

CHAPTER 5: LABORATORY RESULTS

This chapter presents descriptions and a brief analysis of the materials collected during survey and excavation and the results of wood taxa identification and radiocarbon dating. Results of geochemical analysis for the basalt artifacts can be found in Appendix C. Collected materials include traditional artifacts, historic artifacts, midden, botanics (unburned plant material), and charcoal. A total of 41 charcoal samples were taxonomically identified and 19 were dated.

Cultural Material

Traditional Artifacts

Traditional artifacts were found in all survey areas. These consisted of basalt flakes, basalt cores, an adze, adze blanks, adze fragments, awls, a chisel fragment, a pounder fragment, unidentified modified basalt, abrading stones, a basalt cutting tool, a basalt chopping tool, hammerstones, a whetstone, and volcanic glass fragments.

Basalt flakes were most common, with 387 found in excavations (Figure 5.1-Figure 5.25). Of these, 329 were from Ku‘ele, 41 from Makea, three from Eliali‘i, five



Figure 5.1: Basalt flakes from habitation platform C-2, surface of TU 25.



Figure 5.2: Basalt flakes from habitation platform C-2, Layer I level 1 of TU 25.



Figure 5.3: Basalt flakes from habitation platform C-2, TU 25: *a* Layer I level 2; *b* Layer I level 4.



Figure 5.4: Basalt flakes from terrace C-6, Layer I level 1 of TU 26.



Figure 5.5: Basalt flakes from terrace C-6, Layer I level 2 of TU 26.



Figure 5.6: Basalt flakes from terrace C-6, TU 26: *a* Layer I level 3; *b* Layer II level 1.

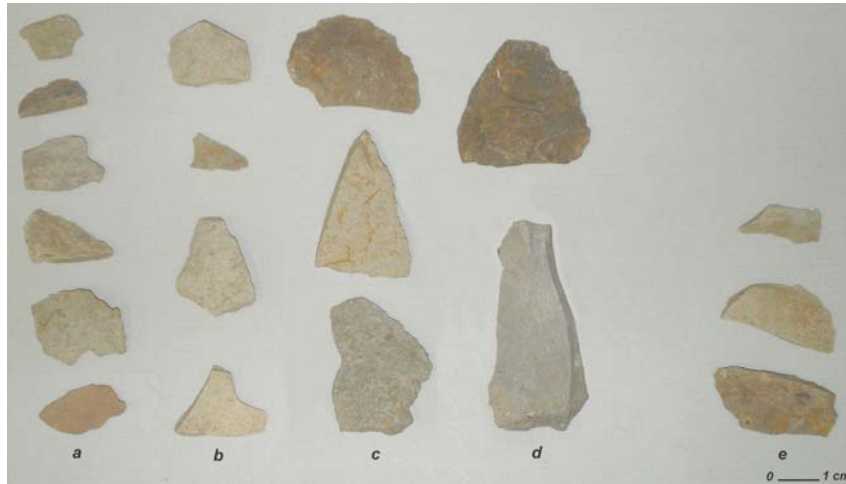


Figure 5.7: Basalt flakes from *lo'i* terrace C-8, TU 27: *a-d* Layer I level 5; *e* Layer I level 6.



Figure 5.8: Basalt flakes from *lo'i* terrace C-8, Layer I of TR 38.



Figure 5.9: Basalt flakes from *lo'i* terrace C-9, Layer I of TR 16.



Figure 5.10: Basalt flakes from *lo'i* terrace C-9, TR 37. Bottom left, surface; others Layer I.



Figure 5.11: Basalt flakes from the area around hearth C-18, surface.

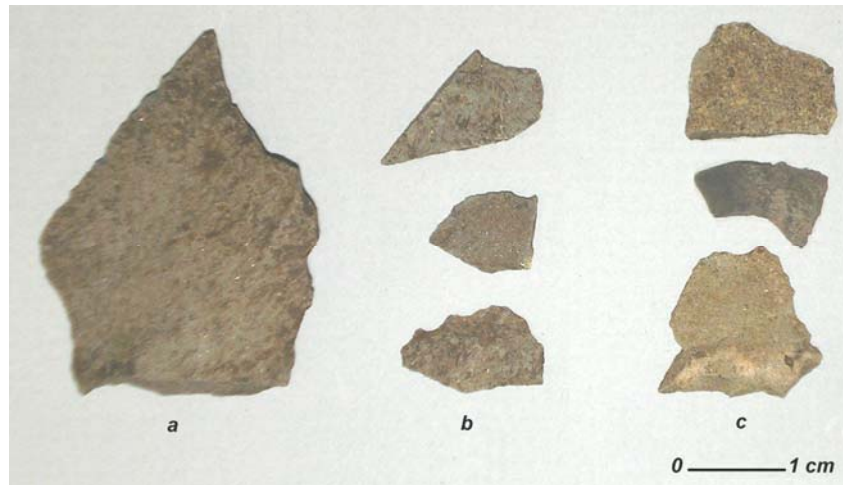


Figure 5.12: Basalt flakes from hearth C-18, Layer I level 1 of TU 22, outside the hearth feature.



Figure 5.13: Basalt flakes: *a* from *lo'i* terrace C-20 surface; *b* from *lo'i* terrace C-21, TU 23 Layer I level 1.



Figure 5.14: Basalt flakes from *lo'i* terrace C-20, TU 23: *a* and *b* Layer I level 2; *c* Layer I level 3; *d* Layer I level 4.



Figure 5.15: Basalt flakes from *lo'i* terrace C-30, Layer I of TR 3.



Figure 5.16: Basalt flakes from *lo'i* terrace M-2, Layer I level 3 of TU 6.



Figure 5.17: Basalt flakes from *lo'i* terrace M-6, Layer I of TR 11.

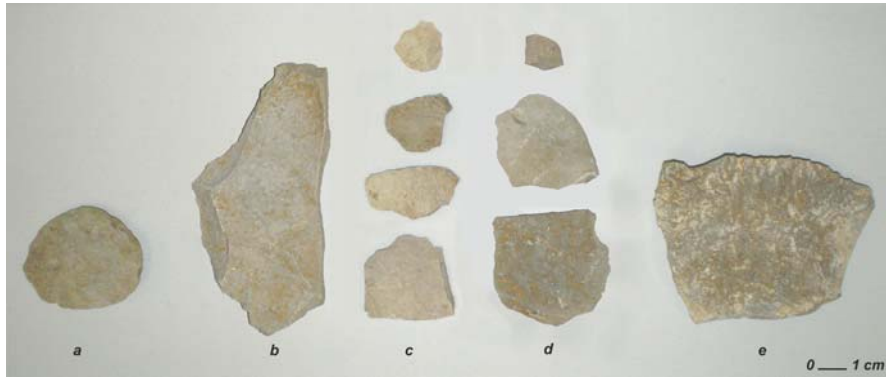


Figure 5.18: Basalt flakes: *a* from *lo'i* terrace M-7, Layer I of TR 10; *b-d* from terrace M-8, Layer I of TR 9; *e* from terrace M-9, Layer I of TR 8.

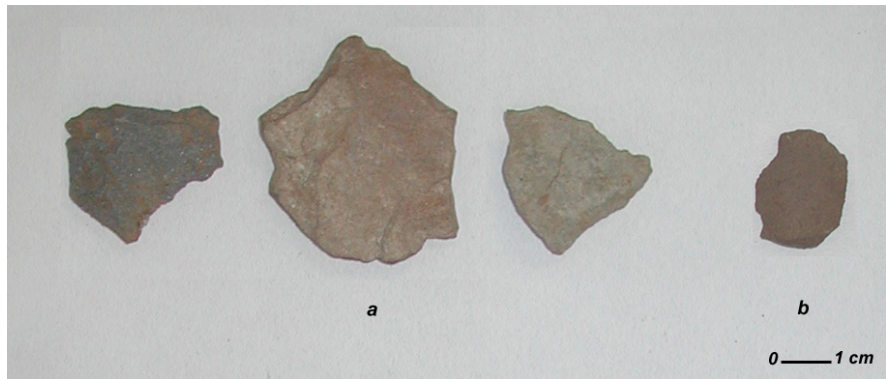


Figure 5.19: Basalt flakes: *a* from *lo'i* terrace M-10, Layer I level 3 of TU 11; *b* from *lo'i* terrace M-13, Layer I level 1 of TU 10.

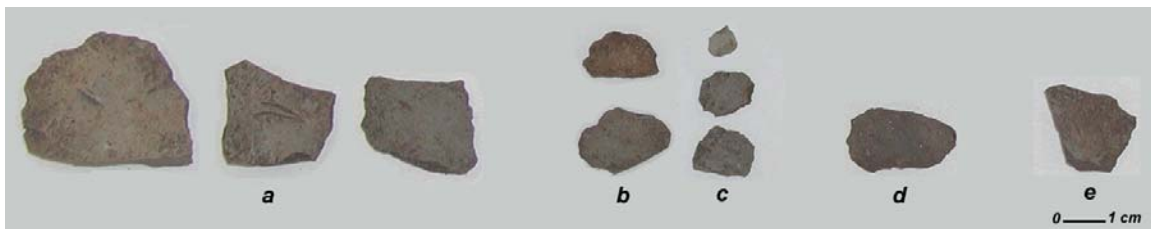


Figure 5.20: Basalt flakes from historic house platform M-17, TU 7: *a* Layer I level 1; *b* and *c* Layer I level 2; *d* Layer I level 5; *e* Layer II level 1.



Figure 5.21: Basalt flakes: *a* from *lo'i* terrace M-22, Layer I of TR 17; *b* from enclosure M-31, Layer I level 4 of TU 24.



Figure 5.22: Basalt flakes: *a* from *lo'i* terrace E-33, Layer I level 2 of TU 2; *b* from *lo'i* terrace E-48, Layer I level 5 of TU 1; *c* from *lo'i* terrace E-48, Layer I level 6 of TU 1.

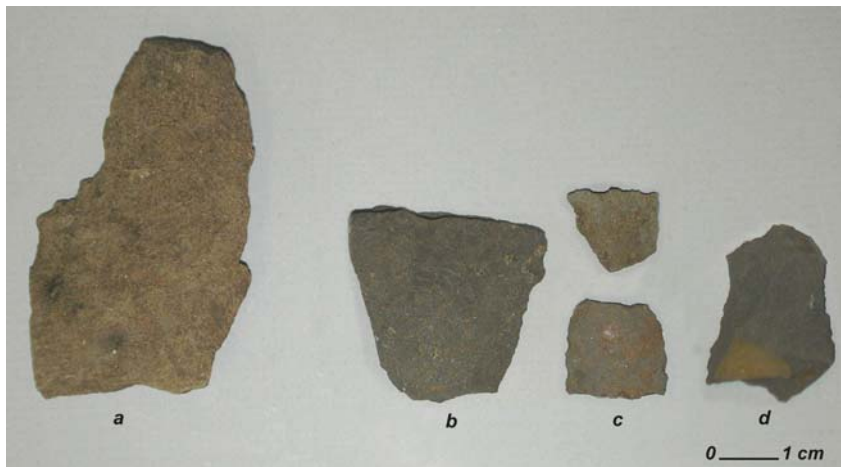


Figure 5.23: Basalt flakes: *a* from *lo'i* terrace H-23, TR 29 surface; *b-d* from *lo'i* terrace H-57, TR 30 Layer I.

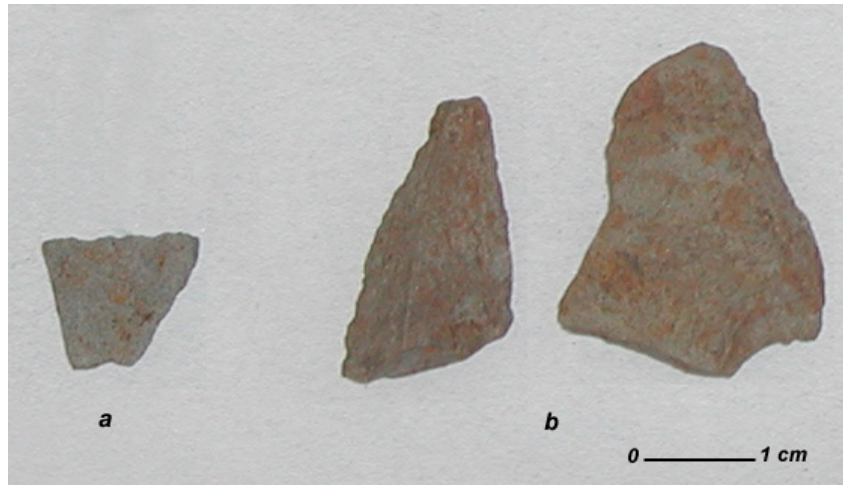


Figure 5.24: Basalt flakes from *lo'i* terrace L-24, TU 16: *a* from Layer I level 4; *b* from Layer I level 6.



Figure 5.25: Basalt flakes from TU 28 (Palaloea hearth): *a* from Layer I level 1; *b* and *c* from Layer I level 2.

from Halepoki, three from Lahokea, and six from Palaloea. No flakes were found in Keiu, Pawa'a, or Kukuinui.

Flakes were generally small, ranging in size from 1.0 to 10.2 cm long (Table 5.1). Four flakes exhibited possible use wear, with an edge that appeared worn (see Figure 5.4 *a* left; Figure 5.17 *b* 2nd from right; Figure 5.18 *a*; and Figure 5.21 *b*); 13 flakes exhibited possible retouch, with chipping along one or more edges (see Figure 5.2 *a* 3rd from left and *c* 2nd from right; Figure 5.5 *a* 3rd from right and right; Figure 5.7 *c* top; Figure 5.8 *a* 2nd from left; Figure 5.10 *b* 2nd from left; Figure 5.11 *a* left and *b* 3rd from left; Figure 5.17 *a* right; Figure 5.18 *e*; Figure 5.20 *a* left; and Figure 5.23 *d*). Eleven flakes exhibited surface polish (see Figure 5.2 *b* left; Figure 5.5 *c* left, *c* 2nd from left, and *e* 5th from left; Figure 5.9 *b* 4th from right and *c* 7th from right; Figure 5.10 *f* 4th from right; Figure 5.19 *b*; Figure 5.20 *c* top; Figure 5.22 *c*; and Figure 5.23 *c* top). These may have once been part

Table 5.1: Basalt Flake Data

Area	Photo	Weight (g)	Length (cm)	Width (cm)	Notes
Ku‘ele	Figure 5.1	left	19.8	5.6	2.7
		right	19.0	4.7	4.0
	Figure 5.2	row <i>a</i> , left to right	3.1	2.8	1.6
			8.5	3.3	2.1
		row <i>b</i> , left to right	46.1	6.5	3.5
			20.8	6.0	2.8
			5.7	3.0	2.6
			9.7	3.0	2.7
			1.2	2.2	1.9
			0.7	1.5	1.4
			2.0	2.4	1.8
			1.1	2.0	1.3
			0.7	2.5	1.0
			0.7	2.5	1.5
			0.9	1.6	1.0
			0.4	1.4	1.2
			0.8	1.9	1.1
			0.8	1.8	1.1
			1.8	2.1	1.7
			3.9	2.2	2.2
		row <i>c</i> , left to right	2.4	2.3	1.8
			2.6	2.5	2.2
			5.2	2.5	2.1
			2.7	3.0	1.7
			3.1	2.5	2.2
		row <i>d</i> , left to right	6.4	4.8	2.1
			10.5	3.5	3.3
			1.6	1.8	1.8
			1.1	1.5	1.5
			5.6	3.4	2.1
			4.9	3.7	2.0
			8.2	4.6	3.4
			10.9	3.1	2.7
			10.4	4.0	2.1
	Figure 5.3	<i>a</i> bottom left	0.6	1.7	1.0
		<i>a</i> top left	0.1	1.1	0.6
		<i>a</i> right	8.1	3.5	2.9
		<i>b</i>	4.6	2.5	2.6
	Figure 5.4	row <i>a</i> , left to right	9.8	4.5	2.6
			19.8	4.2	2.9
			10.2	4.4	3.4
			12.0	3.4	2.4
			82.7	5.8	5.3

Table 5.1: Basalt Flake Data (continued)

Area	Photo		Weight (g)	Length (cm)	Width (cm)	Notes
Ku‘ele (cont.)	Figure 5.4 (cont.)	row <i>b</i> , left to right	4.0	2.6	1.8	
			4.9	2.5	2.3	
			6.2	2.5	2.5	
			4.9	3.7	2.6	
			5.2	3.3	2.7	
		row <i>c</i> , left to right	10.6	3.5	3.1	
			1.5	2.2	2.1	
			3.6	2.3	2.7	
			0.4	1.8	1.4	
			0.4	1.8	0.7	
			1.0	1.9	1.0	
			0.6	1.3	1.0	
			0.3	1.2	0.9	
		row <i>a</i> , left to right	33.8	5.0	4.5	
			36.1	6.2	3.8	
			25.1	5.1	4.3	
			44.1	4.6	3.9	
			32.1	6.2	3.9	chipping on 2 edges
			74.1	6.4	5.9	
			87.2	6.3	5.4	chipping on 3 edges
		row <i>b</i> , left to right	4.8	3.3	2.4	
			7.9	4.0	2.1	
			12.0	3.9	3.1	
			11.7	4.6	2.9	
			14.3	4.8	3.5	
			15.0	5.0	3.3	
			14.5	3.9	2.7	
			12.0	4.0	2.5	
		row <i>c</i> , left to right	4.5	3.0	2.4	polish on 1 surface
			10.2	4.0	2.2	polish on 1 surface
			6.9	3.8	2.6	
			7.3	3.1	2.3	
			11.6	3.9	2.9	
			6.5	3.0	2.3	
			6.1	3.1	3.0	
			4.7	2.9	2.2	
		row <i>d</i> , left to right	4.9	2.9	2.0	
			5.3	3.0	2.3	
			1.7	1.9	1.5	
			8.4	3.6	2.9	
			3.0	3.3	2.3	
			10.3	3.5	3.5	
			0.3	1.5	0.8	

