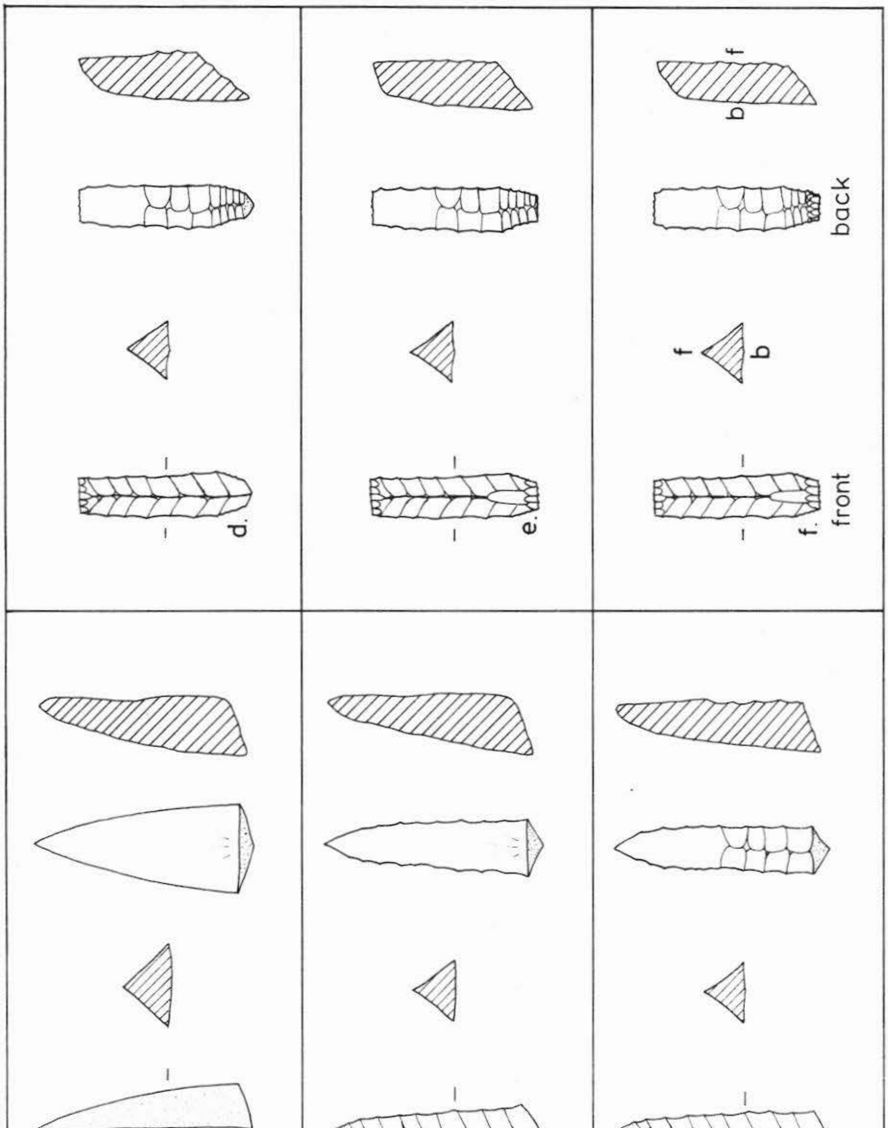

Figure 12: **Reduction of the type C blank.**

the dorsal ridge required straightening but this was only possible if the original blank had been a corner blade with a ridge angle of 90 degrees or less. The aim was to produce a preform with three flat sides, three straight edges and a slight taper towards the butt end. The butt was formed on the narrow tapering distal end which usually needed to be shortened (d).

Bevel preparation commenced with a series of flakes running in from the edges of the ventral surface, narrowing the preform (d). These provided a platform for the removal of the bladelets from the front ridge, thereby creating a front facet (e). The first bladelet was generally crested in that it ran up and detached part of the dorsal ridge. Ideally the rest of the bladelets were broad and left a flat surface ready for grinding. Using the front facet as the striking platform, the final flaking of the bevel took place, but not without risk of end shock (f).

The finished adze was three-sided with a narrow front facet and a cutting edge more like a gouge than a chisel. It would have fitted into Green and Davidson's Type VI or VII.

