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LEONE WATER PROJECT PHASE 1 REPORT

09 MAY 1995

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STAFF ARCHAEOLOGISTS

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1.0 LEONE WATER PROJECT: REPORT OF FINDINGS

1.1 Introduction

ASPA is replacing approximately 2,500' of existing water line with new PVC line. Where the plan calls for reusing the existing water line trenches which run alongside the road we anticipate that there will be no effect on historic properties in this developed area of Leone (see map #1).

Approximately 2,000' of new line will be placed in the northern Leafu Stream Valley alongside the existing road. The narrow road runs on average 75' (20m) to the east of Leafu Stream in the south half of the project area and 100-150' (33-50m) to the east in the north half. The road is on a gentle grade (approx 3%). This gentle grade rises as it runs north up the valley floor, and down as one goes west across the valley from the road to the stream. Although maps and airphotos of the area show no obvious large surface features, the area's relationship to both the historic and prehistoric village of Leone and to the nearby prehistoric quarry and toolmaking complex, *Tataga Matau*, suggest it must be considered to have high potential for subsurface historic properties.

1.2 Research Plan

In order to locate subsurface historic properties we recommended the use of four backhoe trenches along the road at slightly more than 150m intervals with 2 shovel test pits (STP) placed between each trench location, for a total of 10 STPs. This approach would yield both profiles of subsurface stratigraphy and indicators of prehistoric deposits. The backhoe trench dug for the 2.0 inch PVC waterline would be 60.0cm deep (24 inches). The backhoe trenches for the archaeological examination dug with a 24 inch bucket would be nearly one meter wide and three meters long, with a maximum depth of one meter reached in the center of each trench, well below the waterline depth. Sample columns 50.0cm square would be excavated in the trench wall guided by the apparent stratigraphy. All recovered materials would be screened through 1/4 inch mesh.

In addition to the subsurface tests conducted prior to the excavation of the pipeline trench we proposed to monitor the excavation of the new water line trench connecting the line from the ends of the west road and the east road as it crossed Leafu stream and the mucky soils in the center of the valley on either side of the stream. We would also spot monitor the replacement line trenches.

1.3 Changes to the Research Plan

We dug and examined two backhoe trenches, and discovered a subsurface soil record of active alluvial redeposition and repeated flood events, with no undisturbed deposits of prehistoric lithics. We examined the third trench and found ridgeslope debris redeposited at this location. We dug two 1.0m squares on the pipeline route, 30m and 60m north of Trench 3 to further examine the nature of the disturbances. In this case we discovered more evidence of active redeposition in the form of colluviation. With the examination of Trench 4 yielding large angular clastics as a colluvial record, we had completed sufficient sampling of the subsurface to conclude that the lithics we observed were located where they were because of periodically active, high energy geomorphological processes, not direct human cultural processes.

In our judgement, based on data from field observations, no further subsurface testing work could be justified given that the aim of this research was to determine whether subsurface cultural deposits posessing site integrity would be in the path of the pipeline. We determined to our satisfaction that any cultural materials we did observe were without cultural context. We stand by our judgement that any cultural materials we would recover from tests dug between those already examined would in like manner be without necessary context. We continue to monitor project pipeline excavation as described above, and report our test findings in Part 2.0, below.

1.4 Description of the area

Leone valley (Leafu Stream valley) is a north to south flowing drainage, running 1.0 mile from 30' above sea level to sea level at the bay where the valley is slightly more than 1/2 mile wide. Valley walls rise steeply to approximately 700' at Mulimauga Ridge on the west and Malaoto Ridge on the east.

The upper valley, the general area of the ASPA waterline, has experienced a rapid increase in home construction since the early 70s (personal communication,Suafo'a) (see 1963 USGS map 5). Originally the area was plantations of banana and coconut which,today, still make up approximately 50 % of the area. Homes in the north 1/2 of the valley have large, well kept lawns, walls, driveways and gardens with large numbers of both domestic and ornamental exotic trees and shrubs. According to Suafo'a, the landowners have used bulldozers to landscape the sites. In the north 1/2 of the valley there has been no attempt to control the stream with walls and hence rainwater flooding the surface of the flood plain has deposited deep silts across the valley floor. This soil is typically dense,fine silts with poor drainage.

1.5 Geology

Leone is within a Pliocene-age area of Taputapu volcanics which are composed of olivine basalts associated with cinder cones, dikes, and thin vitric tuff beds. More recent volcanic flows from Vailoatai, Fagatele, and Fogama'a Craters cover Leone and the south half of Leafu Valley (See map 3). The valley bottom is composed of colluvial deposits at the foot of mountain slopes and deep alluvials within the stream flood plain.