Table 5.1: Basalt Flake Data (continued)

Area	Photo		Weight (g)	Length (cm)	Width (cm)	Notes
Ku‘ele (cont.)	Figure 5.5 (cont.)	row <i>d</i> (cont.)	1.9	2.1	1.4	
			3.1	2.8	2.3	
			1.5	1.7	1.6	
			3.4	3.4	2.0	
			8.1	3.6	1.7	
			9.5	4.1	2.7	
		row <i>e</i> , left to right	11.8	3.5	2.8	
			3.6	3.8	1.9	
			6.3	3.5	2.0	
			7.2	2.8	2.3	
			4.2	2.8	2.2	
			1.2	1.7	1.4	polish on 1 surface
			0.8	2.0	1.3	
			0.4	1.8	0.9	
			0.9	2.5	1.0	
			4.4	2.6	2.3	
			4.9	3.2	1.9	
			3.5	2.8	1.9	
			0.9	2.5	2.2	
			1.8	2.1	1.5	
	Figure 5.6	<i>a</i> bottom	1.6	2.5	1.5	
		<i>a</i> top	0.4	2.0	1.0	
		<i>b</i> left to right	31.0	5.5	3.2	
			10.6	4.4	3.3	
			5.3	4.4	2.3	
			4.0	3.1	1.8	
	Figure 5.7	column <i>a</i> bottom to top	0.6	2.0	1.5	
			1.6	2.4	1.6	
			1.0	2.1	1.3	
			0.6	1.6	0.8	
			0.6	1.6	0.8	
			0.5	1.5	0.9	
		column <i>b</i> bottom to top	1.2	2.1	1.9	
			2.4	2.4	1.8	
			0.3	1.5	0.8	
		column <i>c</i> bottom to top	1.5	1.9	1.5	
			4.8	3.0	2.1	
			4.8	3.5	2.2	
		column <i>d</i> bottom to top	6.1	3.1	2.3	chipping on 1 edge
			12.6	5.0	2.3	
			7.5	3.5	3.3	
		column <i>e</i> bottom to top	3.1	2.9	1.6	
			1.8	2.7	1.4	
			0.4	1.9	0.6	

Table 5.1: Basalt Flake Data (continued)

Area	Photo		Weight (g)	Length (cm)	Width (cm)	Notes
Ku‘ele (cont.)	Figure 5.8	row <i>a</i> , left to right	16.6	4.3	3.7	
			39.2	6.6	4.6	chipping on 1 edge
			15.3	5.0	4.2	
			29.9	5.9	4.9	
			35.0	6.9	3.7	
		row <i>b</i> , left to right	18.3	5.2	2.3	
			10.8	3.9	2.8	
			12.0	3.9	2.9	
			8.8	3.9	3.0	
			10.5	4.4	2.7	
			5.3	4.0	1.9	
			18.4	4.9	2.7	
			9.9	4.5	2.4	
			9.6	4.2	3.1	
			6.6	3.5	2.4	
			6.2	3.3	2.4	
			7.4	3.5	2.0	
			7.9	3.6	2.5	
			6.6	4.1	1.3	
		row <i>c</i> , left to right	4.0	3.5	2.2	
			4.0	3.2	1.9	
			2.4	2.8	2.3	
			3.3	3.1	1.8	
			14.5	2.3	2.0	
			3.5	1.5	2.3	
			2.9	2.7	2.1	
			1.8	2.4	2.2	
			3.3	2.4	2.0	
			2.5	2.3	2.3	
			3.7	2.9	1.8	
			1.8	2.3	1.4	
			2.6	2.3	2.2	
			3.0	2.4	2.0	
			3.0	2.9	1.3	
		row <i>d</i> , left to right	2.0	2.7	1.3	
			1.4	2.4	1.6	
			1.3	4.2	1.5	
			0.2	1.0	1.0	
			0.7	2.5	1.1	
			1.0	2.0	1.6	
			1.1	2.0	1.5	
			0.5	1.8	1.0	
			1.2	1.7	1.4	
			2.3	1.7	1.4	
		row <i>e</i> , left to right				

Table 5.1: Basalt Flake Data (continued)

Area	Photo	Weight (g)	Length (cm)	Width (cm)	Notes
Ku'eie (cont.)	Figure 5.8 (cont.)	row <i>e</i> (cont.)	1.2	1.8	1.4
			1.3	1.9	1.1
			0.5	1.4	1.0
			0.1	1.4	0.8
	Figure 5.9	row <i>a</i> , left to right	9.8	4.6	3.4
			13.8	4.9	3.5
			16.3	5.7	4.7
			46.8	7.3	4.2
			48.1	6.5	5.2
		row <i>b</i> , left to right	42.2	5.6	5.5
			34.3	6.5	4.5
			8.0	3.0	2.9
			15.1	4.0	3.5
			14.0	4.7	3.0
			3.7	4.6	2.5
			11.9	4.8	2.8
			7.3	4.0	2.3
			6.6	3.2	3.1 polish on 1 surface
			1.7	3.2	2.0
		row <i>c</i> , left to right	4.6	3.6	2.3
			4.0	4.0	2.5
			0.3	1.2	0.7
			0.4	1.7	0.8
			0.4	1.6	1.1
			0.7	1.9	1.7
			1.8	2.3	1.8
			1.4	2.3	2.1
			4.2	2.4	2.3
			3.1	2.5	2.5
			2.9	3.3	1.5
			3.2	2.1	2.0 polish on 1 surface
			1.0	2.8	1.6
			1.7	2.2	1.6
			0.9	2.0	1.7
			2.0	2.2	1.9
			1.9	1.9	1.3
			1.3	2.4	1.2
	Figure 5.10	row <i>a</i> , left to right	3.1	2.3	5.4
			68.8	5.2	3.5
			17.5	4.6	3.3
			10.5	3.0	2.8
			10.2	4.0	3.3
			20.1	5.9	2.8

Table 5.1: Basalt Flake Data (continued)

Area	Photo	Weight (g)	Length (cm)	Width (cm)	Notes
Ku‘ele (cont.)	Figure 5.10 (cont.)	row <i>b</i> , left to	13.9	5.1	3.4
		right	33.2	5.7	4.6
			18.1	5.0	3.5
			18.0	4.7	3.6
			12.4	4.6	2.9
			7.5	3.7	2.6
			6.4	3.7	2.4
		row <i>c</i> , left to	12.5	3.9	3.8
		right	7.2	3.7	3.0
			15.0	4.5	3.1
			18.4	4.6	2.9
			13.4	3.7	3.3
			8.8	3.9	2.9
			6.4	3.9	2.2
			6.6	3.2	2.9
			5.1	2.8	2.3
		row <i>d</i> , left to	4.8	3.5	2.1
		right	6.5	3.2	2.7
			8.3	3.5	2.4
			6.3	3.7	2.4
			4.0	4.0	2.6
			12.3	2.7	2.0
			3.2	2.9	2.8
			3.5	2.9	2.1
			5.2	4.3	1.5
			4.4	3.2	1.9
			5.3	4.0	2.0
		row <i>e</i> , left to	3.5	2.6	2.0
		right	1.7	3.2	1.1
			2.6	2.7	2.0
			1.6	2.9	1.4
			3.8	3.3	2.9
			2.8	3.0	1.4
			2.7	2.5	2.1
			1.7	2.5	1.9
			0.9	2.0	1.3
			6.4	2.9	2.1
			2.6	2.9	2.4
			3.2	2.6	1.6
			2.6	2.2	2.1
			2.0	2.0	1.9

Table 5.1: Basalt Flake Data (continued)

Area	Photo	Weight (g)	Length (cm)	Width (cm)	Notes
Ku‘ele (cont.)	Figure 5.10 row <i>f</i> , left to (cont.) right	2.6	3.7	1.2	
		0.8	3.4	0.9	
		3.2	2.5	1.9	
		2.4	2.1	1.7	
		1.8	2.7	1.6	
		1.0	2.6	1.0	
		0.5	1.7	0.9	
		1.0	2.0	1.2	
		2.4	2.3	2.0	
		3.3	2.1	1.6	
		1.9	3.2	1.7	
		2.0	2.1	1.8	polish on 1 surface
		0.7	1.8	1.3	
		1.3	2.3	1.6	
		0.2	1.2	0.8	
	row <i>g</i> , left to right	1.6	2.0	1.5	
		0.4	1.7	0.7	
		1.6	2.1	1.1	
		0.8	1.6	1.0	
		0.5	1.3	1.1	
		0.5	1.3	1.2	
		0.2	1.4	0.5	
		1.0	1.6	1.3	
		0.6	1.9	1.5	
		0.5	2.8	1.1	
		1.1	1.9	1.4	
		0.5	1.2	1.0	
		0.5	1.7	1.1	
		0.6	2.0	1.1	
		0.8	1.4	1.4	
		0.8	1.8	1.3	
		0.2	1.3	0.8	
		0.3	1.3	0.9	
	Figure 5.11 row <i>a</i> , left to right	50.1	5.4	4.4	chipping on 1 edge
		38.9	4.0	3.4	
		88.5	6.3	4.4	
		35.3	7.3	5.0	
		11.5	4.6	3.0	
	row <i>b</i> , left to right	27.3	5.0	5.4	
		12.7	4.6	3.0	
		13.8	3.6	3.5	chipping on 2 edges
		11.5	4.5	3.1	
		6.0	4.0	2.3	

Table 5.1: Basalt Flake Data (continued)

Area	Photo	Weight (g)	Length (cm)	Width (cm)	Notes
Ku'ele (cont.)	Figure 5.11 row <i>b</i> (cont.)	4.5	2.4	1.8	
	(cont.)	1.0	1.4	1.3	
	Figure 5.12 <i>a</i>	7.0	3.8	2.8	
	column <i>b</i> ,	0.3	1.5	0.9	
	bottom to top	0.3	1.2	0.9	
		1.0	1.7	1.5	
	column <i>c</i> ,	0.5	1.9	0.9	
	bottom to top	0.5	1.3	0.8	
		0.7	1.5	1.2	
	Figure 5.13 <i>a</i> left to right	66.6	6.3	3.9	
		131.2	7.7	5.5	
		81.7	8.7	6.2	
	<i>b</i> bottom to top	41.4	6.1	3.6	
		36.3	6.8	3.5	
		0.2	1.1	0.7	
	Figure 5.14 column <i>a</i>	0.5	1.7	0.8	
	bottom to top	2.1	3.3	1.3	
		1.1	2.1	1.5	
	column <i>b</i>	20.9	6.0	3.2	
	bottom to top	6.2	3.1	2.0	
		4.7	3.0	2.2	
	column <i>c</i>	20.0	6.0	3.6	
	bottom to top	5.2	2.8	2.5	
	<i>d</i>	17.0	4.5	3.8	
	Figure 5.15 left to right	8.9	3.5	3.3	
		6.8	4.4	2.1	
		14.9	4.4	3.1	
Makea	Figure 5.16 left to right	2.2	2.9	1.8	
		4.4	3.5	2.4	
		10.2	5.2	2.5	
		16.2	4.4	3.2	
		5.6	2.8	2.5	
		7.2	3.0	2.6	
	Figure 5.17 row <i>a</i> , left to right	44.6	6.0	4.8	
		33.0	5.5	3.6	
		63.4	10.2	5.0	chipping on 2 edges
	row <i>b</i> , left to right	2.0	2.5	1.6	
		1.7	3.0	1.4	
		3.3	2.3	2.3	
		1.4	5.0	3.5	
		9.3	3.5	3.4	1 utilized edge
		10.3	3.8	2.9	

Table 5.1: Basalt Flake Data (continued)

Area	Photo	Weight (g)	Length (cm)	Width (cm)	Notes	
Makea (cont.)	Figure 5.18	<i>a</i>	17.1	4.0	3.6	1 utilized edge
		<i>b</i>	52.8	9.6	4.6	
		column <i>c</i> , bottom to top	12.5	3.2	3.0	
			3.4	3.4	1.8	
			2.4	2.5	1.8	
			0.8	2.0	1.7	
		column <i>d</i> , bottom to top	12.3	4.1	4.0	
			8.1	4.0	3.4	
			0.8	1.6	1.1	
			<i>e</i>	65.3	7.5	
	Figure 5.19	<i>a</i> left to right	4.2	3.2	2.7	
			12.3	4.5	3.6	
			4.6	3.0	2.5	
		<i>b</i>	4.3	2.5	1.9	polish on 1 surface
Figure 5.20			<i>a</i> left to right	16.2	3.9	2.8
	5.3	2.5		2.3		
	3.1	3.0		2.4		
	<i>b</i> bottom	6.3	3.6	2.3	polish on 1 surface	
		<i>b</i> top	3.7	3.0		1.6
	<i>c</i> bottom to top	2.8	2.2	1.9		
		1.6	2.3	1.7		
		0.5	1.5	1.1		
	<i>d</i>	1.7	2.6	1.6		
		<i>e</i>	3.5	2.4		1.8
Figure 5.21		<i>a</i>	15.8	5.5		3.3
	<i>b</i>	5.2	2.7	2.4		1 utilized edge
Eliali'i	Figure 5.22	<i>a</i>	6.9	3.5		2.6
		<i>b</i>	6.4	3.7	2.4	
		<i>c</i>	2.6	2.2	1.7	polish on 1 surface
Haleopki	Figure 5.23	<i>a</i>	25.3	5.5	2.7	
		<i>b</i>	15.4	3.5	3.2	
		<i>c</i> bottom	1.1	1.5	1.5	
		<i>c</i> top	1.2	1.7	1.6	polish on 1 surface
		<i>d</i>	3.5	2.8	2.0	chipping on 1 edge
Palaloea	Figure 5.24	<i>a</i>	0.5	1.4	1.2	
		<i>b</i> left	2.3	2.8	1.6	
		<i>b</i> right	5.6	2.9	2.4	
Lahoeka	Figure 5.25	<i>a</i> bottom	3.0	3.1	1.5	
		<i>a</i> top	0.4	1.7	0.9	
		<i>b</i> bottom to top	3.2	2.2	2.2	
			0.7	2.2	0.9	
			0.5	1.4	0.8	
		<i>c</i>	11.3	3.4	3.4	

of another implement, such as an adze. Ten of the flakes were found at the M-17 historic house platform, indicating that traditional tool-making continued into the historic era in Wailau.

Three basalt cores were found in Ku‘ele. The first was from feature C-2, a possible habitation platform. It was recovered from the surface of TU 25. This core weighed 179.0 g and measured 6.5 cm long and 4.5 cm wide (Figure 5.26 *a*). The second core was found during surface survey near the Coastal West *lo‘i* system, between hearth feature C-18 and *lo‘i* terrace C-19 at the northwest corner of the complex. This core weighed 199.6 g and measured 8.0 cm long and 6.5 cm wide (Figure 5.26 *b*). The third core was found in Layer I of TR 3, which was placed along the interior alignment feature of *lo‘i* terrace C-30 (see Figure 3.36). This is on the west side of the Coastal West *lo‘i* complex. This core weighed 91.3 g and measured 6.0 cm long and 5.0 cm wide (Figure 5.26 *c*). It was fashioned from a waterworn cobble.

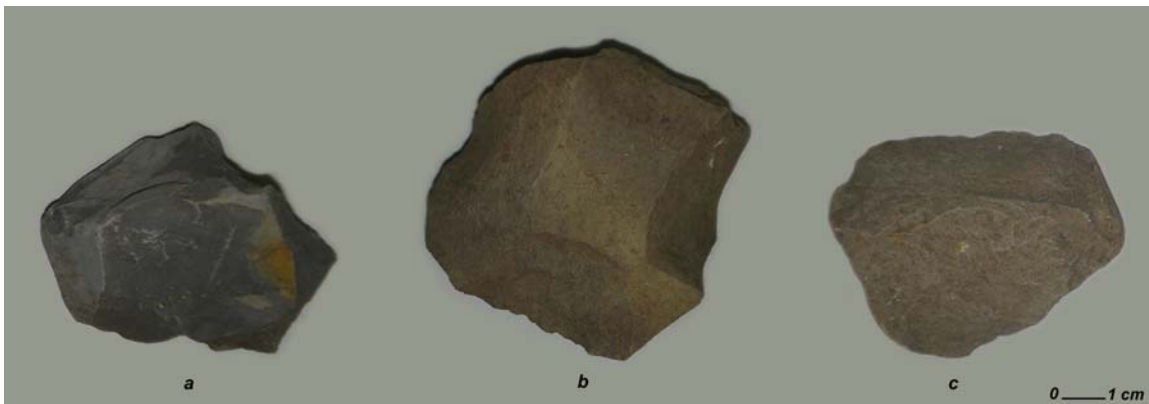


Figure 5.26: Basalt cores from Ku‘ele: *a* from platform C-2, surface of TU 25; *b* from surface collection between hearth C-18 and *lo‘i* terrace C-19; *c* from *lo‘i* terrace C-30 Layer I of TR 3.

The adze was found at historic house platform M-17, within TU 7, Layer I level 1 or 2. It weighs 42.8 g and measures 4.5 cm long, 1.4 cm thick, 3.1 cm wide at the cutting edge, and 2.6 cm wide at the opposite end. It appears that the butt has been snapped off, thus it cannot be determined if the adze once had a tang (Figure 5.27). The adze has a rectangular cross-section, straight cutting edge, and is expanding in plan (*cf.* Cleghorn 1992). It exhibits polishing on the front and back and on part of one side, and the cutting edge is chipped.