LESS COMMON REDUCTION PROCESSES

The fourth blank type (an elongated, thick flake or short blade with a dorsal ridge) was oriented longitudinally and flaked initially from the ventral surface, narrowing both sides. When the platform approached 90 degrees it was turned over and flakes were removed across the ventral surface. Using the ventral scars as a platform, the bevel was made on the dorsal side. The result was a bifacially flaked adze wider in front than back, corresponding to Green and Davidson's Type IV.

There was no obvious blank or preform from Tataga-matau or the Museum indicating manufacture of the important early adze Type V, a plano-convex form. Following the suggestion that stream cobbles may have provided the blanks, some experimental attempts were made to flake them. A bifacial technique in which the row of flake scars along one side set up the platform for the adjoining side, proved most effective but produced a lenticular, not a plano-convex cross section. None of the informal replication trials produced preforms which would readily fit into this category. It is possible that a particular grinding procedure led to this distinctive cross-section, perhaps to achieve an adze which could be hafted in the same manner as the shell adze common further west (cf. Green 1974a: 141–4) and used by Lapita artisans, probably ancestral to the Samoans.

THE CULTURAL AFFILIATIONS AND SIGNIFICANCE OF TATAGA-MATAU

These preliminary technological studies have demonstrated that the stone workers of Tataga-matau were engaged in the production of a range of adzes, all of which conformed to the finished adze types of the Buck (1930) and the later Green and Davidson (1969, 1974) Samoan adze typologies. There is no evidence that adze-makers of other Polynesian cultures independently produced their own non-Samoan types at the quarry. If they were present at all they must have produced distinctive Samoan styles.

Arguments for such visits by non-Samoan artisans run up against the obstacle of their lack of familiarity with the particular flaking characteristics of Tataga-matau basalt. Even skilled modern knappers need a period of familiaristion with a new material. Furthermore it has been suggested that only a limited range of blank types could be produced at this quarry because of block size, geometry and type of hammerstone and this would in turn restrict the types of preforms. Given these restrictions it is likely that the adze types made at Tataga-matau had evolved to the point where they represented the most economical and technically feasible use of this basalt. In other words, the Samoan adze types produced at Tataga-matau were technologically in tune with the source material and significantly influenced by it. For this evolutionary process to occur, the stone workers had to be part of a continuous craft tradition, passing the technical information from one generation to the next and having long periods on the site practising their skills.

Tangless triangular and rectangular sectioned adzes (usually front narrower than back) were characteristic of the Samoan adze industry for nearly two millennia. However, similar adzes of Oceanic alkali basalt also appear in assemblages outside the Samoan islands. Even without definitive sourcing, archaeologists and ethnologists have suggested that some of these adzes were made in Samoa (Beaglehole and Beaglehole 1938: 164–5 (Pukapuka); Bellwood 1978: 348 and Duff 1968: 125 (Rarotonga); Poulsen 1967: 226 (Tonga); Birks and Birks 1968: 114 (Fiji); Kirch and Yen 1982: 236 (Tikopia); Kirch and Rosendahl 1973: 66, 68, 77–79 (Anuta)).

Simon Best (1984: 401–2) finally confirmed by petrological and chemical analysis that Samoan adzes were reaching the Lau Islands, between Fiji and Tonga, and Leach and Davidson's (n.d.) petrological examination of adzes and adze flakes from the Polynesian outliers Nupani and Taumako in the Southeast Solomons conclusively indicated a source in the vicinity of Tonga and Samoa.

Even at this stage of analysis it is clear that Samoa played an important role in the dissemination of adzes in the Central Pacific and possibly even in the Western Pacific. Just how many quarries were involved is as yet uncertain. Two quarries have been mentioned in the literature, one unconfirmed at Mt Vaea near Apia (Golson 1969: 18) and the other Tataga-matau (Green 1974a: 141). Samoan adze rock types have commonly been hand sorted into two colours: a light grey and a darker grey, nearly black (Buist 1969: 37; Best 1984: 403). However, Best found that no simple equation of the two colour types with the two quarry sources was possible because both colours were present in his samples from Leone (probably Leafu streambed material). Having sampled Tataga-matau directly we can say that its freshly fractured basalt is consistently very dark (though weathering to a light grey). Any fresh light grey material found in the catchment is most likely to come from another source.