1.6 Soils

Leafu valley bottom is composed of Leafu silty clay on a 0-3%slope. The soil is very deep and somewhat poorly drained. It is derived from fine textured alluvium from basic igneous rock. The natural vegetation is mixed forest and grasses. Its cultural use has been for coconut, taro, banana and breadfruit. Soils are frequently saturated and vegetation may be limited to medium or shallow rooted crops. The area floods easily during heavy rainfalls. Currently the area is mixed homesite and garden plantations of coconut and banana.

1.7 Previous archeology

The first archeological work in the Leone area was Sinoto and Kikuchi's (1965) work in 1961 and 1962. Along with surface surveys, Sinoto and Kikuchi excavated at 5 house foundation sites in Leone. These sites appeared to be post contact. In 1972 Frost excavated two house foundations in Leone within 100 meters of the coast. Carbon 14 dates put the age of the site at an uncalibrated approximate date of AD 1410.

Kikuchi's 1963 surface survey (see map 4) located the general area of sites in the Leone area. Approximately a dozen sites are within the general area of the water line project and highlight the importance of the area for precontact Samoan communities. Site #83 is a wall built by High Chief Fai'ivai and is probably a historic boundary marker; #84 is a sunken path near Amaluia; #82 is a 2.0m deep ditch on a steep slope; #94 is a platform on Mulimauga Ridge; #96 is a *tia* mound on a muddy talus slope; #101 is an Aitu Cave also on a steep slope; #108, 109, 110 are springs connected with oral history; #133 is a central mound by a ditch with a wall circling the ditch; #134 is a ditch built by the marines which uncovered an ancient wall unknown previously to the Leone villagers; #146 is an adze grinding stone at an area called Ologa-to'i.

Of greatest importance is the *Tataga Matau* Quarry site, placed on the National Register of Historic Places in 1987. Best, Leach and Witter's 1989 report indicate a site area which extends beyond the quarry to the valley floor(see figure 1). USGS maps, Best, Leach and Witter's location map and ASPA's project map taken from aerial photos do not accurately correspond and the exact site boundary overlaps with ASPA's project area by an undetermined amount. Leach and Witter (1987) describe 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 archeologist lies in separating in situ from redeposited material. Artifacts 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.

This location was also used for the last stage of adze manufacturing: 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 420m 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 adzes) as the place name of this locality. However our informant took us to another place with this name, on a tributary of Leafu Stream (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.

These features of the adze quarry and the recorded sites for the upper valley in general suggest that the gently sloping valley floor was an important use area for the precontact Samoans. Particularly because of the labor intensive activity of adze grinding and the political and economic importance of that activity, some sort of habitation sites should be expected in the area. Although Mr.Suafo'a stated that the area was all plantations as far back as he could remember (he is 73) and that there may have been some burials in the area and that there may have been a fale or two he thought that they were probably destroyed by the land clearing for the houses.

1.8 Test Areas: Archaeological Overview

Generally, there is a surface layer 25-50cm thick of roadfill or topsoil with historic trash in the corridor of concern. Cultural materials in the form of basalt flakes appear in the soils immediately under this fill to approximately 1.0m below the surface. Charcoal flecks appear occasionally, throughout the silty matrices and probably signal land clearing events in the past.

Archaeological sites located near the pipeline include a quarry and workshop observed near the top of a recently bulldozed road cut into the flank of the eastern ridge, and originating near Trench #3. The area on the ridge had been flattened earlier, and iron pipes dislodged by the bulldozing suggest that water catchment apparatus was in use transporting water from a stream flowing off the ridge a little to the north. The site has been heavily damaged by large excavation equipment. A Type I adze (see Figure 1) was located on the site surface amidst a large volume of flakes.

A dense surface scatter of lithic debitage appears to exist on the west side of the stream, from the base of the western ridge and across the valley floor an unknown distance toward the stream. The lithic materials are visible and were first seen associated with waterworn flat stones that form a paepae adjacent to a house located at the base of Mulimauga Ridge and having no lawn grass to obscure them. This lithic scatter is hidden at the level of the sod on the surface nearby. A low stone-walled terraced garden on the hillside was built by the current residents. There is a grinding stone approximately 1.0m x 0.7m located approximately 20m north of the house in a banana planting near the foot of the ridge. Another smaller grindstone is in the hedge separating the house without grass from the one immediately north.