Six adze blanks were found during excavation and surface survey (Figure 5.28). Three were from Ku‘ele, two from Makea, and one from Pawa‘a. The smallest of these was from habitation platform C-2 in Ku‘ele. It was found in Layer I level 1 of TU 25. It weighs 13.2 g and measures 3.5 cm long, 1.5 cm thick, and 1.5 cm wide. It exhibits flaking on all surfaces except the proximal end, where the butt appears to have snapped off (Figure 5.28 *a*). The size and shape of this artifact suggest that it might have been a chisel blank. The tip of a finished chisel was found in terrace C-6, just south of where this artifact was found.



Figure 5.27: Adze from historic house platform M-17. Front, back, and side shown.

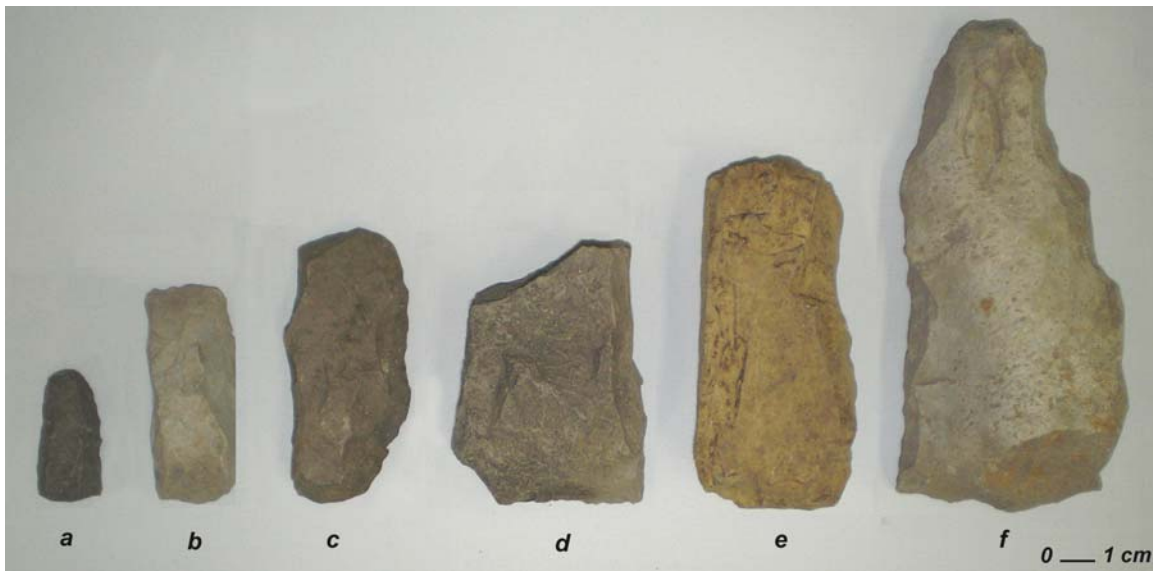


Figure 5.28: Adze blanks: *a* from platform C-2, Layer I level 1 of TU 25; *b* from *lo'i* terrace M-8 surface collection; *c* from Pawa'a surface collection, not associated with a particular feature; *d* from *lo'i* terrace M-7 surface collection; *e* from Ku'ele surface collection, southwest of *lo'i* terrace C-24; *f* from terrace C-6, Layer I level 2 of TU 26.

The second smallest adze blank was found within the Makea *lo'i* system at terrace M-8. It was collected from Layer I of TR 9. It weighs 58.9 g and measures 6.1 cm in length, 2.6 cm in width, and 2.3 cm in thickness at the thickest point of the artifact, near the center. It exhibits flaking on all surfaces and the cutting edge and appears to be unbroken (Figure 5.28 *b*).

The next adze blank was found on the surface during survey in Pawa'a, between the feature P-11 wall and P-13 alignment, not associated with either feature. The adze blank weighs 93.4 g and measures 7.8 cm long, 2.4 cm thick, and 3.5 cm wide. It exhibits flaking on all surfaces and one edge and appears unbroken (Figure 5.28 *c*).

Another adze blank was collected from the Makea *lo'i* system during surface survey of terrace M-8. This blank weighs 240 g and measures 7.0 cm in length, 3.2 cm in thickness, and 5.3 cm in width. It exhibits flaking on all surfaces except the distal end that has broken off (Figure 5.28 *d*).

The second largest adze blank was found during surface survey of the Coastal West *lo'i* system in Ku'e'e, southwest of terrace C-24 on the west side of the complex. This artifact weighs 246.9 g and measures 9.4 cm long, 3.0 cm thick, and 4.2 cm wide. It exhibits flaking on all surfaces and polishing on part of one surface, possibly the surface that would have been fashioned into the front of the adze (Figure 5.28 *e*). This artifact appears unbroken.

The largest adze blank was recovered from the Coastal Central *lo'i* system in Ku'e'e, from Layer I level 2 of TU 26. This was in terrace C-6, at the north end of the complex (see Figure 3.31). The artifact weighs 456.5 g and measures 14.0 cm long, 4.1 cm thick, and 5.6 cm wide. It was fashioned from a waterworn stone, similar to those found in the streams and on the boulder beach. This adze blank exhibits flaking only on the two sides, the cutting edge, and the butt. The front is a clean break, and the back is entirely cortex (Figure 5.28 *f*). This artifact appears to be unbroken.

Eight adze fragments were collected from Ku'e'e. Five of these were from TU 25, excavated at platform C-2. Four of the fragments were found within Layer I level 1 of the excavation. The first measures 3.9 cm long, 3.2 cm wide, and weighs 13.6 g (Figure 5.29 *a* bottom). It has one polished surface that is convex. The second measures 2.3 cm long, 1.8 cm wide and weighs 2.0 g (Figure 5.29 *a* top). It exhibits one flat surface with polish. The third adze fragment measures 2.5 cm long, 2.4 cm wide, and weighs 10.5 g (Figure 5.29 *b* bottom). It exhibits one polished surface that is slightly convex. The fourth

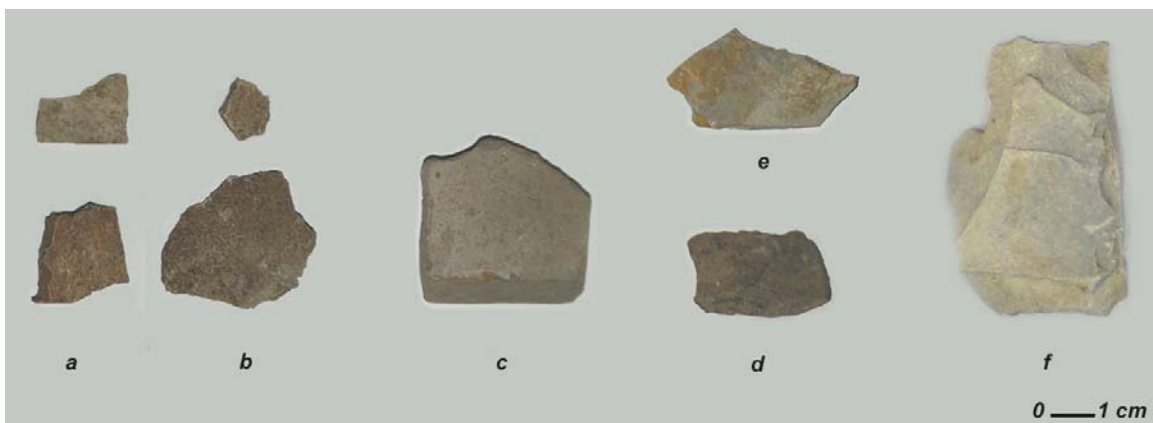


Figure 5.29: Adze fragments from Ku'e'e: *a* and *b* from platform C-2, Layer I level 1 of TU 25; *c* from platform C-2, Layer I level 4 of TU 25; *d* from terrace C-6, Layer I level 1 of TU 26; *e* from terrace C-8, Layer I level 4 of TU 27; *f* from terrace C-9, Layer I of TR 37.

measures 1.4 cm long, 1.3 cm wide, and weighs 0.7 g (Figure 5.29 *b* top). It also exhibits one flat surface with polish. The last adze fragment from TU 5 was recovered from Layer I level 4 of the excavation. It measures 3.5 cm in both length and width and weighs 50.6 g (Figure 5.29 *c*). It represents the butt portion of the adze and exhibits one polished surface that is slightly convex. One adze fragment was recovered from Layer I level 1 of TU 26, excavated in terrace C-6. This piece measures 3.1 cm long, 2.0 cm wide, and weighs 10.8 g (Figure 5.29 *d*). It exhibits one flat polished surface and possible use wear on one edge. It might represent the cutting edge of a small adze. One adze fragment was found within Layer I level 4 of TU 27, excavated at terrace C-9. This piece measures 4.4 cm long, 2.3 cm wide, and weighs 14.0 g (Figure 5.29 *e*). It exhibits one convex polished surface. The final adze fragment was recovered from Layer I of TR 37, excavated within terrace C-9. It measures 5.7 cm long, 4.0 cm wide, and weighs 70.7 g (Figure 5.29 *f*). Portions of three surfaces are flat and finely polished. These were likely the top and sides of the adze.

Two awls were recovered from Ku‘ele; both are whole specimens. One awl came from Layer I level 2 of TU 26, which was excavated in terrace C-6. This awl measures 5.0 cm long, 1.8 cm wide, and weighs 9.9 g. It exhibits flaking on all surfaces, but no use wear is evident (Figure 5.30). The other awl came from Layer I of TR 16, which was located in *lo‘i* terrace C-9. It measures 8.8 cm long, 2.6 cm wide, and weighs 75.8 g. This awl was fashioned from a broken adze, as evidenced by one flat and finely polished surface. The other surfaces exhibit heavy flaking (Figure 5.31). Awls are relatively rare in Hawaiian excavations; they were used for punching holes in soft materials.

The chisel fragment was found in Ku‘ele, within Layer I level 2 of TU 26, in terrace C-6. Only the tip portion of the chisel is present (Figure 5.32). It measures 1.6 cm in length, 0.9 cm in width, and weighs 1.9 g. It is circular in cross-section and is ground



Figure 5.30: Awl from terrace C-6, Layer I level 2 of TU 26.



Figure 5.31: Awl from terrace C-9, Layer I of TR 16.

smooth on all surfaces, with the tip worn down at a 50° angle. Brigham (1902) speculates that chisels functioned without hafting and were used for wood carving.

The pounder fragment was found in Ku‘ele in *lo‘i* terrace C-9, within Layer I of TR 16. The fragment is 7.3 cm long, 4.6 cm wide, and weighs 148.6 g. It is made from a crumbly reddish basalt and exhibits one convex surface that has been abraded to a smooth finish but not to a shiny polish (Figure 5.33 *a*).

An unidentified piece of modified basalt of similar material to the pounder fragment was found in the adjacent terrace C-8, within Layer I level 5 of TU 27. This piece measures 7.0 cm long, 3.5 cm wide, and weighs 47.0 g. It exhibits one flat polished surface (Figure 5.33 *b*). The other surfaces are broken. It is unclear what kind of artifact this fragment came from.

Two abrading stone fragments were found in Ku‘ele. One was recovered from terrace C-8, from Layer I of TR 38. This is a small piece, measuring 2.3 cm long, 1.7 cm wide, and weighing 4.1 g. It has one surface that has been worn flat (Figure 5.34 *a*), one naturally rounded surface, and three broken surfaces. The other abrading stone was



Figure 5.32: Chisel fragment from terrace C-6, Layer I level 2 of TU 26.



Figure 5.33: Crumbly basalt from Ku‘ele: *a* pounder fragment from terrace C-9, Layer I of TR 16; *b* unidentified modified basalt from terrace C-8, Layer I level 5 of TU 27.



Figure 5.34: *a* fragment of an abrading stone from terrace C-8, Layer I of TR 38; *b* abrading stone from terrace C-21, Layer I level 2 of TU 23.

collected from terrace C-21, from Layer I level 2 of TU 23. This piece is 5.1 cm long, 4.0 cm wide, and weighs 67.0 g. It exhibits one natural surface (Figure 5.34 *b*), and the rest of the stone is broken. A 2.0 x 1.5 cm area on the natural surface is worn flat.

The basalt cutting tool was found at *lo'i* terrace L-24 within Layer I level 6 of TU 16. It weighs 17.1 g and measures 4.9 cm long, 1.0 cm thick, and 2.7 cm wide. It was fashioned from a waterworn cobble sliver and exhibits possible chipping on the working edge and the smooth surface of the cobble on the opposite end (Figure 5.35). The chipped edge is sharp and is suitable for cutting. Bamboo knives were used for most cutting tasks in traditional Hawai'i, while stone knives were reserved for heavier work, such as cutting meat (Brigham 1902:19).

The chopping tool was found during surface survey in Lower Eliali'i, upslope of terrace E-11 among a scatter of natural stones and cobbles, not associated with a particular feature. It is a sturdy implement, weighing 356.8 g and measuring 10.3 cm in length, 3.4 cm in thickness, and 8.8 cm in width (Figure 5.36). The chopping tool exhibits flaking on at least one surface and one edge. Tools such as these were used for heavy cutting and chopping work, such as butchering animals.



Figure 5.35: Basalt cutting tool from TU 16 in Lahokea.



Figure 5.36: Basalt chopping tool from Lower Eliali'i surface survey, front and back.

Two hammerstones were collected. One was found during the survey of Pawa'a on the surface near wall feature P-15. It weighs 364 g and measures roughly 6 cm in diameter. It was fashioned from a waterworn cobble and exhibits one battered surface (Figure 5.37). Another hammerstone was recovered from Halepoki Makai during excavation of Layer I of TR 31, at *lo'i* terrace H-45. This hammerstone was also fashioned from a waterworn cobble and exhibits battering on one end (Figure 5.38). The other end



Figure 5.37: Hammerstone found during surface survey near wall P-15.



Figure 5.38: Hammerstone found within Layer I of TR 31, terrace H-45. The end on the right exhibits battering.

of the artifact is broken. It measures 12.0 cm long, 6.5 cm wide, and weighs 501.7 g. Hammerstones were used for flaking basalt and volcanic glass for stone tool production and crushing items such as *kukui* nuts.

The whetstone was found in Ku'ele, during excavation of Layer I level 2 of TU 26 at terrace C-6. It was fashioned from a

waterworn stone and exhibits two surfaces worn flat and smooth from abrasion. One end of the stone is broken (Figure 5.39). The whetstone measures 10.0 cm long, 8.5 cm wide, and weighs 674.7 g. Whetstones were used for sharpening tools such as adzes.

A total of 40 volcanic glass fragments were found in the excavations (Figure 5.40–Figure 5.44). Of these, one came from Keiu, six from Makea, 23 from Ku‘ele, four from Eliali‘i, three from Halepoki, one from Lahokea, and two from Palaloa. Aside from a few large pieces, the fragments were generally small in size, most measuring 1 cm long or smaller (Table 5.2). Of the 40 pieces, 13 pieces, or 32.5%, exhibit flaking and/or possible edge damage. This is a high percentage, as typically less than 10-20% of flakes in a volcanic glass collection show

signs of use, and these are usually limited to larger pieces (Kirch 1985:195). Indeed, the 13 artifacts showing signs of retouch and use wear were generally the larger specimens in the collection. Volcanic glass was used in food preparation, processing of plant materials, and in fine woodworking (Barrera and Kirch 1973).



Figure 5.39: Whetstone found within Layer I level 2 of TU 26, terrace C-6.

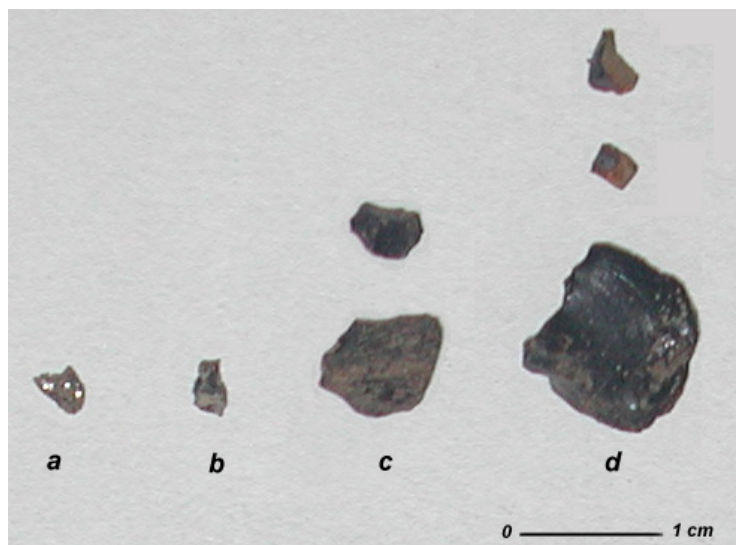


Figure 5.40: Volcanic glass: *a* from Layer I level 2 of terrace K-11; *b* from Layer I level 2 of terrace M-11; *c* from Layer I level 2 of terrace M-10; *d* from Layer I level 3 of terrace M-10.