Obviously Tataga-matau played an important role as a high quality rock source used in Samoan adze manufacture, a role reflected in oral tradition and site magnitude, but whether it was the paramount source cannot be confirmed without further surveying and sourcing. We believe that future studies will demonstrate that many separate sources supplied the small adzes used on a routine basis by ancient Samoans, but that only one or two quarries offered the fine-grained relatively homogeneous material in a form suited to the manufacture of the large triangular and quadrangular forms required by specialist canoe and house builders.

Besides its value as a rock source, Tataga-matau may prove significant as a fortified and possibly residential quarry. Within Polynesia, quarries and associated workshops are known from Hawaii, New Zealand, Pitcairn Is., Easter Is., the Society Is, the Marquesas and the Australs. The best recorded are those from Hawaii and New Zealand. Of the 13 described from Hawaii by Cleghorn *et al.* (1985), three have evidence of rockshelters or residential structures, and two have religious sites within the quarry complex. In New Zealand, signs of habitation (midden, oven stones etc.) occur in a few combined quarry-workshop sites (e.g., Riverton—Leach and Leach 1980; Tiwai Point—Huffadine 1978), but fortifications are only rarely associated. At the Tahanga site on the Coromandel (Moore 1982), the summit of the basalt dome is fortified, but the quarry areas of outcrop and talus lie outside the defences. On Mayor Island, defensive ditches occur close by some of the obsidian outcrops (Seelenfreund 1982) and in two cases (Panui Pa and the Devil's Staircase), these would have restricted easy access to the flow. On the basis of our present knowledge, therefore, Tataga-matau is one of only a few Polynesian quarries where earthworks appear to have been constructed to protect the rock source.

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REFERENCES

Amerson Jr, A. B., Whistler, W. A. and Schwaner, T. D. 1982. *Wildlife and Wildlife Habitat of American Samoa. 1. Environment and Ecology.* United States Department of the Interior, Fish and Wildlife Service, Washington D.C.

Beaglehole, E., and Beaglehole, P. 1938. *Ethnology of Pukapuka.* Bernice P. Bishop Museum Bulletin 150, Honolulu, Hawaii.

Bellwood, P. 1978. *Man's Conquest of the Pacific.* Collins, Auckland.

Best, S. 1977. The Maori adze: an explanation for change. *Journal of the Polynesian Society* 86(3): 307–337.

Best, S. 1984. Lakeba: The Prehistory of a Fijian Island. Unpublished Ph.D dissertation, Anthropology, University of Auckland.

Birks, L., and Birks, H. 1968. Adzes from excavations at Sigatoka, Fiji. *Archaeology and Physical Anthropology in Oceania* 3(2): 105–115.

Buck, Sir P. H. 1930. *Samoan Material Culture.* Bernice P. Bishop Museum Bulletin 75, Honolulu, Hawaii.

Buist, A. G. 1969. Field archaeology on Savai'i. *In* Green and Davidson 1969, pp. 34–68, *q.v.*

Clark, J. T. 1980. *Historic Preservation in American Samoa: Program Evaluation and Archaeological Site Inventory.* Department of Anthropology, Bernice P. Bishop Museum, Honolulu, Hawaii.

Cleghorn, P. L. 1982. The Mauna Kea Adze Quarry: Technological Analyses and Experimental Tests. Unpublished Ph.D dissertation, Anthropology, University of Hawaii.

Cleghorn, P. L., Dye, T., Weisler, M., and Sinton, J. 1985. A preliminary petrographic study of Hawaiian stone adze quarries. *Journal of the Polynesian Society* 94(3): 235–251.

Davidson, J. M. 1969. Survey of sites and analysis of associated artefacts, Luatuanu'u. *In* Green and Davidson 1969, pp. 185–204, *q.v.*

Davidson, J. M. 1974a. Samoan structural remains and settlement patterns. *In* Green and Davidson 1974, pp. 225–244, *q.v.*

Davidson, J. M. 1974b. Specialised sites in the Upper Falefa Valley. *In* Green and Davidson 1974, pp. 205–209, *q.v.*

Duff, R. 1968. Archaeology of the Cook Islands. *In* I. Yawata and Y. H. Sinoto (Eds), *Prehistoric Culture in Oceania*, pp. 119–131. Bishop Museum Press, Honolulu, Hawaii.