Lithic materials associated with this exposure became apparent in the sticky trenching soils only after a heavy rain had washed clay from the flakes. Examinations of the trench had showed a red silty soil overlying shallow bedrock.The lithic materials had been, in all liklihood, on the surface and covered by cinder fill when the road had been made sometime after the 1963 USGS quad was field checked.. The extent of lithics observed in the trench spoils was continuous for approximately 430 meters north-south along the base of the western ridge (see map 1). Examination of a household water-delivery trench showed the site to extend eastward from the base of Mulimauga Ridge to the meander/oxbow drainage 100m away. Individual members of the flake deposit have migrated from 0.0cm to 60cm depth in some locations. Observations of flake behavior in water suggest that they behave like hydrofoils in saturated soil, and will migrate down through the local clays and silts at differing rates depending on the configuration of each flake. The differing rates of movement will alter original relationships and associations among the members of the deposit. The meanings of the flakes are not as they appear.

We think that on the west side of the valley from the base of the ridge and extending as far east as stream flooding and meandering would permit site occupation and formation, the flake and tool scatter marking a large work and living area is hidden at the level of the lawn grassroots.

2.0 LEONE: LITHIC ANALYSIS

2.1 Background

The prehistoric human activities associated with <u>Tataga Matau</u> probably determine the quantity, location, and state of preservation of the vast majority of the archaeological data of the Leone region. This extensive archaeological complex at the head of Leafu Valley may, in fact, be but a part of one nearly continuous site evolving in complexity for at least one thousand years. This cultural landscape of two square kilometers includes the valley floor, the surrounding ridges, and the shoreline. All of the known features, those previously reported and those we have discovered in 1995, appear to describe the largest domestic and export manufactory for stone tools on Tutuila.

Other quarries exist on this island, but none as extensive, and probably none so linked to tool production for export. Stories tie the prehistory of Leone with Tonga and other nearby islands, as do typological and petrographic analyses of basalt adzes found on these islands. To gain a preliminary knowledge of the historic and cultural context for this significant area, the reader is encouraged to consult (1)Leach and Witter (1987), (2)Best, Leach, and Witter (1988), (3)Clark (1989), (4)Clark (1992), (5)Best et al.(1992), and (5)Moore and Kennedy (1994).

2.2 Operational Hypothesis

Based on our synthesis of data from (1)our reading of the archaeological literature, (2)our observations of the evident geomorphological processes affecting the Leafu valley floor, streambed, slopes, and several ridges, (3)monitoring backhoe trenches dug for the installation of fresh drinking water distribution pipes, and from (4)test squares and trenches we excavated to provide in situ archaeological data, we propose one hypothesis, the story of ***Tataga Matau***, as follows:

> The entire area from Tataga Matau at the head of Leafu Valley to the coast, the ridgetops and the valley floor, is one nearly continuous prehistoric site. The site consists of related features and specific areas at each of which people did specialized, definable, sequential tasks directly related to or supporting the production and export of stone tools. This trade sent stone adzes and other tools and toolmaking material to populations at other locations on Tutuila, and to other south Pacific islands possessing inferior tool stone.
>
> Owing to steadily increasing populations on Tutuila and on other south Pacific islands, demand for stone tools increased proportionately for at least one thousand years, peaking in the early nineteenth century. The gradual necessary intensification of labor to supply the increasing demand resulted in an increasing local population of quarriers, toolmakers, food producers, trade managers, and their families. There was an intensification of social, economic, and political management of this trade resource and the people associated with it. These trends resulted in an ever increasing total site area which this increasing population used.
>
> Activities at this site complex were rapidly reduced in direct proportion to the quantity of euroamerican iron available to replace stone tools on the former trading islands and in the villages of Tutuila ending in abandonment in the early Nineteenth century.

This hypothesis generates many research questions which will not be answered as a result of this season's limited work. ASPA's waterline project will not provide sufficient data to prove or disprove this hypothesis. We can, however, contribute data, and establish a direction for research built on our findings.

2.3 Detecting Site Function(s)

We can provide methods for analysis of lithic materials which will indicate differences between assemblages of stone tools collected in different areas of Leafu Valley and Leone, and ultimately for comparison with more distant areas on Tutuila, including other quarry and tool manufacturing sites.

These differences, shown as the preference for one tool type, class of tool types, or cluster of classes, over another, characterize the kinds of work performed at each area. The differences between areas will be expressed as the difference in ratios of tool types within a class, or among tool classes.

It must be understood that rarely will a use area be devoted exclusively to one purpose. Instead, use areas are usually multiple use areas which may emphasize one task over another. The emphasized task or tasks will be framed against local or culturally specific and generic "background noise", consisting of the organization, disorganization, signs, and debris of domestic life lived alongside and in support of the emphasized specialty of a given area: family, food, kids, dogs, visiting friends, and the social events reinforcing economic and political interrelationships among the local producers and traders, and the off-island trading partners and their camps, camp followers, and boat moorages. There may be signs of an occasional skirmish as the strains of increasing population were mediated or accomodated more or less successfully. Future archaeological work using these methods can expand on existing data, drawing the map and filling in the blanks of living in this intriguing and significant site.