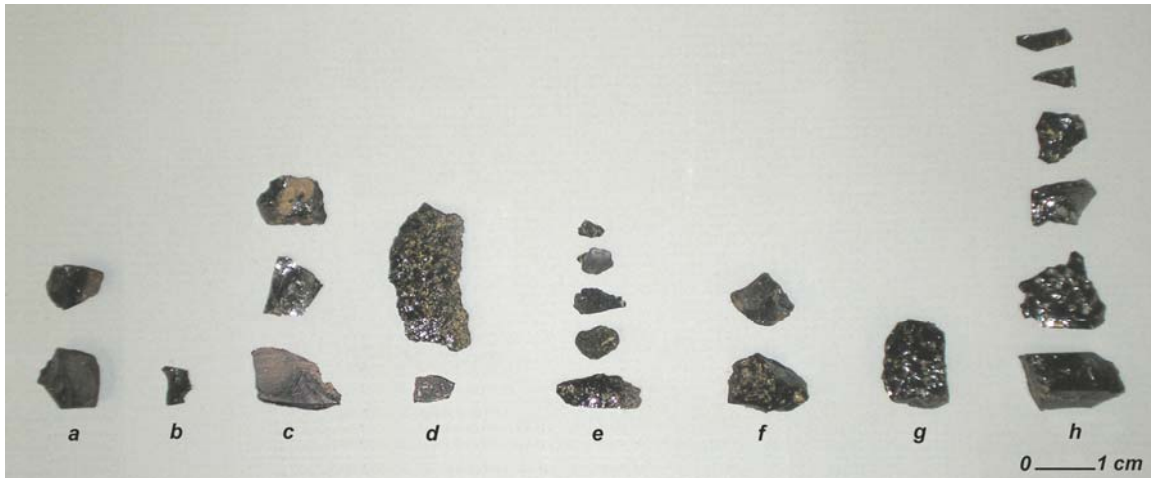


Figure 5.41: Volcanic glass from Ku‘ele: *a* from Layer I level 1 of terrace C-2; *b* from Layer I level 2 of terrace C-2; *c* bottom from Layer I level 1 of terrace C-6; *c* center and top from Layer I level 2 of terrace C-6; *d* bottom from Layer I level 4 of terrace C-8; *d* top from Layer II level 1 of terrace C-8; *e* from Layer I level 5 of terrace C-8; *f* from Layer I of terrace C-8; *g* from Layer I of terrace C-9; *h* from Layer I of terrace C-9.



Figure 5.42: Large volcanic glass flake from terrace C-34, 12 cmbs.

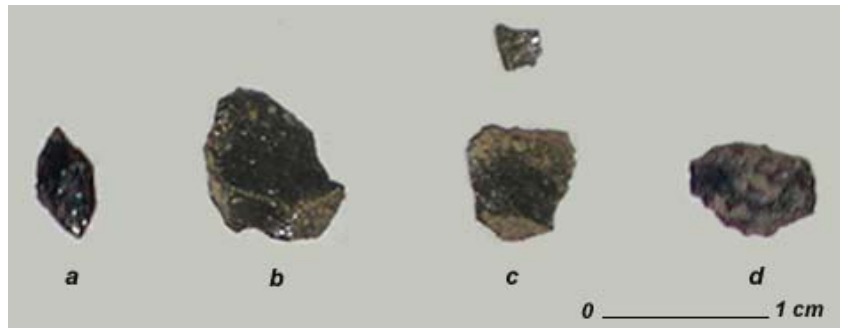


Figure 5.43: Volcanic glass: *a* from Layer I level 3 of terrace E-1; *b* and *c* from Layer 1 of terrace E-78; *d* from Layer I level 4 of terrace L-34.

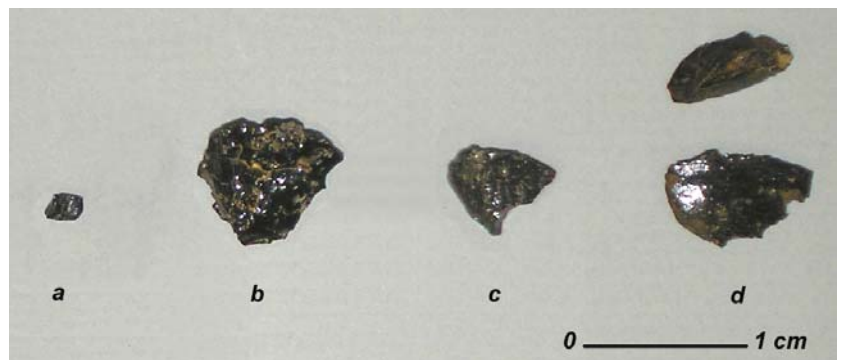


Figure 5.44: Volcanic glass: *a* from Layer I of terrace H-20; *b* from Layer I of terrace H-57; *c* from Layer I of TR 32 (terrace with no number, Halepoki Central); *d* from Layer I level 2 of TU 38 (hearth feature with no number, Palalao).

Table 5.2: Volcanic Glass Data

Photo	Weight (g)	Length (cm)	Width (cm)	Notes
Figure 5.40	<i>a</i>	tr.	0.3	
	<i>b</i>	tr.	0.4	
	<i>c</i> bottom	0.2	0.9	
	<i>d</i> top	tr.	0.5	
	<i>d</i> bottom	0.6	1.1	possible edge damage
	<i>d</i> center	tr.	0.3	
	<i>d</i> top	tr.	0.3	
Figure 5.41	<i>a</i> bottom	0.8	1.0	0.8 flaking
	<i>a</i> top	0.4	0.9	0.6 flaking
	<i>b</i>	tr.	0.6	0.5
	<i>c</i> bottom	0.5	1.6	0.9
	<i>c</i> center	0.1	0.7	0.8
	<i>c</i> top	0.2	1.0	0.9 possible edge damage
	<i>d</i> bottom	0.1	0.7	0.4
	<i>d</i> top	1.8	2.1	1.3 possible edge damage
	<i>e</i> bottom	0.3	1.5	0.6
	<i>e</i> 2nd row	0.2	0.8	0.6
	<i>e</i> 3rd row	0.1	0.8	0.4
	<i>e</i> 4th row	tr.	0.6	0.5
	<i>e</i> top	tr.	0.5	0.3
	<i>f</i> bottom	0.8	1.3	1.0 possible edge damage
	<i>f</i> top	0.6	1.1	0.8
	<i>g</i>	0.9	1.4	1.1 possible edge damage
	<i>h</i> bottom	1.3	1.4	0.8 flaking
	<i>h</i> 2nd row	0.4	1.3	0.8 possible edge damage
	<i>h</i> 3rd row	0.3	1.1	0.6
	<i>h</i> 4th row	0.2	0.9	0.8
	<i>h</i> 5th row	tr.	0.7	0.3
	<i>h</i> top	tr.	0.9	0.3
Figure 5.42	5.0	3.0	1.8	possible edge damage
Figure 5.43	<i>a</i>	tr.	0.7	0.4
	<i>b</i>	0.6	1.4	1.3 flaking + possible edge damage
	<i>c</i> bottom	0.4	1.1	1.0 possible edge damage
	<i>c</i> top	tr.	0.4	0.4
	<i>d</i>	0.1	0.8	0.5 possible edge damage
Figure 5.44	<i>a</i>	tr.	0.4	0.3
	<i>b</i>	0.6	1.3	1.3 flaking + possible edge damage
	<i>c</i>	0.3	1.0	0.7
	<i>d</i> bottom	0.4	1.3	0.8
	<i>d</i> top	0.3	1.1	0.5

Historic Artifacts

Historic artifacts were analyzed with the assistance of Steven Eminger and Bishop Museum historic archaeologist Susan Lebo, with reference to Costello and Maniery

(1988), Godden (1964), Lebo (1997), Leun (1987), Lister and Lister (1989), and Robacker and Robacker (1978). Historics were found at Pawa‘a, Ku‘ele, Makea, Upper Eliali‘i, and Lahokea. The majority are ceramics and glass, although metal, slate, leather, rubber, and plastic items were found as well. Curiously, no artifacts were found at historic house platform P-19 even though the structure is clearly post-contact in age.

Ceramics

Ceramics were found at historic house complex P-8, historic house complex P-12, Pawa‘a not associated with a particular feature, habitation platform C-2, historic house platform M-17, *lo‘i* terrace KU-13, historic house platform E-93, *lo‘i* terrace L-24, ‘auwai H-5, *lo‘i* terrace H-50, and *lo‘i* terrace H-52. These include Japanese, Chinese, and English or American wares, the majority of which date to the turn of the Twentieth Century. Vessel types include a shipping container, tableware, serving vessels, and baking dishes.

Nine sherds were recovered from the surface at historic house complex P-8, representing a shipping container, two bowls, and a soup plate. Two sherds were part of a Chinese shipping container known as *Min Gei* (Figure 5.45 *a*). The two sherds mend to form the base of a wide-mouthed food or soy sauce jar. The inside of the vessel is brown glazed, while the base was left unglazed. This piece dates from the mid-Nineteenth to the Twentieth Century. Two sherds were from a Chinese *tz‘u*, or porcelainous stoneware, vessel (Figure 5.45 *b*). The two sherds do not mend but are likely part of the same rice or soup bowl, exhibiting the “double happiness” motif, hand-painted in blue. This vessel also dates from the mid-Nineteenth to the Twentieth Century. Four sherds came from an English or American soup plate. These are undecorated ironstone whiteware sherds that mend. One sherd was part of a plain English or American ironstone whiteware bowl.



Figure 5.45: Chinese ceramics from historic house complex P-8: *a* *Min Gei* shipping container; *b* *tz‘u* rice or soup bowl.

At historic house complex P-12 only two ceramic sherds were found, both undecorated. They are part of an English or American white ironstone hotelware bowl that dates to after 1880.

Eleven sherds were collected from the slope in Pawa'a, not associated with a particular feature. They are all English or American, aside from one Chinese piece. A serving vessel, two to three large bowls, two plates, two soup plates, and a rice bowl are represented, most dating from the 1850s to the early 1900s. One sherd came from an English or American large serving vessel, probably an oval platter (Figure 5.46 *a*). A blue flower transfer print decorated the inside and outside of this ironstone vessel. This piece dates to ca. 1850-1910. One sherd is part of an English or American ironstone whiteware large bowl (Figure 5.46 *b*). It dates to ca. 1850-1930. Two sherds came from an English or American ironstone soup plate (Figure 5.46 *c*). A blue flower transfer print decorated the inside of this vessel. This piece dates to ca. 1850-1910. One sherd came from a Chinese rice bowl, hand-painted with the "three circles and dragonfly" motif (Figure 5.46 *d*). A sherd of the same style was found at historic house platform E-93 in Upper Eliali'i, but the two sherds do not mend. This *tz'u*, or porcelainous stoneware dates from the Nineteenth to the early Twentieth Century. Two sherds were part of an English or American ironstone whiteware plate (Figure 5.46 *e*). This piece was hand-painted with green leaves, a red line, and a red rim band. The two sherds do not mend but are likely from the same plate, which dates to after 1870. One sherd was part of an undecorated English or American ironstone whiteware plate. Two sherds came from one or two English or American ironstone whiteware large bowls. One sherd was part of an English or American plain white ironstone soup plate (Figure 5.47). A maker's mark on the base depicts a royal arms crest and indicates that the plate was manufactured by George Jones

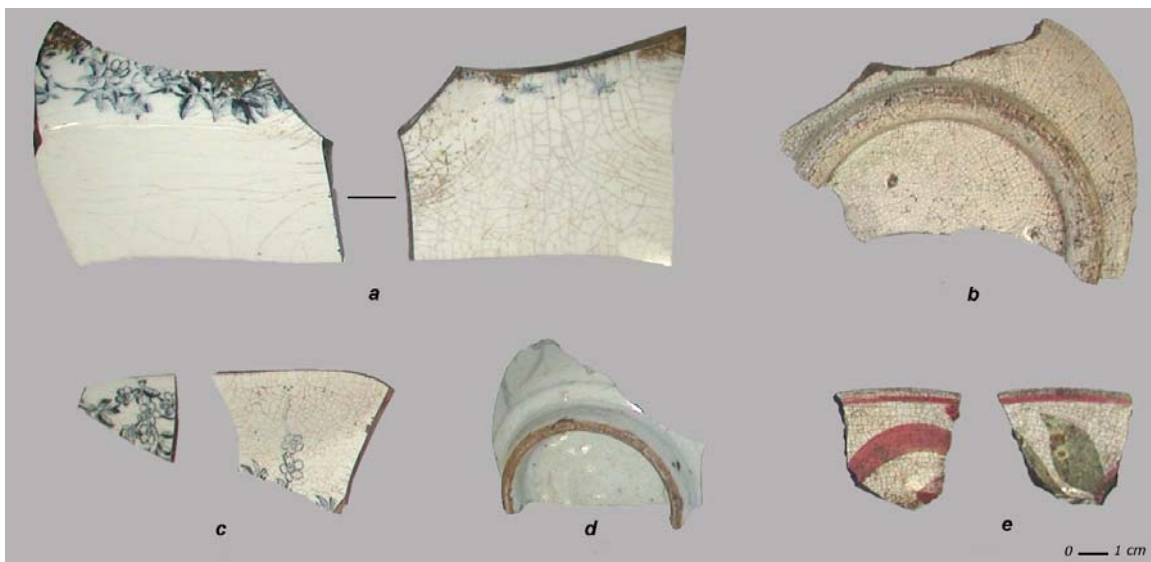


Figure 5.46: Selected ceramics from Pawa'a, not associated with a feature: *a* English or American serving vessel, front and back; *b* English or American large bowl; *c* English or American soup plate; *d* Chinese *tz'u* rice bowl; *e* English or American plate.



Figure 5.47: English or American plate from Pawa'a, showing maker's mark.

Historic house platform M-17 yielded the largest number of ceramics: 120 vessel sherds, a ceramic doorknob, and three porcelain buttons. The ceramic vessels were all English or American, with no Japanese or Chinese wares found. At least nine plates, five bowls, two cups, two large serving vessels, and one baking or serving dish are represented.

Twenty-four sherds were found on the surface at and around feature M-17. Two sherds came from a large whiteware vegetable dish (Figure 5.49 *a*). Vessels such as this

& Sons from 1873-1891. Part of a matching soup plate was found in Upper Eliali'i at historic house platform E-93, but the two sherds do not mend.

Two ceramic sherds were found in Ku'ele at habitation platform C-2. The first was recovered from the surface of TU 25. It is an English or American saucer fragment. The base portion of the vessel is present. It depicts part of a royal arms crest that reads "YAL PATENT" (Figure 5.48). The second sherd came from Layer I level 1 of TU 25. It is a plain white English or American saucer fragment.



Figure 5.48: English or American saucer sherd from Ku'ele, showing maker's mark.

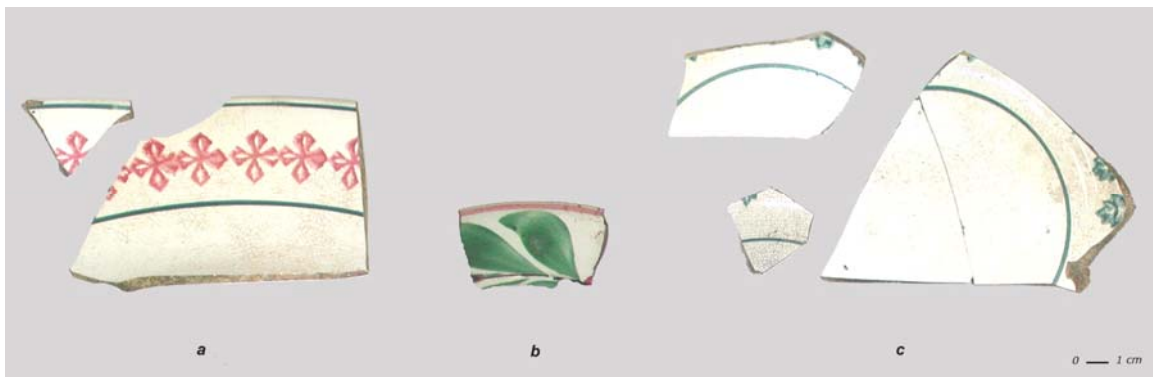


Figure 5.49: Selected ceramics from historic house platform M-17, surface collection: *a* vegetable dish with cut sponge stamping and hand-painted rim band; *b* hand-painted plate; *c* plate with cut sponge stamping and hand-painted line.

were suitable for communal serving. This piece is decorated with a cut sponge stamped design featuring tightly repeating red four-petaled flowers, and a hand-painted green line along the inner edge. It dates to ca. 1870-1930. The two sherds do not mend. One sherd was from a plate, hand-painted with a green leaf pattern and red line along the inner edge (Figure 5.49 *b*). A hint of red in the bottom right corner of the sherd suggests a possible flower pattern. This piece dates to after 1870. Four sherds came from a plate decorated with a cut sponge stamped green leaf motif and a hand-painted green line (Figure 5.49 *c*). Two of the four sherds mend. Three sherds were from a whiteware cup with a blue flower transfer print on the inside and outside (Figure 5.50 *a*). The cup was manufactured between 1820 and 1870. The three sherds do not mend. This piece dates to ca. 1870-1930. Four sherds came from an ironstone whiteware flat-based vegetable dish, possibly oval in shape (Figure 5.50 *b*). This thick-bodied vessel was hand-painted with large flowers and a double blue line around the rim, dating to ca. 1870-1930. The four sherds do not mend. One sherd was part of a heavy ironstone cup (Figure 5.50 *c*). The cup is decorated with a blue transfer print and dates to ca. 1850-1900. Undecorated ceramics found on the surface include nine ironstone whiteware sherds from two plates and two bowls. These date to ca. 1850-1930.



Figure 5.50: Selected ceramics from historic house platform M-17, surface collection: *a* cup with blue flower transfer print (front and back shown); *b* hand-painted vegetable dish; *c* cup with blue transfer print.