Emory, K. P. and Sinoto, Y. H. 1965. Preliminary report on the archaeological investigations in Polynesia. Fieldwork in the Society and Tuamotu Islands, French Polynesia, and American Samoa in 1962, 1963, 1964. Mimeographed, Honolulu.

Golson, J. 1969. Preliminary research: archaeology in Western Samoa, 1957. *In* Green and Davidson 1969, pp. 14–20, *q.v.*

Green, R. C. 1971. Evidence for the development of the early Polynesian adze kit. *New Zealand Archaeological Association Newsletter* 14(1): 12–44.

Green, R. C. 1974a. Excavation of the prehistoric occupations of Su-Sa-3. *In* Green and Davidson 1974, pp. 108–154, *q.v.*

Green, R. C. 1974b. A review of portable artefacts from Western Samoa. *In* Green and Davidson 1974, pp. 245–275, *q.v.*

Green, R. C. and Davidson, J. M. (Eds) 1969. *Archaeology in Western Samoa Vol.1*. Auckland Institute and Museum Bulletin 6.

Green, R. C. and Davidson, J. M. (Eds) 1974. *Archaeology in Western Samoa Vol.2*. Auckland Institute and Museum Bulletin 7.

Herman, Bro. 1970. *Tales of Ancient Samoa*. The Book Shop, Samoan Church, Pago Pago.

Huffadine, M. S. 1978. To leave no stone unturned: an examination of a lithic assemblage from Tiwai Point, Southland. Unpublished Research Essay, Anthropology, University of Otago.

Jones, K. L. 1984. Polynesian quarrying and flaking practices at the Samson Bay and Falls Creek argillite quarries, Tasman Bay, New Zealand. *World Archaeology* 16(2): 248–266.

Kikuchi, W. K. 1963. Archaeological Surface Ruins in American Samoa. Unpublished M.A. dissertation, Anthropology, University of Hawaii.

Kirch, P. V. and Rosendahl, P. H. 1973. Archaeological Investigation of Anuta. *In* D. E. Yen and J. Gordon (Eds), *Anuta: A Polynesian Outlier in the Solomon Islands*, pp. 25–108. Pacific Anthropological Records 21. Department of Anthropology, Bernice P. Bishop Museum, Honolulu, Hawaii.

Kirch, P. V. and Yen, D. E. 1982. *Tikopia: The Prehistory and Ecology of a Polynesian Outlier*. Bernice P. Bishop Museum Bulletin 238, Honolulu, Hawaii.

Leach, B. F. and Davidson, J. M. n.d. Archaeology on Taumako. Unpublished ms.

Leach, H. M. 1981. Technological changes in the development of Polynesian adzes. *In* B. F. Leach and J. M. Davidson (Eds), *Archaeological Studies of Pacific Stone Resources*, pp. 167–182. British Archaeological Reports, International Series 104.

Leach, H. M. 1984. Jigsaw: reconstructive lithic technology. *In* J. E. Ericson and B. A. Purdy (Eds), *Prehistoric Quarries and Lithic Production*, pp. 107–118. Cambridge University Press.

Leach, H. M. and Leach, B. F. 1980. The Riverton Site: an Archaic adze manufactory in Western Southland, New Zealand. *New Zealand Journal of Archaeology* 2: 99–140.

McCoy, P. C. 1977. The Mauna Kea Adze Quarry project: a summary of the 1975 field investigations. *Journal of the Polynesian Society* 86(2): 223–244.

Milner, G. B. 1966. *Samoan Dictionary*. Oxford University Press, London.

Moore, P. R. 1982. The prehistoric stone quarries and workshops of Tahanga, Coromandel Peninsula. *Historical Review (Whakatane and District Historical Society)* 30(1): 32–42.

Poulsen, J. I. 1967. A Contribution to the Prehistory of the Tongan Islands. Unpublished Ph.D Dissertation, Australian National University, Canberra.

Pratt, G. 1893. *A Grammar and Dictionary of the Samoan Language*. 3rd edn. (facsimile published by R. McMillan, Papakura, 1984).

Scott, S. D. and Green, R. C. 1969. Investigation of Su-Lu-41, a large inland fortification. *In* Green and Davidson 1969, pp. 205–209, *q.v.*

Seelenfreund, H. A. 1982. Mayor Island Archaeological Survey. Unpublished Report. (Copy in Anthropology Dept, University of Otago).

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