The degree of clarity in the definition of the function or functions for a given area will in each case depend on the size of the sample considered for analysis, with greater clarity deriving from a numerically larger sample in most cases. Therefore the identification of all the types of stone tools utilized at a site becomes very important.

> **Throughout the Pacific, basalt is the single most important stone for tool making. Adzes are the most common, most studied, and most informative of the stone tools, but a variety of other tools are also produced in basalt. Unfortunately, studies of basalt tools other than adzes have been too few and there is still much to learn about prehistoric basalt use (Clark 1989:112).**

Often the most frequently used tool at prehistoric sites is the flake. The raw recently struck flake is the most versatile tool available. As the item with the sharpest margin available at the least human expenditure in labor it can be used first to cut and slash. After this use results in wear making it less useful as a cutter, the margin is still suitable for use as a shaper or scraper. For many cutting, perforating, scraping, and shaping uses the prehistoric tool user may intuit the formal characteristics needed and select or produce an appropriate fresh flake.

The supply of flakes from which one selected the appropriate form was not limited to leftovers produced in making other tools. In fact, the tool user may have brought a chunk of basalt from which he or she struck flakes for use only as flake tools with no other reduction or shaping aim in mind. One example of a purposefully made flake is the observed recurrence of a flake form resembling a double edged axehead. Quadrilateral in plan, the two non-parallel margins are sharp and the parallel margins are not. This form appears throughout North America, and can be found made of chert, obsidian, or basalt. It was usually executed in smaller sizes (2cm-4cm across in maximum dimension) when made of fine glassy material, and in American Samoa, in the more difficult to work local basalt, it is sometimes nearly ten centimeters across. The point is that it was a flake form which was deliberately made to result in the two cutting margins with no further preparation.

Historically and currently in American Samoa and elsewhere, archeologists may classify these and other flakes as edge-modified flakes, or retouched flakes, if they are classified at all. They are often simply put aside from further study, or weighed, or classified as "waste flakes". Generally, and unfortunately in American Samoan archaeology, flakes have not often been examined for use as tools, even though they exist as the most frequently occurring descriptor of site function.

What have been most frequently examined and reported in Samoa are adzes, in all their myriad forms (Green and Davidson 1969). They are attractively finished, look like art objects, and in some contexts they probably do have significant ritual meaning (Firth 1959; Cleghorn 1985).

For purposes of assessing site function adzes are one, and only one, part of the puzzle. They are not the most frequently occurring tool and they were used by no more than half of the population: men. Because the tool form was dictated by its important utilitarian function, adzes were ground, often polished, and symmetrical. This made them more attractive than a "waste flake" to researchers and collectors. They have been therefore more often collected. This fact alone makes them less-reliable markers of site activities than tools left in place. In addition, that they are associated with male activities and not female activities means that paying research attention to them out of proportion to their contribution to understanding any site has skewed the data and our interpretations.

To begin the process of assessing site function(s) through the creation of an expanded, observable lithics data base, we examined lithics recovered from controlled excavations at Utusia, on the Faga'itua Bay coastal plain in eastern Tutuila, and from Leafu Valley, Leone, in western Tutuila. First we examined the Utusia materials, consisting of 266 artifacts. Of these 266 items, two were recognizable adze preforms, and would surely have been recorded as such by any archaeologist. The remaining 264 were "flakes".

Using an eight power loup and conservative criteria for determining regular, consistent, and recurrent patterns of flake (1)form selection, (2)preparation, (3)use, retouch, and wear, the margins of all of the flakes were examined on edge and from above, ninety degrees to the margin. Sixty-two additional tools were observed. They consistently fell into five groups: (1)cutter, (2)spokeshave, (3)plane [straightshave], (4)drill/awl, and (5)Graver/burin.

We then examined the 225 artifacts from the Leone test excavations armed with these observations, and found a similar range of tools. Of the 225 artifacts, 58 (26%) were tools, with 41 of these (71% of the tools) tools assignable to Class 4.00, Unprepared Flake Tools. Observations of the enlarging sample suggest the existence of varieties in several of the types. In addition to the five types of unprepared flake tools in Class 4, other familiar tool types were observed, which included obviously prepared flake tools, cores, and utilized cores.

As a result of this work we prepared on Lotus 1-2-3 a preliminary and infinitely expandable and modifiable list ordering the classifiable lithic categories, shown below. We hope it proves useful in the comparative investigation of site definition and functions throughout American Samoa. Its first use will be in reporting the lithic artifacts from the Leone test Excavations.