Ninety-six sherds came from below the surface within TU 7 at feature M-17. Five sherds were part of a yellowware “nappy” with a scalloped edge (Figure 5.51 *a*). Nappies were baking or serving flat-based vessels that were sold as a set of nested bowls from ca. 1830-1930. The five sherds found here do not mend. Three were from Layer I level 1, and two were from either Layer I level 1 or Layer I level 2. Five sherds came from an

ironstone whiteware plate decorated with a cut stencil flower and star motif and a hand-painted blue line on the rim (Figure 5.51 *b*). The five sherds came from Layer I level 1 within TU 7. A sixth matching sherd came from Layer I level 2, and all sherds mend. This plate dates to ca. 1870-1930. One sherd was part of a whiteware bowl, hand-painted with a green leaf design (Figure 5.51 *c*). A hand-painted double red line adorned the outside of the bowl, and a single red line decorated the inside. This piece dates to ca. 1870-1930. It was recovered from Layer I level 1 of TU 7. One sherd came from an ironstone whiteware plate (Figure 5.51 *d*). The plate was hand-painted with green leaves and a red line along the rim, dating to ca. 1870-1930. It was collected from Layer I level 1 of TU 7. Undecorated ceramics from the TU 7 excavations include three plate sherds, common before 1880, 75 plain whiteware sherds from Layer I level 1, four plain whiteware sherds from Layer I level 2, and one plain whiteware sherd from Layer I level 3. At least three small bowls and one plate are represented from the plain whiteware sherds. They date to the late Nineteenth to early Twentieth Century.



Figure 5.51: Selected ceramics from historic house platform M-17 excavations: *a* nappy with scalloped edge; *b* cut stencil plate with hand-painted rim band (five of six sherds shown); *c* hand-painted bowl; *d* hand-painted plate.

Other ceramics recovered from historic house M-17 include three porcelain buttons and a doorknob. The buttons are 4-hole sew through style and date from 1850 to the present (Figure 5.52). All three were recovered from Layer I level 1 of TU 7. The doorknob is most likely yellowware stoneware with Rockingham glaze (Figure 5.53). It was found during surface survey.

One large ceramic sherd was found in Kukuinui. It was collected from the surface just west of *lo'i* terrace KU-13, where the terrace has eroded into the stream. It is part of an undecorated thick-bodied English or American serving bowl. Most of the footring and part of the body of the vessel are represented.

Nine ceramic sherds were found on the surface at historic house

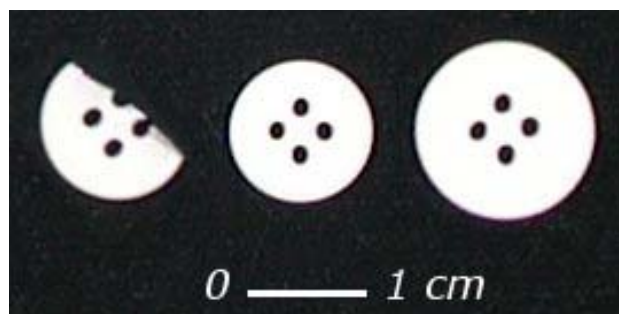


Figure 5.52: Porcelain buttons from historic house platform M-17.



Figure 5.53: Ceramic doorknob from historic house M-17.

platform E-93 in Upper Eliali'i. These include pieces from England or America, China, and Japan. Two rice bowls, two saucers, one soup plate, and one large bowl are represented. One sherd came from a Chinese rice bowl, hand-painted with the "three circles and dragonfly" motif (Figure 5.54 *a*). A sherd of the same style was found during surface survey at Pawa'a, but the two sherds do not mend. This *tz'u*, or porcelainous stoneware dates from the Nineteenth to the early Twentieth Century. One sherd was part of a Japanese porcelainous rice bowl (Figure 5.54 *b*). The rice bowl is decorated with a blue transfer print "flower blossoms" motif and dates from 1870 to the Twentieth Century. Three sherds were part of a plain white ironstone soup plate (Figure 5.55 *a*). A maker's mark on the base reads "ROYAL PATENT; IRONSTONE; GEORGE JONES & SONS" and depicts a royal arms crest. This piece was manufactured in England or America from 1873-1891. The three sherds mend. One sherd came from an English blue tinted ironstone saucer. The maker's mark on the base reads "INA; HNSON BROS; ENGLAND" and depicts a royal arms crest (Figure 5.55 *b*). It was manufactured by Johnson Bros. from 1883-1913. One sherd was part of an English or American blue tinted ironstone saucer (Figure 5.55 *c*). The maker's mark on the base reads "ROY". It does not mend with the previous piece. It was probably manufactured in England, ca. 1880-1930. Two sherds came from an undecorated large mixing or serving bowl. This thick-bodied vessel was manufactured in England or America. The two sherds mend.

A single porcelain button was found at Lahokea (Figure 5.56). This is a plain sew-through 3-hole button, dating from ca. 1850 to the present. The size of the button is suggestive of use on children's clothing or a shirt collar. It was found in Layer I level 2 of TU 18, at *lo'i* terrace L-2.

A total of 29 ceramic sherds were found in the Halepoki Makai *lo'i* system. Three sherds of a modern plate were collected from the surface within 'auwai H-5. These three

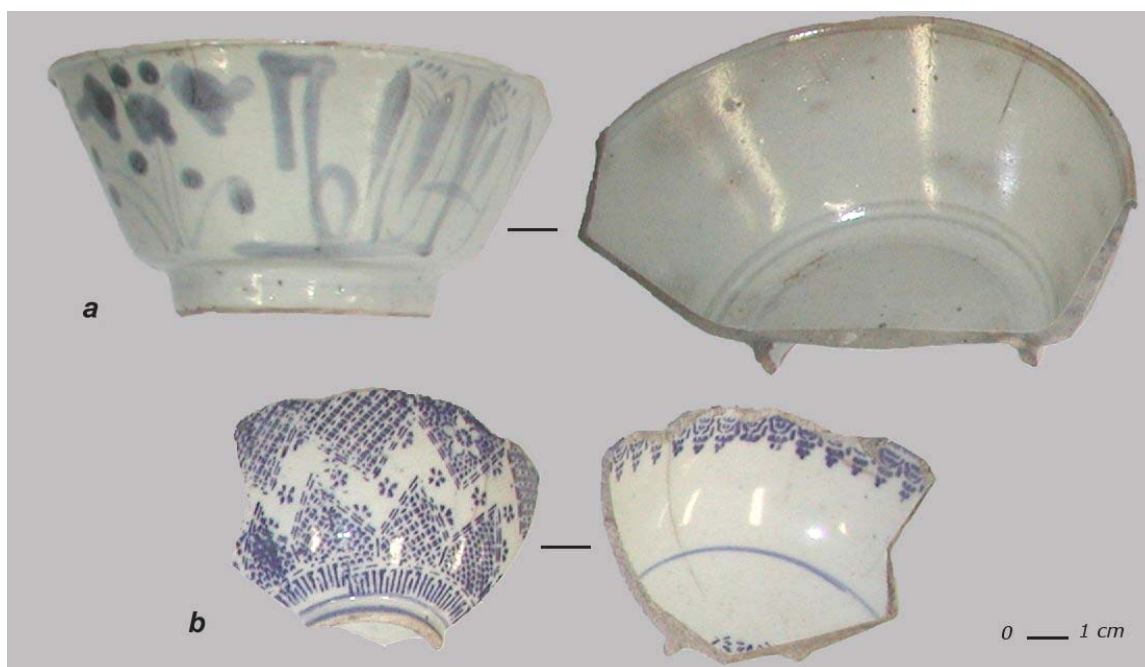


Figure 5.54: Selected ceramics from historic house platform E-93: *a* Chinese *tz'u* rice bowl (front and back); *b* Japanese porcelainous rice bowl (front and back).



Figure 5.55: Selected ceramics from historic house platform E-93: *a* English or American soup plate; *b* English saucer; *c* English or American saucer.

sherds mend and they represent nearly the entire vessel (Figure 5.57). “Bennett 8/85” is inscribed on the base, indicating manufacture by Molokai’s Dan Bennett in 1985. Bennett has manufactured pottery on Moloka’i from 1974 to the present (Hogan 2006). His pieces

have been sold throughout the island, from his studios in Kipu and Kalae, Big Wind Kite Factory, Hotel Molokai and the R.W. Meyer Sugar Mill (Hogan 2006).

Just south of *lo'i* terrace H-50, 25 ceramic sherds were found on the surface. Two of these are part of a Chinese *tz'u* rice or soup bowl. The two sherds mend and are hand-painted, possibly with the “double happiness” motif (Figure 5.58). This vessel dates from the mid-Nineteenth to the Twentieth Century. Three sherds are from an undecorated English or American saucer. They do not mend and represent at least two different

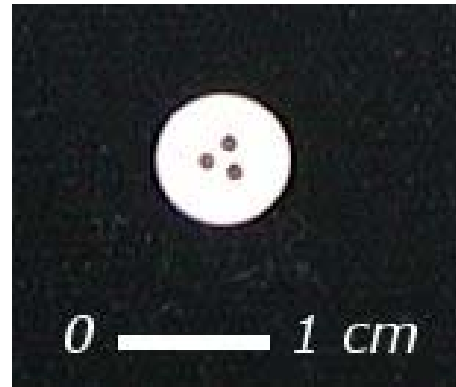


Figure 5.56: Porcelain button from *lo'i* terrace L-2.

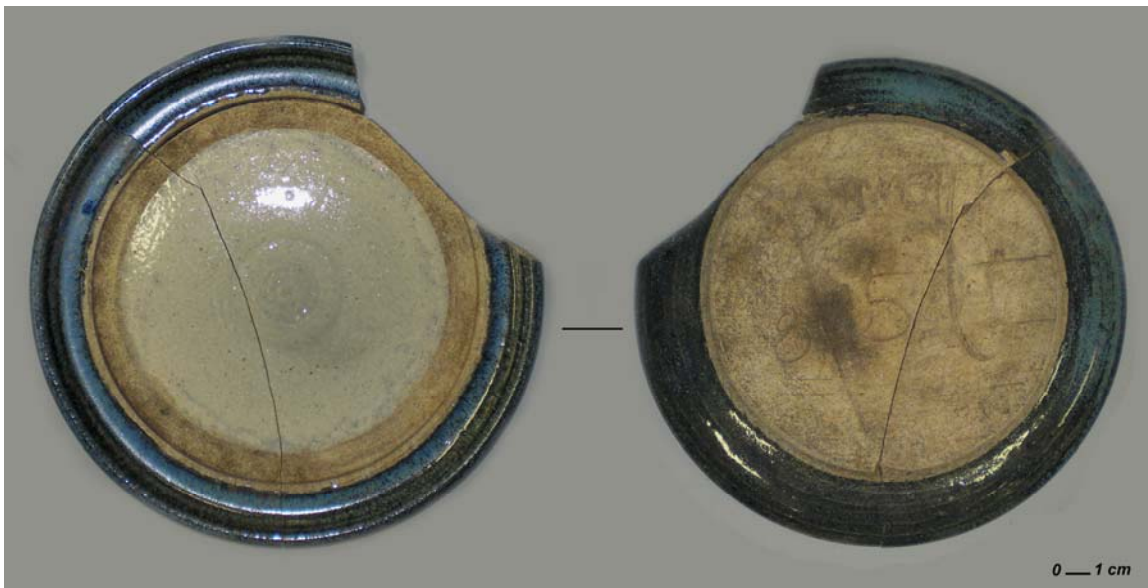


Figure 5.57: Modern plate from 'auwai H-5 (front and back).

vessels. Three sherds are from a hand-painted English or American large bowl (Figure 5.59). A red flower and green leaf motif adorn the outside of the vessel, and a red rim band is painted on the inside. Hints of blue can also be seen on the outside of one sherd. This vessel dates from ca. 1870-1930. A total of 17 sherds are from an undecorated large bowl. Three sherds mend to form part of the footring and two sherds mend to form a portion of the body of the bowl. It is unclear if one or more vessels are represented.



Figure 5.58: Chinese bowl from *lo'i* terrace H-50.

One sherd was collected from the surface of *lo'i* terrace H-52 near a tangerine tree. It is from an undecorated English or American saucer.

Glass

Glass was found at historic house complex P-8, historic house complex P-12, Pawa'a, not associated with a particular feature, habitation platform C-2, terrace C-6, historic house platform M-17, terraces L-1 and L-2, and terrace H-50. The majority are alcohol bottles, but medicine bottles, lamp globes, window glass, and a tumbler are also represented.

Historic house complex P-8 yielded two alcohol bottles and a tumbler. All were found on the surface during survey. One of the bottles consisted of the base and body of an amber to brown alcohol bottle (Figure 5.60 *a*). The bottle was turn-molded and exhibits a snap base with a nipple. The base and body fragments mend. This bottle was manufactured from 1870 to 1910. The base of a large clear glass tumbler was also found (Figure 5.60 *b*). The date of manufacture could not be determined for this piece. The other alcohol container is a manganese decolorized case gin bottle (Figure 5.60 *c*). This bottle was machine-made between 1910 and 1920.



Figure 5.59: English or American bowl from *lo'i* terrace H-50.

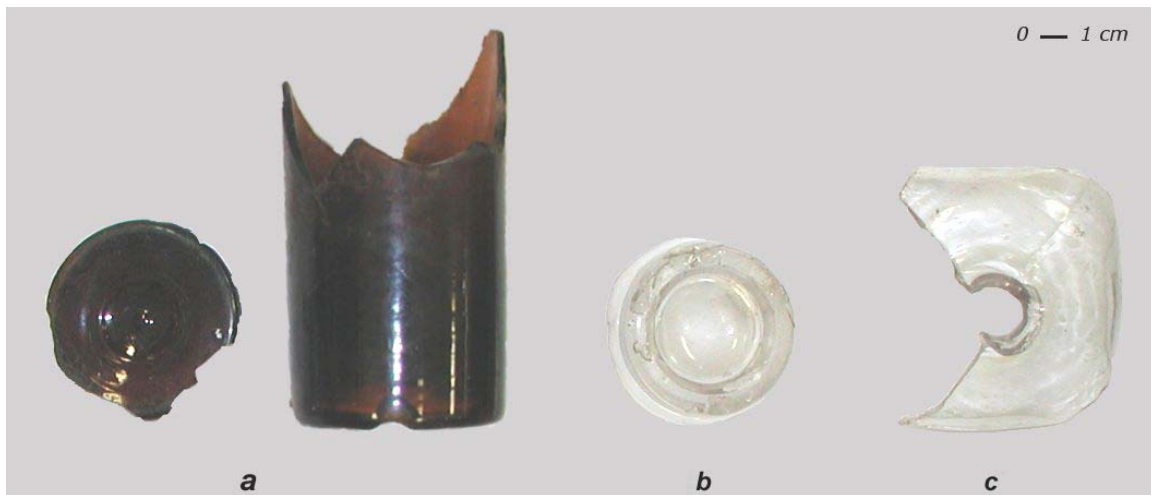


Figure 5.60: Glass from historic house complex P-8: *a* alcohol bottle, turn-molded; *b* tumbler; *c* case gin bottle, machine-made.

Four bottle fragments were recovered from the surface at historic house complex P-12; two of these are alcohol bottles and two are unidentified beverage containers. The first alcohol bottle is a light olive green wine or champagne bottle with a kick-up or push-up base (Figure 5.61 *a*). No seams are evident, so this would appear to be a turn-molded bottle, although striations are absent. This piece dates to the late Nineteenth or early Twentieth Century. The second alcohol bottle is a medium olive green wine or champagne bottle (Figure 5.61 *b*). It is turn-molded with a kick-up or push-up base, also dating to the turn of the Twentieth Century. The unidentified beverage containers are more modern. The first is a base and body fragment of a blue-green machine-made bottle. It exhibits stippling and "1481-W" embossed on the base, dating to the 1950s to 1960s. The second unidentified beverage container consists of the base and body of a clear machine-made bottle. It exhibits stippling and a maker's mark on the base, indicating manufacture by Maywood Glass Co., of Compton, CA in 1958.

Three beverage bottle fragments and a whole medicine bottle were collected during surface survey in Pawa'a, and were not associated with a particular feature. A light blue alcohol bottle was found on the west side of the survey block between features P-10 and P-13 (Figure 5.62 *a*). This is a two-piece mold-blown bottle with "A.B.G.M. CO. 82" embossed on the base, indicating manufacture by Adolphus Bush Glass Manufacturing Company between 1886 and 1920. A clear medicine, extract, or toiletry bottle was found on the north side of the survey block between features P-7 and P-8. This is a whole two-piece snap case bottle with chamfered corners (Figure 5.62 *b*). It was mold-blown, exhibits a square lip, and likely had a cork stopper. The lip of this bottle is chipped, and this probably happened during opening, when the cork was removed. The bottle was manufactured from 1850 to 1910. Fragments of two less-diagnostic bottles were found in the vicinity of the A.B.G.M. bottle. One consisted of two pieces of a pale green quart size beer or soda bottle. "428 H" is embossed on the base. The other consisted of three pieces of a pale blue mold-blown alcohol bottle. Neither could be dated.



Figure 5.61: Wine or champagne bottles from historic house complex P-12: *a* probably turn-molded; *b* turn-molded.

Glass from Ku‘ele consisted of 42 bottle and window shards. TU 25 at habitation platform C-2 yielded three olive green bottle fragments from the surface and 11 olive green bottle fragments, three light blue window pieces, and one clear window shard from Layer I level 1. TU 26 at terrace C-6 yielded 24 bottle and window shards. Layer I level 1 produced 13 window glass pieces and one green bottle fragment. Layer I level 2 yielded three window glass shards, four medium green bottle pieces, two clear bottle shards, and one aqua bottle shard.

A total of 215 glass fragments were collected from historic house platform M-17 in Makea and Ku‘ele. Of these, 49 were found on the surface on and around the platform, and 166 were collected during excavation of TU 7. They consist of at least 19 alcohol bottles, 18 non-diagnostic bottles, four medicine bottles, four lamp globes or chimneys, and assorted window glass. Glass found on the surface of feature M-17 includes bottles, lamp pieces, and window shards. No whole bottles were found.

Surface glass finds include: 1) A mold-blown medium olive green quart size alcohol bottle with “II” embossed on the base, manufactured in France until 1870 or in the U.S. until the late 1800s (Figure 5.63 *a*); 2) A dark olive green mold-blown turn-molded alcohol bottle manufactured between 1870 and 1910 (Figure 5.63 *b*); 3) A medium olive green quart size alcohol bottle with a kick-up/push-up base (Figure 5.63 *c*); 4) An aqua mold-blown beer or soda bottle with “A.B.G.M. CO. E22” embossed on the base, indicating manufacture by Adolphus Bush Glass Manufacturing Company, from 1886 to 1920 (Figure 5.63 *d*); 5) A mold-blown olive green turn-molded alcohol bottle with a nipple, most common from the 1870s to 1917 (Figure 5.63 *e*); 6) A two-piece mold-blown olive amber alcohol bottle with an “A” and backward “Z” embossed on the base and “EHE CO” embossed on the side, indicating manufacture by Edward H. Everett Glass Company from 1883-1904 (Figure 5.63 *f*); 7) A manganese decolorized snap case, mold-blown case gin bottle, manufactured between 1880 and 1920 (Figure 5.64 *a*); 8) Two fragments of a clear selenium decolorized lamp globe with molded grape leaf decoration,



Figure 5.62: Selected bottles from Pawa‘a surface survey: *a* alcohol bottle, mold-blown; *b* medicine/extract/toiletry bottle.

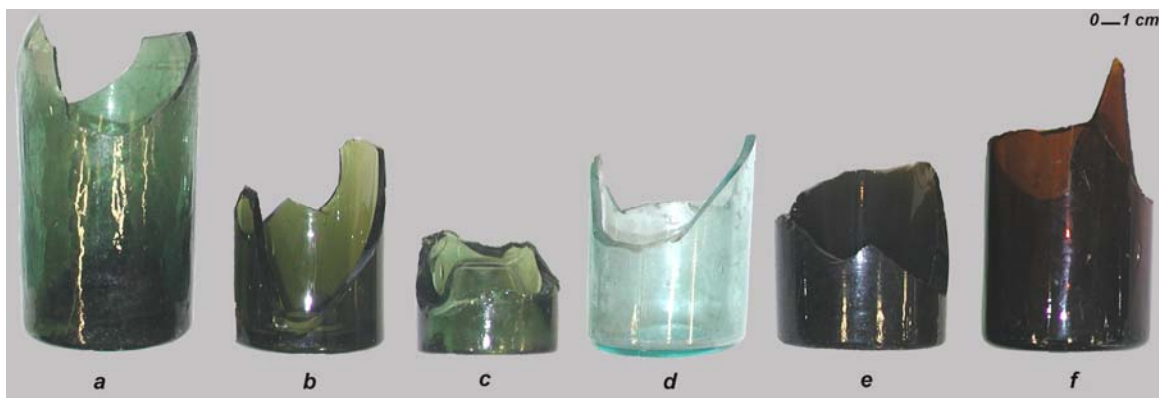


Figure 5.63: Selected bottle glass from historic house platform M-17, surface collection: *a* alcohol, turn-molded; *b* alcohol, turn-molded; *c* alcohol, with kick-up/push-up base; *d* beer or soda, mold-blown; *e* alcohol, turn-molded; *f* alcohol, mold-blown.

manufactured from 1916 to 1930 (Figure 5.64 *b*); 9) A dark olive green mold-blown alcohol bottle with a pontil, manufactured before 1865 (Figure 5.64 *c*); 10) A pale green beer or soda bottle, possibly mold-blown, with “R1” embossed on the base, dating to ca. 1850 to 1910 (Figure 5.64 *d*); 11) Two pieces of a clear medicine, extract, or toiletry bottle, square with chamfered corners, dating to ca. 1850 to 1910 (one piece shown in Figure 5.64 *e*); 12) A neck fragment of a pale green mold-blown alcohol bottle, square bead over a sloping ring; 13) A base fragment of a green wine or champagne bottle with a kick-up/push-up base,



Figure 5.64: Selected glass from historic house platform M-17, surface collection: *a* case gin bottle; *b* lamp globe with grape leaf decoration; *c* alcohol bottle, mold-blown; *d* beer or soda bottle, possibly mold-blown; *e* medicine bottle.

probably machine-made; 14) A base fragment of a light olive green wine or champagne bottle with a kick-up/push-up base, probably machine-made; 15) One base and one neck fragment of a pale green mold-blown wine or champagne bottle with a kick-up/push-up base; 16) Two fragments of a medium olive green alcohol bottle; 17) A fragment of a pale green alcohol bottle; 18) Two pieces of a clear manganese-decolorized medicine bottle; 19) One clear non-diagnostic manganese decolorized bottle fragment; 20) A clear non-diagnostic glass fragment exhibiting a delicate embossed curving line pattern; 21) Seven clear non-diagnostic bottle shards, one with chamfered corners; 22) Seven clear undecorated lamp globe fragments exhibiting a lip ground from wear; 23) Two clear, thin, undecorated lamp chimney pieces; 24) Three possible lamp fragments, clear with a yellowish tint, embossed with a leaf pattern; and 25) Five light blue-green window glass shards.

Glass unearthed during excavation of TU 7 at historic house platform M-17 consists of bottle, lamp, and window shards. Excavated glass from Layer I level 1 includes: 1) Three fragments of at least two light green wine or champagne bottles, one mold-blown with a single band lip; 2) Four shards of a dark olive green mold-blown alcohol bottle; 3) One fragment of a dark olive green wine or champagne bottle; 4) An amber beer or whiskey bottle shard; 5) Four fragments of a clear mold-blown case gin bottle; 6) A piece of a clear mold-blown medicine bottle with chamfered corners and square lip; 7) Two shards of a clear, flat panel, machine-made medicine bottle; 8) 42 clear non-diagnostic bottle shards; 9) 15 base and body fragments of a medium olive green bottle with a kick-up/push-up base; 10) Two pieces of a blue green bottle with an oval base and relief molded decoration; 11) 29 non-diagnostic fragments (19 light green, 10 light blue green), representing at least five quart-size beverage bottles; 12) 27 pieces (three mending) of a selenium decolorized lamp globe with molded grape leaf pattern and "DIETZ No 0.TUBULAR NEW YORK" embossing, manufactured from 1916 to 1930; 13) Five clear, thin, undecorated shards of a lamp chimney; 14) 23 light blue green window glass shards; and 15) Three non-diagnostic glass shards, two cornflower blue and one cobalt blue.

Glass below Layer I level 1 was sparse in TU 7, and consisted of four non-diagnostic shards. Two olive green and one light green fragment were recovered from Layer I level 2, and one clear shard was collected from Layer I level 3.

Four pieces of glass were found in Lahokea, one within the wall of *lo'i* terrace L-1, and three during excavation of TU 18 at *lo'i* terrace L-2. The glass from feature L-1 was a base fragment of an olive green black alcohol bottle (Figure 5.65). It was mold-blown and exhibits a kick-up or push-up base



Figure 5.65: Mold-blown alcohol bottle base from within the wall of *lo'i* terrace L-1.

and pontil, probably dating from the mid to late Nineteenth Century. Three small shards were excavated from TU 18. One clear non-diagnostic fragment came from Layer I level 1, and two medium olive green non-diagnostic pieces were collected from Layer I level 3.

Halepoki Makai produced two glass shards. Both were found within the eroded wall section of terrace H-50 (see Figure 3.76). One was a medium green bottle shard and one was a light green bottle base fragment.

Metal, Slate, Leather, Rubber, Plastic, Chert

Metal was found at historic house complex P-12, at Pawa'a not associated with any feature, at terrace C-6 in Ku'e, at historic house platform M-17 in Makea, and in a non-numbered *lo'i* terrace in Kukuinui Mauka. Items included lock hardware, ranching equipment, a bullet casing fragment, and construction materials.

At feature P-12, three metal rings, two buckles, a spike, a bolt, and a nail were collected. The rings are metal cinch buckles from a horse harness. One ring measured 9 cm in diameter (Figure 5.66 *a*), while the other two measured 12 cm in diameter (Figure 5.66 *b* and *c*). They date to ca. 1850 to 1910. The two rectangular metal buckles are harness or rein parts (Figure 5.66 *d* and *e*). They also date to ca. 1850 to 1910. Construction material included a 16.5 cm-long iron spike with a rounded head, a 10.8

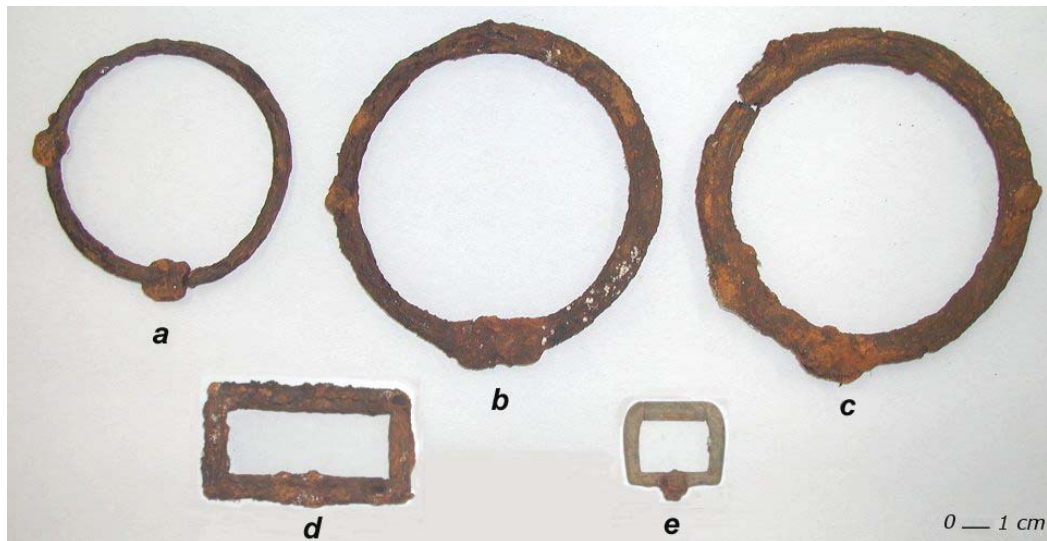


Figure 5.66: Metal collected from historic house complex P-12: *a-c* cinch buckles from a horse harness; *d, e* buckles from a harness or rein.

cm-long iron bolt with portions of threading visible and probably with a flat square head, and a 6.4 cm-long wire nail with a flat, circular head. All are severely rusted. The nail was found with many other nails of the same type, rusted together in the form of the container that once held them. Wire nails such as these were imported to Hawai'i as early as 1893. The lock hardware was found between features P-11 and P-12, and was probably associated with the feature P-12 historic house complex. It is the kind of lock that would

have been mounted on the wall of a house or other building. The lock is severely rusted and measures 11 cm long, 2.5 cm wide, and 5 cm thick. A brass doorknob was found on the Pawa'a slope between terrace P-9 and wall segment P-11, not associated with either feature. The doorknob measures 5.7 cm in diameter and exhibits an engraved pattern (Figure 5.67).



Figure 5.67: Brass doorknob from Pawa'a.

A metal bullet casing fragment was found within Layer I level 2 of TU 26, at terrace C-6 in Ku'ele. The fragment measures 0.6 cm long and 1.1 cm in diameter. It weighs 1.2 g. A total of 72 unidentifiable metal fragments and 43 rusty nails were also found within Layer I of TU 26. These were discarded in the field and were not further examined.

A horse bit, a piece of barstock, seven rusted iron pieces, and a reshaped blob of lead were found at feature M-17. The horse bit was found on the surface of TU 7. It measures 16 cm long and 13.5 cm wide (Figure 5.67). The barstock was found on the surface of the platform; it measures 14.5 cm long and 4 cm wide. Six rusty iron pieces were found in Layer I level 1 of TU 7, probably representing large nails, bolts, or machinery parts. Two measure roughly 10 cm long, and three are roughly 5 cm long. Layer I level 2 of TU 7 yielded an 11 cm-long rusty iron bolt, large nail, or machinery part and a 3 cm-long and 1 cm-wide amorphous blob of lead, pounded flat. The function of the lead blob is unknown.



Figure 5.68: Metal horse bit from historic house platform M-17.

Two rusty nails and three unidentified small rusty metal pieces were found within Layer I of TR 24 in Kukuinui Mauka. They were discarded in the field and were not further examined.

A total of 13 pieces of slate were found: 12 from historic house platform M-17 and one from historic house platform E-93. Eight pieces were collected from the surface of feature M-17 at TU 7; two were edge pieces engraved with a straight line near the edge (Figure 5.69 *a* bottom left and bottom center), one was a corner piece with an engraved line (Figure 5.69 *a* bottom right), and five were plain (Figure 5.69 *a* top). Two pieces were found on the surface of the platform outside the test unit. One was engraved with a

straight line (Figure 5.69 *b* bottom) and one was not (Figure 5.69 *b* top). Two fragments were recovered during excavation of TU 7: a tiny piece from Layer I level 2 (Figure 5.69 *c*) and an edge fragment with no engraving from Layer I level 1 or Layer I level 2 (Figure 5.69 *d*). One slate fragment was collected from the surface of feature E-93 (Figure 5.69 *e*). Slate was used as a roofing material and for chalkboards in the historic era. All slate pieces found here are finely polished and were probably used as chalkboards. The fragments exhibiting an engraved edge were likely part of a chalkboard with a wooden frame.

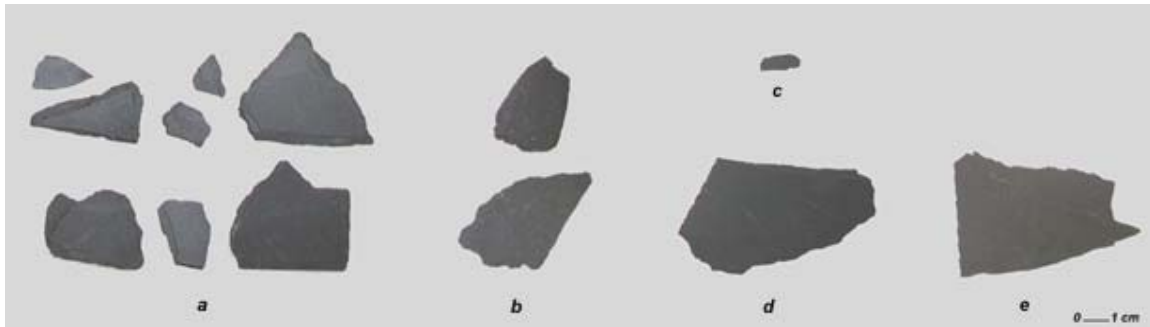


Figure 5.69: Slate fragments: *a* from historic house platform M-17, TU 7 surface; *b* from feature M-17 surface, elsewhere on the platform; *c* from TU 7 Layer I level 2; *d* from TU 7 Layer I level 1 or level 2; *e* from the surface of historic house platform E-93.

Two fragments of leather were found on the surface at historic house complex P-12. The first piece is 6 cm long, 1.9 cm wide, and perforated. The second piece consists of two leather strips, 3.4 cm long and 1.9 cm wide, and 2.5 cm long and 1.9 cm wide, rusted together with a metal snap. Both are pieces of a horse rein.

Rubber strips were found at historic house platform M-17. Two pieces were recovered from the surface at TU 7 and three pieces were collected from the surface elsewhere on the platform. One strip was found during excavation of TU 7 in Layer I level 1. Rubber strips identical to these are still utilized by those who frequent the valley today. The strips are an ideal fastening material, used to tie bamboo poles together to construct a frame upon which tarps are set up for camping.

Two tiny bits of plastic were found during excavation of TU 1 at *lo'i* terrace E-48. Both are black and thin. The first piece was collected from Layer I level 2. It is flat and measures 1.2 cm long and 0.4 cm wide. The second piece measures 2 cm long and 1 cm wide and is slightly rounded, as if it came from a plastic pipe.

Two fragments of chert were recovered from Ku'e Central. They are included in the discussion of historic material because at least one fragment is non-Hawaiian in origin. This piece was collected from Layer I of TR 37,



Figure 5.70: Non-local chert from *lo'i* terrace C-9.

excavated at *lo'i* terrace C-9. It resembles plastic in appearance (Figure 5.70), but does not burn when exposed to an open flame. The second fragment may or may not be from a Hawaiian source. It was recovered from Layer I level 2 of TU 26, excavated at terrace C-6. Neither piece exhibits signs of retouch or use wear.

Discussion of Historic Material

The data discussed above indicate that diagnostic historic artifacts were found at house complex P-8, house complex P-12, on the slope in Pawa'a not associated with a feature, house platform M-17, house platform E-93, *lo'i* terraces L-1 and L-2, *'auwai* H-5, and *lo'i* terrace H-50. Figure 5.71–Figure 5.77 show the ages of dated historic material from each feature.

Four items from feature P-8 were diagnostic (Figure 5.71). These dated from the mid-1800s to the mid 1900s.

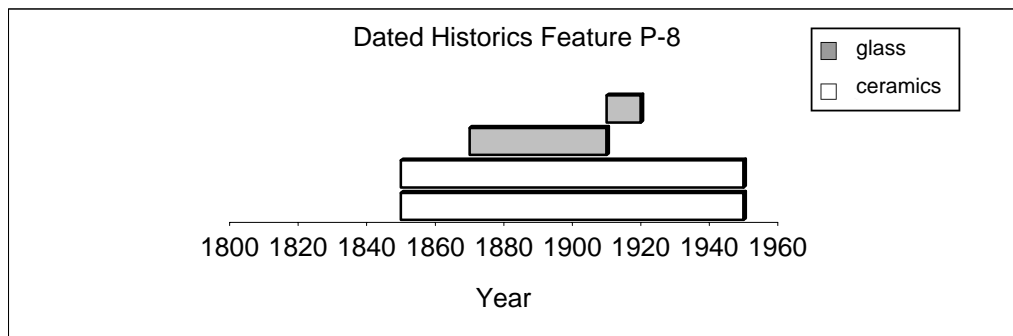


Figure 5.71: Date ranges of diagnostic historic artifacts from house complex P-8.