2.4 Stone Artifact Classes and Types

We present the working classification system we think will permit (1)coherant data reporting and collation, and, (2)comparative functional analysis of site with site, or features within a site. The names of artifact classes end in .00, with familiar types subsumed within each class. The numbering system permits additions and revisions. NVU means No Visible Use, and applies to (1)cores, which often are used as choppers or hammers, and to (2)flakes which have not been selected for use as examples of types in Class 4.

Lithic Artifact Classes and Types Within Classes

1.00 Core
1.10 Core: No Visible Use (NVU)
1.20 Core:Chopper
1.30 Core:Hammer

2.00 Ground and Polished
2.10 Preform: Adze
2.20 Preform: Other
2.30 Adze
2.40 Coconut Grater
2.50 Other

3.00 Flake Tools: Prepared
3.10 Chopper
3.20 Sidescraper
3.30 Endscraper

4.00 Flake Tools: Unprepared
4.10 Cutter
4.20 Spokeshave
4.30 Plane
4.40 Drill/Awl
4.50 Graver/Burin

5.00 Cobble: Hammer

(6.00 Total number of Tools)

7.00 Flakes: No Visible Use (NVU)
7.10 Primary Decortication Flakes
7.20 Secondary Decortication
7.30 Reduction

The tools in Class 4 are probably unfamilar to many researchers, or at the least, have not been seriously examined for the role they play at, we think, most prehistoric lithic sites. Because Class 4 may be new to some, we expand our discussion of this group, below. Idealized forms are shown in Figure 2.

Class 4.00 -- Unprepared Flake Tools, are those tools we found which, in American Samoa may amount to nearly one-quarter of what would otherwise be undifferentiated as "waste flakes", or, chipping debris. To be used as a tool and to show signs of use we found that the selected flake must exceed 2.0cm in any dimension, and that the vast majority of tools were on flakes larger than 3.0cm.

The name we chose for the class is not entirely accurate. Each type in this class does contain members which have been systematically prepared to some degree, or "retouched". Evidence of preparation is clearest and most frequent when examples of this class are made of fine cryptocrystalline glassy material: chert, chalcedony, obsidian. Such evidence is nearly impossible to detect in Tataga Matau basalt.

This class is made up of tools which are the domestic and craft labor workhorses, doing most of the work done at most sites. These are, perhaps, throwaway tools: flakes struck, then used, then discarded where they were used. They could be re-formed and re-used at low labor cost wherever work was done. It is probably in the differential distributions of tools of this class that some of what the women do is recorded.

These tools perform cutting, shaping, and piercing functions characteristic of and necessary to fiber processing for the manufacture of string, nets, matting, basketry, and their analogues, including fish traps and sewing and lashing in boat and house assembly. Additionally they can finely carve, groove, and remove or flatten surfaces of wood and bone objects, for example, in the making of design surfaces on wood blocks for Tapa printing.

4.10 Cutter, may be the most underrepresented of the tool types in this class. Without microscopic examination, those artifacts admitted to this type had to show erratic margin wear of often bifacially alternating small lunate chipping, or else have either an unmistakeable (1)blade or (2)"winged" double headed axe form. In all cases the cutting margin is formed from the sharp meeting of opposing faces at an acute angle of less than 10 degrees. An examination of a larger sample of flakes will probably force subdivision of this type into at least three formally described varieties, each of which may prove to be functionally and/or temporally distinct.

4.20 Spokeshave, the curved shaper for wooden rods, basketry coils, and similar cylindrical shaft forms, is the most frequently encountered type of this class. The specialized working bit is concave and always less than semicircular in plan. It is always unifacially prepared or worn into the margin, and displays a bit angle of more than 20 degrees and up to 90 degrees. This bit may be located anywhere on the perimeter of the flake. Our sample of tools of this type ranges from a width of 7.0mm to 13.0mm, and a depth into the margin varying from 2.0mm to 4.0mm. There may be more than one spokeshave on a flake, or one may share a flake with an example of 4.30, Plane. We expect that as more examples are found this type may become differentiated by at least a bi-modal distribution of the bit dimensions.

4.30 Plane, is better described as an endoplane, since the tool is a straight shaver formed either through wear, or by unifacial preparation, into the perimeter margin of a flake. The bit is straight, rather than curved as in the spokeshave. It is a steep-walled micro-scraper with a bit angle of more than 20 degrees and less than 90 degrees. More than one may be present on a flake. Those in our sample range between 5.0mm and 13.0mm in width, and 1.0mm to 4.0mm in depth into the flake margin. Two variations occur, (a)one which is bounded at both ends by unworn flake margin (the trapped endoplane), and (b)the other with only one end bound (the infinite endoplane).

4.40 Drill/Awl, is a long sharp flake projection which has wear attributable to drilling motion and forces. A drill may be used as an awl without causing easily detectable wear, however, a tool used as a drill shows small pressure flakes removed from the angular facets a short distance from the pointed distal terminus. The working drill bit, the pointed projection, is often ten times longer than its width at the base of the working portion. It classically is four-sided (diamond) in cross section, although our basalt examples were often three-sided. To be admitted to this type at least one margin of the three or four facetsshowed wear from twisting forces. The basal half of the tool is at least three times as wide as the base of the drill bit. Drill bits exist in a great array of lengths and sizes, and are usually in excess of 15.0mm long.

4.50 Graver/Burin, is a small projection out and away from the margin of a relatively flat flake. To be admitted as a member of this type the projection must show one small flake scar originating from the distal face of the projection, and usually appearing on its dorsal surface. The projection is square or rectangular in cross section. Examples tend to approach 2.0cm to 3.0cm in length and width. A variant form is the rectangular bit with two sharp corners formed at the corner of a flake when it is broken. This form too will show a small pressure flake scar as a result of use as a small chisel.

2.5 Leone Test Data

The archaeological tests were conducted in March, 1995. Map 1, Leone and the Leafu stream valley, shows the route of the high-pressure mains ASPA will install. On the map the tests are shown, with **Trench 1** the southernmost of the tests. As one goes to the north the sequence continues as follows: **Trench 2, Trench 3, Square A, Square B, and Trench 4. Trench 4** is at the end of the paved road.

The tests were conducted to provide information on (1)presence or absence of historic properties in the pipeline route, (2)soil data to permit assessment of local geomorphological processes at each test, from which we could infer processes at work in the areas between the tests, and (3)from these two sources of information we could make a probabilistic judgement about the effect of the project on historic properties, if any were found. See Figure 3-6 for soil profiles.

The four trenches were dug by backhoe using a 24 inch bucket to a depth below that to be dug for the high pressure pipeline. Three of the four were parallel to the road and in the proposed route of the trench. Each vertical exposure was approximately one meter or more. In each trench, one column, 50cm on a side, was excavated into the trench wall, using the apparent stratigraphy revealed on the exposed wall as a guide. Excavation was by stratum, and all materials were screened through one-quarter inch steel wire mesh hardware cloth. **Trench 3** was oriented at 90 degrees to the road and the path of the pipeline in an effort to sample more of the adjacent soils for data at the valley edge at the foot of the eastern ridge, near a raw eroding bulldozer cut into its flank.

The two test squares were one meter on a side, and were excavated by stratum without the benefit of the window given by the backhoe trench. Materials were screened in the same manner as the columns from the trench tests. We dug these squares between Trench 3 and Trench 4 to test the necessity for redundant or confirming data to augment data from the trenches.

All but one of the artifacts, flakes and tools, recovered from the excavations, had a patina almost as if they had been given a light gray plating or had been painted in light gray primer. The one item carrying no patina was fresh road ballast. When exposed through striking a flake from a chunk of material, the fresh interior tool material was very dark, blue-black.

2.5.1 Trench 1

Lithics

No lithics were found in the uppermost level. Those in the remaining three levels were all patinated, and virtually all the larger flakes and tools, one-third of the total, showed wear from tumbling. The smaller two-thirds showed little or no tumbling wear. Small flakes transported in water, or a soil and water slurry, tend to ride higher in the stream than larger stones, and may suffer less damage. If they originate from the same location as larger stones they will likely travel farther than the larger stones in water of similar force and yet appear less tumbled.

One hundred percent of the tools found in Trench 1 were members of Class 4, Unprepared Flake Tools. Eight percent of the total number of flakes recovered were found to be tools.

Soils

Level 1: 0-25cm below surface (cmbs) apparently is road fill, consisting of light scoria cinder and heavy basaltic clastics used as ballast. Historic debris (glass, plastic, cans) is found mixed with the fill.

Level 2: 25-70cmbs is a matrix of dark gray-black (7.5YR 3/3) clay soil, with the odor of active compost suggesting deep standing marsh deposits of fine silt and vegetative matter. Within this matrix are records of episodic flood intrusions into the marsh of varying intensity. From most recent to earliest in this level, they are (a)Waterworn pebbles >15.0cm diameter are present in the 25-40cm soil; (b)blue-green sand appears as a diffuse band from 40-46cm; (c)between 50-53cm is a band of waterworn pebbles >4.0cm diameter; (d)60-70cmbs is a deposit of waterworn angular basalt fragments. Artifacts were apparently transported to this location from several different sources, as indicated by the tumbling wear of rocks in one deposit, and the lack of tumbling wear in another. What was observed as deposits also describes the amount depending on the energy of each flood event, measurable by the size of materials transported.