From feature P-12, 11 items were diagnostic (Figure 5.72). These appear to represent two periods of use: the first around the turn of the Twentieth Century, reflected by ceramics, glass, and metal, and the second around 1960, represented by two beverage containers. The first period of use probably represents the main occupation of the complex, while the second likely results from short-term use of the area, perhaps as a picnic or resting spot.

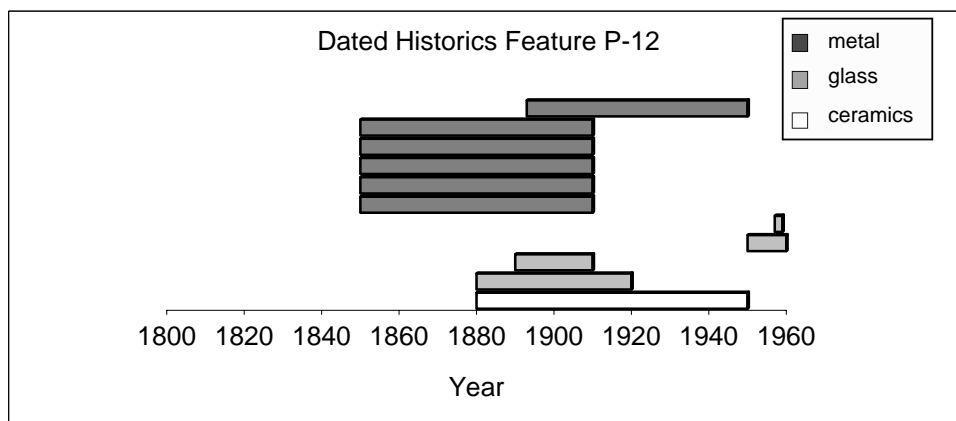


Figure 5.72: Date ranges of diagnostic historic artifacts from house complex P-12.

Various items were strewn along the slope of the Pawa'a survey area, not associated with a particular feature. Eight of these were diagnostic, and likely represent a period of use from the late 1800s to early 1900s (Figure 5.73).

A total of 27 diagnostic historic items were recovered from the surface and excavation of feature M-17 (Figure 5.74). The date ranges of most artifacts overlap from

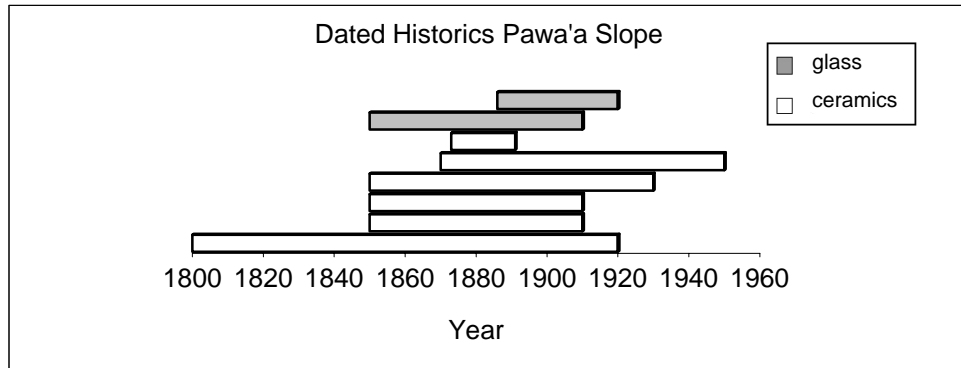


Figure 5.73: Date ranges of diagnostic historic artifacts from the Pawa'a slope.

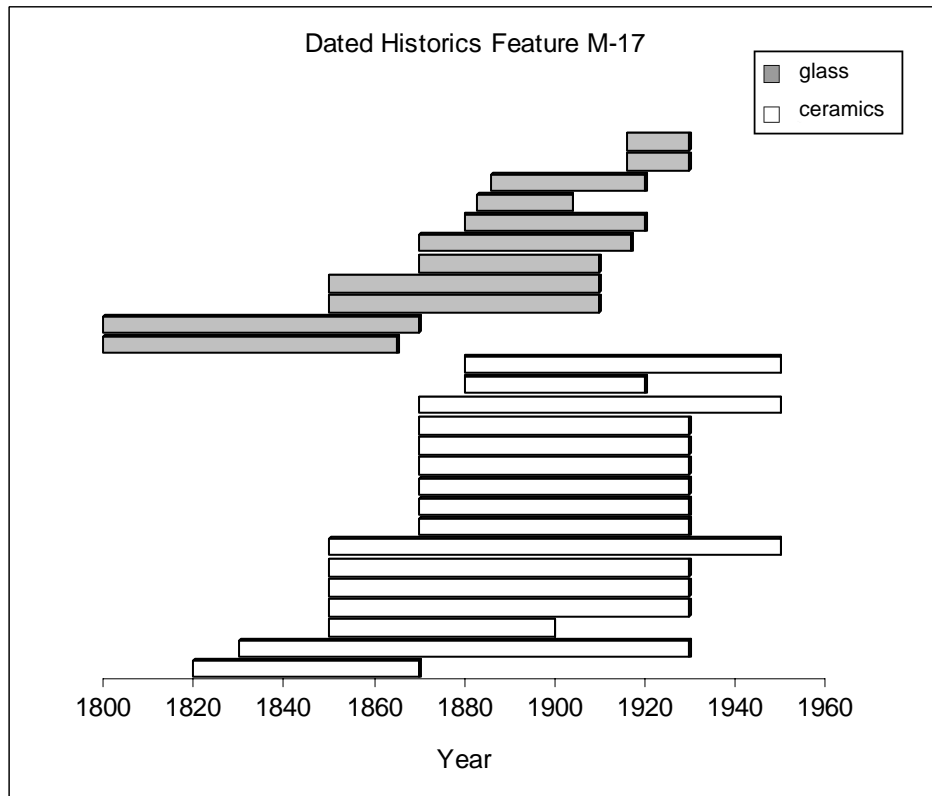


Figure 5.74: Date ranges of diagnostic historic artifacts from house platform M-17.

ca. 1880 to 1900, with a few pieces dating to earlier or later than this time. This could mean that the house was occupied for a long span of time, from the early 1800s to the early 1900s, with a peak period of use at the end of the Nineteenth Century.

Five diagnostic ceramic sherds were found at historic house platform E-93 (Figure 5.75). Date ranges for these overlap around 1880, and this was probably the peak period of use for this structure.

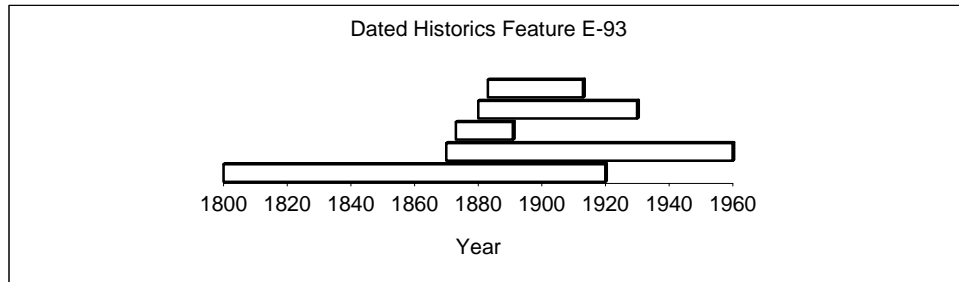


Figure 5.75: Date ranges of diagnostic ceramics from historic house platform E-93.

Diagnostic items from Halepoki consist of a modern ceramic plate from ‘auwai H-5 and sherds from at least two ceramic vessels from terrace H-50 (Figure 5.76). These latter items indicate probable use of the area around the turn of the Twentieth Century. The modern plate likely represents a random discard event, and not another period of use for the terraces.

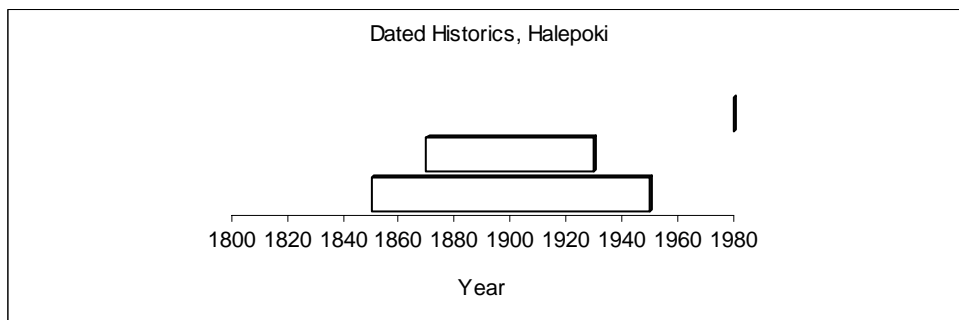


Figure 5.76: Date ranges of diagnostic ceramics from Halepoki Makai.

Only two diagnostic historic items were recovered from Lahokea: part of a bottle base from within the wall of *lo‘i* terrace L-1 and a ceramic button from the excavation of *lo‘i* terrace L-2. They indicate a probable period of use from the mid to late 1800s (Figure 5.77).

In sum, Wailau’s historic features show a peak period of use around the turn of the Twentieth Century. This is consistent with historic accounts that portray a thriving taro industry before abandonment of the valley in the 1930s (see Chapter 1).

A variety of domestic items were used in Wailau, including tableware, bakeware, food and beverage containers, buttons, doorknobs, lamps, and slate chalkboards. In all

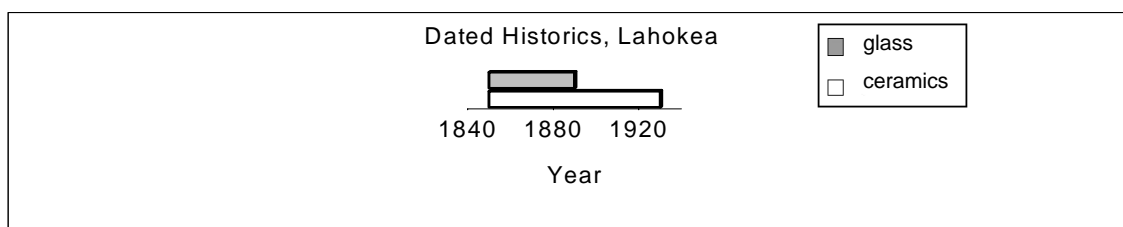


Figure 5.77: Date ranges of diagnostic historic artifacts from *lo'i* terraces L-1 and L-2.

parts of the valley, glass assemblages were dominated by alcohol bottles. Many of the ceramic dishes were large serving vessels or soup plates, and these vessel forms would have been well-suited for traditional Hawaiian foods and the traditional style of communal serving.

Ceramics were imported largely from England or America, with a few imports from China and Japan, possibly representing a multi-ethnic community, or at the very least a community with multiple ethnic influences. Curiously, no Asian ceramics were recovered from historic house platform M-17, which yielded the largest assemblage of ceramics by far.

An interesting connection was made between Pawa'a and the Eliali'i historic house (feature E-93), with sherds of identical Chinese and English vessels recovered. It is possible that these items were shipped into the valley as a set and purchased separately by the two households, or the connection might represent sharing between different parts of the valley.

Metal and leather harness and rein parts and a metal bit indicate that domestic animals were being used in the valley, probably as pack animals. This is consistent with historic accounts that mention donkeys in Wailau (Handy and Handy 1972:519).

Historic artifacts were conspicuously absent from house platform P-19, which is clearly post-contact in age, with its mortared construction. The reason for this absence remains a mystery.

Midden

Table 5.3: Midden Data

Unit	Depth**	Count	Weight (g)	Material
TU 7	I/1	1	0.2	unidentified
TU 7	I/1	14	0.7	<i>hihiwai</i> shell
TU 7	I/2	4	0.1	<i>hihiwai</i> shell
TU 12	I/2	1	0.2	<i>hihiwai</i> shell
TU 17	I	3	0.3	<i>hihiwai</i> shell
TU 26	I/2	1	0.1	animal bone
TR 26	I	1	0.1	marine shell

Midden remains consisted of *hihiwai* (*Neritina granosa*) shell, an unidentified animal bone fragment, an unidentified marine shell fragment, and a tiny fragment of unidentified bone or shell (Table 5.3). The *hihiwai* was very deteriorated, with only the black bumpy outer covering of the shell remaining.

Hihiwai were found throughout the valley in excavation: in Keiu at the *ahupua'a*

** Layer/level

boundary wall (TU 12, feature K-11), in Makea at historic house platform M-17 (TU 7), and in Lahokea at 'auwai L-25 (TU 17). *Hihiwai* is a freshwater gastropod closely related to the *hapawai*, *hūwai*, *wī*, and *pipipi*. The *hūwai* is most similar to the *hihiwai* and differs only in size and color, and *wī* is referred to as *hihiwai* in some localities (Titcomb 1978:338). *Hihiwai* was eaten raw and salted, often with poi, or cooked in ti leaf or in hot water for easier extraction from the shell (Titcomb 1978:338). Wailau is noted for its *hihiwai* in song (e.g., *E Hihiwai* by Dennis Kamakahi) and is one of the last places in Hawai'i where *hihiwai* are still found in abundance.

Botanics and Charcoal

Botanics consisted of *kukui* nutshell and unidentified seed pods. Partially burned *kukui* nutshell was recovered from Layer I level 1 and Layer II level 1 of the TU 7 excavation at historic house platform M-17. Unburned *kukui* nutshell was common in the upper layers of almost every excavation, and samples were collected from TR 14 in Pawa'a, TU 26 in Ku'eale, TU 6, TU 7, and TR 6 in Makea, TR 18 and TR 21 in Kukuinui, TU 1 and TU 5 in Eliali'i, and TR 32 and TR 34 in Halepoki. Many of these samples were collected from beneath the wall foundation stones. The deepest unburned *kukui* nutshell was found in TU 5 at *heiau* E-1 between 100 and 110 cmbd. Traditionally, *kukui* nut was most commonly eaten as a relish and used as fuel for lamps, and the nutshell was used in dyes. *Kukui* nut was also used in fishing to clear the surface of the water and as bait, for preserving fish after catching them, as offerings within *kapa* bundles left at fishing shrines, to grease the sled runners or track of a *holua* slide, and as medicine (Handy and Handy 1991; Kirch 1985; Krauss 1993). It cannot be determined if the nutshells found in excavation were utilized in any way. It is likely that they were naturally deposited, as *kukui* grows

Table 5.4: Excavated Charcoal Weight

Area	Unit	Weight (g)
Keiu	TU 12	1.6
	TU 13	25.0
	TR 15	0
Pawa'a	TU 14	1.2
	TU 15	0.5
	TU 20	0.4
	TR 12	tr.
	TR 13	2.3
	TR 14	tr.
Ku'eale - Coastal Central	TU 25	11.7
	TU 26	118.5
	TU 27	83.3
	TR 16	0.1
	TR 37	0.2
	TR 38	14.6
Ku'eale - Coastal West	TU 21	0
	TU 22	32.8
	TU 23	3.5
	TR 1	0
	TR 2	0.5
	TR 3	0.2
Makea Lowland	TR 4	0
	TU 6	4.2
	TU 8	4.6
	TU 9	12.7
	TU 10	15.4
	TU 11	7.5
	TR 5	3.6
	TR 8	tr.
	TR 9	6.4
	TR 10	0.3
	TR 11	1.1
Makea Slope	TU 7	265.6
	TU 24	2.6
	TR 6	0.1
	TR 7	1.0
	TR 17	0.1
Kukuinui	TR 18	1.5
	TR 19	0.1
	TR 20	tr.

throughout the valley. The unidentified seed pods are five tiny specimens that together weigh 0.3 g. They were recovered from *lo'i* terrace M-2 in the TU 6 excavation in Layer I level 2. The seeds are black and possibly burned, but their small size makes it difficult to confirm burning.

Charcoal was collected from almost every unit (Table 5.4). An interesting occurrence in the excavations was anaerobically-blackened basalt that mimicked wood charcoal in color, texture, and weight (see Chapter 4). The eroding basalt is impossible to distinguish from wood charcoal without magnification, and it was not determined how much of the charcoal collected is this basalt. In the field, the pseudo-charcoal could only be recognized when attached to the red non-blackened parts of the rock, and these were more abundant toward the base of the excavations. In an attempt to control this problem, samples suspected to contain the blackened basalt were immersed in water in the laboratory and any matter that did not float was discarded. Of the 46 samples submitted for wood taxa identification, one contained the pseudo-charcoal, so apparently some of this material does float. Therefore it is uncertain to what extent basalt affects the charcoal weights presented in this chapter.

Table 5.4 shows the weight of charcoal collected from the excavation units, not adjusted for unit size and depth. TU 7, excavated at historic house platform M-17, produced the most charcoal by far. The habitation function of this feature clearly affected the amount of charcoal present. TU 26, excavated at terrace C-6 also produced an abundance of charcoal, supporting a non-*lo'i* function for this terrace.

Wood Taxa Identification

The main purpose of identifying the taxa of wood charcoal is to select short-lived species for radiocarbon dating. The heart-wood of large trees can produce dates that are significantly older than the date in which the tree was burned. Selecting short-lived woods for dating reduces the effects of this problem, known as in-built age, or the old wood problem. Wood taxa identification also provides clues as to what the natural vegetation of Wailau was like before the valley was cultivated.