Level 3: 70-97cmbs is red-brown (7.5YR 3/1) clay. At 80cmbs there is a diffuse horizontal locus of occasional flecks of charcoal. Between 90-97cmbs is a densely concentrated deposit of waterworn pebbles >4.0-cm diameter. The border between Level 3 and Level 4 is distinct and horizontal. The charcoal probably signifies human activity, possibly vegetation burning associated with land clearing. This may have resulted in the active, energetic flooding recorded as the 7.0cm thick deposit of pebbles from within the stream itself where they were tumbled before they were transported; apparently they became the bed of the stream for a short while, followed by a period of gentle alluviation for the duration of time (unknown amount) represented by the progressive buildup to 70cmbs, when once again this area flooded.

Level 4: 97-118cmbs is a matrix of very light red-brown (10YR 2/2) silts occasionally containing waterworn stones more than 15cm in diameter scattered throughout the upper half of the level, grading imperceptibly into an ever-increasing density of smaller waterworn pebbles >4.0cm in diameter in the bottom half of the level. The stones of whatever size apparently have some history tumbling in the stream. They may have been torn away from earth and stone deposits laid down earlier upstream and then redeposited at the site of the test trench.

2.5.2 Trench 2

Lithics

Only two artifacts from deep in the trench were observed throughout this column; the one tool observed was from Class 4, and the other artifact was a flake with no visible use or wear marks. Both showed tumbling wear.

Soils

Level 1: 10-51cmbs, below the surface topsoil ten centimeters thick, is recent roadfill consisting of cinder and large chunks of basalt ballast. The history of road construction in Leafu Valley is currently elusive. U.S. Marines are credited with most major earthmoving and roadbuilding activities in Tutuila. A large presence of Marines was known to have lived and worked in the Leone area, and contributed the water catchment system located at the waterfall at the head of the valley. To get there with steel and concrete required this road construction upstream from Leone, across the silty valley along the base of the ridge on the east side of the valley.

Level 2: 51-110cmbs is Leafu Silty Clay, showing a few charcoal flecks suggestive of horticultural pursuits. There is a band of micaceous, somewhat greenish (7.5YR 2.5/1) very small 2.0-4.0mm diameter waterworn stones and sand appearing at 74cmbs. The clay occasionally shows fracture cracks rust-stained from water moving through it. Again, the soils provide a record of slow sheet washing and stream-assisted alluviation with one slightly energetic punctuation (a heavy local shower?) resulting in the micaceous band at this location in the time span represented by this level.

Level 3: 110-120cmbs consists of orange-red rust-stained loose silts with angular and waterworn rocks. The rocks are evidence of colluvial transport activities, probably including material from upstream soils and from the flank of the nearby ridge. A single tumbled waterworn tool was recovered at this depth.

Level 4: 120-122cmbs is an arbitrary sampling level taken from the same material as in Level 3. One flake, showing no visible use, was recovered from this depth. It is probably part of the same transport events as the tool found in Level 3.

2.5.3 Trench 3

Lithics

Four tools were recovered from the same level 90cm below the surface and were waterworn and rust stained. Two were from Class 4.

Soils

Level 1: 0-30cmbs, brown (2.5YR 5/2) topsoil and historic modern deposits; one out-of-place basalt flake (not collected) was found with the pop cans, pampers, and plastic.

Level 2: 30-50cmbs, apparently diffuse boundary of historic fill, horticultural soil, and lessening organic material down to the clear horizon at 50cmbs.

Level 3: 50-90cmbs, red soil matrix (2.5YR 3/4)holding waterworn gravels and boulders. The four tools from this excavation unit were located at 90cmbs. Because boulders are found embedded in soils on the ridges and were the source for toolmaking basalt, this deposit may originate from materials associated with quarrying and tool making on the ridge directly above.

2.5.4 Square A

Lithics

Approximately one-third of the 35 artifacts, tools and flakes, in this square show tumbling wear. The occurrence of artifacts abruptly diminishes below 45cm depth. Twenty-six percent of the flakes were observed to be tools in Class 4, and make up 71 percent of the total number of tools in this unit.

Soils

Level 1: 0-20cmbs, historic, light brown crumbly soil containing beer and pop cans, some glass, and basalt flakes and tools.

Level 2: 20-28cmbs, historic, arbitrary observation level, containing an increasing amount of flakes and tools.

Level 3: 28-47cmbs, sandy additions to wet, sticky dark soil and occasional flecks of charcoal; rock chunks and boulders; tools and flakes abruptly decreasing in frequency at 47cmbs.

2.5.5 Square B

Lithics

The nine tools recovered are all noticeably larger than tools found in the other tests. They are rust stained and waterworn. Class 4 tools make up 55 percent of the tool total recovered in this test, and 100 percent of the recovered flakes.

Soils

Level 1: 0-10cmbs, orange brown soil with roadfill cinder and modern debris; no prehistoric artifacts.

Level 2: 10-30cmbs, sandy light orange soil showing reduced humic material, pebbles less than 10cm in any dimension; no historic materials present. Four prehistoric tools are present.

Level 3: 30-50cmbs, same matrix as above with stones more than 10cm in any dimension occupying much of the volume. Three prehistoric tools are present.

Level 4: 50-60cmbs, occasional red cinder/scoria added to the mix of ever larger boulders and orange matrix. Two prehistoric tools were found in this level. This test square, in its orderly progression of rock sizes through the levels, appears to show that parent material is weathering out and breaking down into clastics which are smaller the closer to the surface one observes rock size. That there are tools among this colluvial debris suggests they are originating nearby and migrating with the sheet wasting flow. The ridge above and the flanks below it are littered with tools and toolmaking debris.

2.5.6 Trench 4

One unworn adze preform appeared among angular colluvial mass wasting debris. No other artifact was observed.

2.6 Discussion of the Lithics and Their Context

The evidence from the six excavations supports the conclusion that in situ archaeological properties will not be found in the route of, nor at the depth of, the waterline along the road on the east side of Leafu Valley.

Prehistoric tools will be found, their numbers rising the closer one is to the base of the ridge to the east of the pipeline route. However, the in situ archaeological context of each has been lost due to the observed geomorphological processes. The artifacts represent orphaned historic properties with no explanatory context.

In an as yet unpublished paper, Jeffrey Clark and Patrick D. Nunn report their observations of geomorphological processes in the Leone Valley. Our findings and theirs, accomplished independently, arrive at similar conclusions. Theirs are as follows:

> Evidence from coring transects, test excavations, and geomorphological survey reveals three main depositional periods affecting the valley landscape. The basal sediment varies from coarse grained to medium grained sand, with very little clay and large fraction. No firm date can be fixed on this basal sand layer. However, if the rate of deposition has remained relatively constant, then the shift from a marine to a terrigenous depositional environment, at least in the lower valley, may have been about 1,500 to 2,000 years ago.
>
> Above the basal layer is a less well defined layer that is coarser grained and shows evidence of considerable stream activity. Conditions of this layer indicate reworked sediments from farther upstream, and the general trend of finer sediments higher up suggests that after a period of low stability, the valley experienced a period of lower energy and higher stability. With the exception of the area adjacent to the coast, the entire valley had an upper layer of clay or silty clay alluvial deposit varying in thickness from 30cm near the edge of the valley to as much as 200cm toward the valley center near Leafu Stream. At the valley flanks there are colluvial deposits overlying alluvial sediment. The nearer to the present coast, the sandier the sediment. A beach berm about 55m inland shows evidence of rapid development about 500-600 years ago.
>
> When sea level had fallen to its present position -- perhaps 2000 B.P. -- the lower Leafu Stream channel probably lay east of its present location. At this time, a high-energy beach existed along the line of the now-exposed beachrock strip named Papaloa. On this beach strip and immediately behind was human occupation. At the back of this beach was an area of swampy ground, the site of the modern lagoon and associated mangrove area.

At a later time, the lower channel of the Leafu shifted its course westward producing a pronounced kink in the middle of the valley. The Papaloa beach was bisected and the associated superficial beach deposits removed. The human occupation that previously existed is evidenced by the abundant basalt flakes and tools in the mud and sand behind Papaloa beach rock. The condition of these artifacts indicates a deflated surface rather than transport down the stream and redeposition.

The cause of the channel shift remains conjectural but may have been related to a catastrophic event. Alternatively, the cause may have been associated with sea-level changes, or simply with sedimentary processes in the area. It is possible that once the fringing reef off Leone caught up with the sea surface, river-borne sediment which had previously been carried far offshore became trapped in the narrow lagoon between the reef and the shoreline, and gradually filled the lagoon. Once this process was complete, then sediment would have begun to choke the lower part of the Leafu channel, forcing the water elsewhere.

Tools and toolmaking debris are abundant on the ridge top and flanks. Rain and sheetwasting have brought and continue to bring them downslope where they accumulate with boulders and other clastics weathering out from the slope soils. As such, the artifacts recovered from these tests document the chronological placement of the observed geomorphological processes, dating these events to less than the last 2,000 years, and quite probably to the most recent of the last 1,000 years of prehistory in Leafu Valley. They demonstrate a part of the picture emerging regarding human effects on the formerly natural landscape in response to quarrying stone, making tools, and gardening activities directed toward feeding an ever-burgeoning local population and visiting traders.

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