A total of 46 charcoal samples were submitted for identification. Four samples could not be identified because the charcoal fragments were too small, and one sample

Table 5.4 Excavated Charcoal Weight (continued)

Area	Unit	Weight (g)
Kukuinui (cont.)	TR 21	tr.
	TR 22	tr.
	TR 23	1.9
	TR 24	2.5
	TR 25	0.1
Lower Eliali'i	TU 5	3.8
	TU 19	5.3
Upper Eliali'i	TU 1	26.5
	TU 2	8.1
	TU 3	6.9
	TU 4	27.5
	TR 26	1.3
	TR 27	tr.
Halepoki	TR 28	0.3
	TR 29	1.8
	TR 30	25.6
	TR 31	7.4
	TR 32	0.1
	TR 33	0.1
	TR 34	tr.
	TR 35	0
Lahokea	TU 16	30
	TU 18	37.3
	TU 17	0.8
Palaloea	TU 28	37.9.
	TR 36	tr.

was not identified because it was composed entirely of decayed basalt and did not contain any wood charcoal. Therefore 41 samples were identified: two from Keiu, four from Pawa‘a, five from Ku‘ele, nine from Makea, three from Kukuinui, seven from Eliali‘i, six from Halepoki, three from Lahokea, and two from Palaloo (Table 5.5). Only two hearths were found, and all other charcoal was scattered throughout the excavated deposits. It is likely that much of this charcoal resulted from burning the native forest in an effort to clear the area before constructing the agricultural terraces.

Samples were selected for identification based on 1) context (first priority to charcoal found within hearths and directly under wall foundation stones; second priority to charcoal from a lower depth than the base of a wall but not directly under the foundation stones); and 2) location (with the goal of sampling from each of the nine land divisions that were excavated). All samples came from the excavation of *lo‘i* terraces, except bags 30 and 209, which were from possibly non-*lo‘i* terraces, bag 32 from the *heiau*, and bags 244 and 367 which were from hearth features. The hearths yielded the greatest diversity of taxa, with 12 different taxa from the Ku‘ele hearth and nine different taxa from the Palaloo hearth.

The 41 charcoal samples were typically very small, most weighing a fraction of a gram. A diverse array of plants were identified for such small samples. A total of 25 taxa were identifiable to genus or species, two specimens could only be identified as a monocot, and six taxa were unidentifiable. Four of the six unidentifiable taxa were found in multiple samples: “Unknown 1” was found in both Pawa‘a and Makea; “Unknown 3” was found in Makea and Eliali‘i; “Unknown 4” was found in Keiu and Makea; and “Unknown 5” was found in Keiu and Halepoki. Of the 25 taxa identified to genus or species, 15 are native plants, five are Polynesian introductions, two are historic introductions, and three could have been either native or introduced. Eight samples were from plant parts other than wood: two were unidentified bark; two were *kukui* nutshell; one was an unidentified seed coat; one was an unidentified vine; one was a monocot stem; and one was an unidentified parenchyma. Parenchyma refers to the cellular tissue of non-woody structures of a plant, such as the leaves, roots, bark, or stems. This particular parenchyma was arc-shaped, as if it encased a cylinder, and was probably the outer part of a stem.

Kukui and *kōpiko* were the most commonly occurring, each found in 14 samples. *Kukui* was found in all land divisions except Palaloo. *Kukui* wood was sometimes fashioned into troughs or canoe gunwales and seats in traditional Hawai‘i, but was more often used in house posts and as firewood (Bohm 2004; Krauss 1993). *Kōpiko* was found in every land division except Lahokea. *Kōpiko* wood was previously used as firewood and to make *kapa* logs (Malo 1951). ‘*Ōhi‘a lehua* was represented in nine samples from Ku‘ele, Makea, Kukuinui, Halepoki, and Palaloo. The hard wood of the ‘*ōhi‘a lehua* was used in ritual, for carving images, as temple posts and palisades, for canoe spreaders and gunwales, and in musical instruments, while flowers were sewn into *lei* for offerings (Kolb and Murakami 1994; Krauss 1993). ‘*Ōlapa* was found in five samples from Keiu, Makea, Kukuinui, and Halepoki. ‘*Ōlapa* leaves were used in *lei*, and the fruit, leaves, and bark were made into a bluish-black dye (Krauss 1993). ‘*Ahakea* was found in five samples

Table 5.5: Wood Taxa Identification

Study Area	Feature	Unit	Bag	Relationship to Feature	Depth ***	Taxa	Common/ Hawaiian Name	Origin/Habit	Part	Date
Keiu	K-11	TU 12	111	Below ahupua'a boundary wall	I/3	cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	√
						Unknown 4			Wood	
						cf. <i>Cheirodendron trigynum</i>	<i>‘Ōlapa</i>	Native/Tree	Wood	
						Unknown 5			Wood	
						cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
			112	Below ahupua'a boundary wall	I/4	cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
		TR 15	275	Directly under wall	30 cmbs	Not analyzed – sample too small				
Pawa'a	P-1	TR 14	184	Directly under wall	42 cmbs	Not identified			Parenchyma Stem	√
						<i>Monocotyledonae</i>				
	P-2	TU 14	127	Directly under wall	23 cmbd	cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
						cf. <i>Monocotyledonae</i>			Wood	
	P-6	TU 15	130	Directly under wall	35 cmbd	cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	√
			131	Directly under wall	45 cmbd	Unknown 1			Wood	
Ku'ele Central	C-6	TU 26	209	Directly under wall	31 cmbd	cf. <i>Pittosporum</i> sp.	<i>Hō'awa</i>	Native/Shrub-Tree	Wood	√
						cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
						cf. <i>Metrosideros polymorpha</i>	<i>‘Ōhi'a lehua</i>	Native/Tree	Wood	

*** Layer/level for charcoal collected from screen; cmbs or cmbd for charcoal collected from directly under walls

Table 5.5: Wood Taxa Identification (continued)

Study Area	Feature	Unit	Bag	Relationship to Feature	Depth***	Taxa	Common/ Hawaiian Name	Origin/Habit	Part	Date
Ku‘ele Central (cont.)	C-6 (cont.)	TR 16	284	Directly under wall	43 cmbs	cf. <i>Antidesma pulvinatum</i>	<i>Hame</i>	Native/Tree	Wood	✓
						cf. <i>Artocarpus altilis</i>	‘ <i>Ulu</i>	Polynesian Introduction/Tree	Wood	
	cf. <i>Psychotria</i> sp.					<i>Kōpiko</i>	Native/Shrub-Tree	Wood		
	cf. <i>Psychotria</i> sp.					<i>Kōpiko</i>	Native/Shrub-Tree	Wood		
Ku‘ele West	C-18 hearth	TU 22	244	Base of hearth	1/2	cf. <i>Metrosideros polymorpha</i>	‘ <i>Ōhi‘a lehua</i>	Native/Tree	Wood	✓
						cf. <i>Pittosporum</i> sp.	<i>Hō‘awa</i>	Native/Shrub-Tree	Wood	
						<i>Cordyline fruticosa</i>	<i>Kī, ti</i>	Polynesian Introduction/ Shrub	Wood	
						<i>Diospyros sandwicensis</i>	<i>Lama</i>	Native/Tree	Wood	
						cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	
						cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
						<i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/ Tree	Nutshell	
						cf. <i>Cocos nucifera</i>	<i>Niu</i> , coconut	Polynesian Introduction/Tree	Wood	
						cf. <i>Bobea</i> sp.	‘ <i>Ahakea</i>	Native/Tree	Wood	
						Unknown 6			Wood	
						<i>Chamaesyce</i> sp.	‘ <i>Akoko</i>	Native/Shrub	Wood	
						cf. <i>Perrottetia sandwicensis</i>	<i>Olomea</i>	Native/Tree	Wood	
						cf. <i>Calophyllum inophyllum</i>	<i>Kamani</i>	Polynesian Introduction/Tree	Wood	

*** Layer/level for charcoal collected from screen; cmbs or cmbd for charcoal collected from directly under walls

Table 5.5: Wood Taxa Identification (continued)

Study Area	Feature	Unit	Bag	Relationship to Feature	Depth ***	Taxa	Common/ Hawaiian Name	Origin/Habit	Part	Date
Ku‘ele West (cont.)	C-21	TU 23	260	Below wall	I/5	cf. <i>Hibiscus</i> sp.		Native+ Introductions/ Shrub	Wood	
	C-34	TR 2	161	Directly under wall	19 cmbs	<i>Metrosideros polymorpha</i>	‘Ōhi‘a lehua	Native/Tree	Wood	
						cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	✓
						<i>Syzygium</i> sp.	‘Ōhi‘a hā, Java plum, rose apple, mountain apple, etc.	Native + Historic & Polynesian Introductions/Tree	Wood	
						cf. <i>Rauvolfia sandwicensis</i>	<i>Hao</i>	Native/Tree	Wood	
Makea Lowland						cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
	M-2	TU 6	47	Below wall	I/6	cf. <i>Metrosideros polymorpha</i>	‘Ōhi‘a lehua	Native/Tree	Wood	
						Unknown 1			Wood	
		TU 8	59	Below wall	I/7	cf. <i>Cheirodendron trigynum</i>	‘Ōlapa	Native/Tree	Wood	
	M-8	TR 9	271	Directly under wall	52 cmbs	Not analyzed – sample too small				
	M-9	TU 9	86	Below wall	I/7	Unknown 3			Wood	
						cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	
		TR 8	178	Below wall	I	cf. <i>Pouteria sandwicensis</i>	‘Āla‘a	Native/Shrub-Tree	Wood	✓
						Unknown 4				
	M-10	TU 11	107	Below wall	I/7	Not identified			Bark	
						cf. <i>Rhizophora mangle</i>	American or red mangrove	Historic Introduction/ Shrub-Tree	Wood	

*** Layer/level for charcoal collected from screen; cmbs or cmbd for charcoal collected from directly under walls

Table 5.5: Wood Taxa Identification (continued)

Study Area	Feature	Unit	Bag	Relationship to Feature	Depth***	Taxa	Common/ Hawaiian Name	Origin/Habit	Part	Date
Makea Lowland (cont.)	M-13	TU 10	100	Below wall	II/1	cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	
						cf. <i>Cheirodendron trigynum</i>	<i>‘Ōlapa</i>	Native/Tree	Wood	
			101	Below wall	II/2	cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
						cf. <i>Metrosideros polymorpha</i>	<i>‘Ōhi‘a lehua</i>	Native/Tree	Wood	
Makea Slope	M-22	TR 17	213	Directly under wall	18 cmbs	cf. <i>Senna</i> sp.	<i>Kolomona</i>	Native+Historic Introduction/Tree	Wood	
						<i>Metrosideros polymorpha</i>	<i>‘Ōhi‘a lehua</i>	Native/Tree	Wood	
	M-24	TR 6	262	Directly under wall	16 cmbs	Unidentified			cf. vine	√
Kukuinui	KU-8	TR 23	304	Directly under wall	30 cmbs	cf. <i>Metrosideros polymorpha</i>	<i>‘Ōhi‘a lehua</i>	Native/Tree	Wood	
						cf. <i>Cheirodendron trigynum</i>	<i>‘Ōlapa</i>	Native/Tree	Wood	
	KU-5	TR 19	215	Directly under wall	18 cmbs	cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
	N/A	TR 25	225	Directly under wall	25 cmbs	cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	√
Upper Eliali‘i	E-33	TU 2	7	Directly under wall	55-65 cmbd	cf. <i>Dodonaea viscosa</i>	<i>A‘ali‘i</i>	Native/Shrub	Wood	√
	E-48	TU 1	8	Directly under wall	68 cmbd	cf. <i>Ochrosia compta</i>	<i>Hōlei</i>	Native/Tree	Wood	
	E-78	TR 26	310	Directly under wall	23 cmbs	Not analyzed – sample too small				

*** Layer/level for charcoal collected from screen; cmbs or cmbd for charcoal collected from directly under walls

Table 5.5: Wood Taxa Identification (continued)

Study Area	Feature	Unit	Bag	Relationship to Feature	Depth ***	Taxa	Common/ Hawaiian Name	Origin/Habit	Part	Date
Upper Eliali‘i (cont.)	E-89	TU 4	30	Charcoal concentration	32 cmbd	cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	✓
	E-91	TU 3	24	Directly under wall	38.5 cmbd	Not charcoal				
			25	Below wall	I/4	<i>Syzygium</i> sp.	‘Ōhi‘a hā, Java plum, rose apple, mountain apple, etc.	Native /Historic & Polynesian Introductions/Tree	Wood	
						cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
Lower Eliali‘i	E-1 heiau	TU 5	32	Within wall	I/3	cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
						<i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Nutshell	
			40	Below wall	II/3	cf. <i>Osteomeles anthyllidifolia</i>	‘Ūlei	Native/Shrub	Wood	✓
	E-23	TU 19	153	Directly under wall	I/4	cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	
						Unknown 3			Wood	
						cf. <i>Osteomeles anthyllidifolia</i>	‘Ūlei	Native/Shrub	Wood	
Halepoki Makai	H-20	TR 28	312	Directly under wall	6 cmbs	cf. <i>Scaevola</i> sp.	<i>Naupaka</i>	Native/Shrub	Wood	✓
						cf. <i>Metrosideros polymorpha</i>	‘Ōhi‘a lehua	Native/Tree	Wood	
						cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	
						Unknown 5			Wood	

*** Layer/level for charcoal collected from screen; cmbs or cmbd for charcoal collected from directly under walls

Table 5.5: Wood Taxa Identification (continued)

Study Area	Feature	Unit	Bag	Relationship to Feature	Depth ***	Taxa	Common/ Hawaiian Name	Origin/Habit	Part	Date
Halepoki Makai (cont.)	H-57	TR 30	235	Directly under wall	22 cmbs	cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	√
						cf. <i>Cheirodendron trigynum</i>	<i>‘Ōlapa</i>	Native/Tree	Wood	
Halepoki Central	N/A	TR 32	321	Directly under wall	3 cmbs	cf. <i>Bobea</i> sp.	<i>‘Ahakea</i>	Native/Tree	Wood	
						cf. <i>Antidesma pulvinatum</i>	<i>Hame</i>	Native/Tree	Wood	
						Not identified Not identified			cf. Bark cf. Seed Coat	√
Halepoki Mauka	N/A	TR 33	329	Directly under wall	6 cmbs	<i>Diospyros sandwicensis</i>	<i>Lama</i>	Native/Tree	Wood	
			328	Directly under wall	4 cmbs	cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	√
	N/A	TR 34	331	Directly under wall	15 cmbs	cf. <i>Bobea</i> sp.	<i>‘Ahakea</i>	Native/Tree	Wood	
						cf. <i>Rauvolfia sandwicensis</i>	<i>Hao</i>	Native/Tree	Wood	
Lahoeka	L-2	TU 18	148	Below wall	I/3	Unknown 2			Wood	
						cf. <i>Osteomeles anthyllidifolia</i>	<i>‘Ūlei</i>	Native/Shrub	Wood	√
						<i>Pinaceae</i>	Pine	Historic Introduction/Tree	Wood	
						cf. <i>Bobea</i> sp.	<i>‘Ahakea</i>	Native/Tree	Wood	

*** Layer/level for charcoal collected from screen; cmbs or cmbd for charcoal collected from directly under walls

Table 5.5: Wood Taxa Identification (continued)

Study Area	Feature	Unit	Bag	Relationship to Feature	Depth ***	Taxa	Common/ Hawaiian Name	Origin/Habit	Part	Date
Lahokea (cont.)	L-24	TU 16	145	Directly under wall	74-76 cmbd	cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
	L-25	TU 17	134	Directly under wall	48 cmbs	cf. <i>Aleurites moluccana</i>	<i>Kukui</i>	Polynesian Introduction/Tree	Wood	
Palaloa	N/A	TR 36	332	Directly under wall	60 cmbs	cf. <i>Perrottetia sandwicensis</i>	<i>Olomea</i>	Native/Tree	Wood	
			333	Below wall	I	Not analyzed – sample too small				
	N/A hearth	TU 28	367	Base of hearth	I/2	<i>Chamaesyce</i> sp.	<i>‘Akoko</i>	Native/Shrub	Wood	
						cf. <i>Metrosideros polymorpha</i>	<i>‘Ōhi‘a lehua</i>	Native/Tree	Wood	
						<i>Sida fallax</i>	<i>‘Ilima</i>	Native/Shrub	Wood	✓
						cf. <i>Bobea</i> sp.	<i>‘Ahakea</i>	Native/Tree	Wood	
						<i>Syzygium</i> sp.	<i>‘Ōhi‘a hā</i> , Java plum, rose apple, mountain apple, etc.	Native + Historic & Polynesian Introductions/Tree	Wood	
						cf. <i>Antidesma pulvinatum</i>	<i>Hame</i>	Native/Tree	Wood	
						<i>Diospyros sandwicensis</i>	<i>Lama</i>	Native/Tree	Wood	
						cf. <i>Pittosporum</i> sp.	<i>Hō‘awa</i>	Native/Shrub-Tree	Wood	
						cf. <i>Psychotria</i> sp.	<i>Kōpiko</i>	Native/Shrub-Tree	Wood	

*** Layer/level for charcoal collected from screen; cmbs or cmbd for charcoal collected from directly under walls

from Ku‘ele, Halepoki, Lahokea, and Palaloo. ‘*Ahakea* was the most favored wood for canoe gunwales, house doors, and door frames, and the ‘*ahakea* bark was used medicinally (Krauss 1993). ‘*Ulei* was found in three samples from Lower Eliali‘i and Lahokea. The berries of the ‘*ulei* were eaten, sewn into *lei*, and used to make lavender dye, and its hard wood used to produce fishing net frames, fishing spears, musical instruments, farming tools, and javelins and spears for sports such as *pahe‘e*, *moa*, *ō‘ō ihe*, and *kākā lā‘au* (Bohm 2004; Krauss 1993). Only on the island of Moloka‘i, ‘*ulei* was known as “*eluehe*” (Bohm 2004). *Hame* was found in three samples from Ku‘ele, Halepoki, and Palaloo. The fruit of the *hame* was made into a red to dark purple dye. *Hō‘awa* was represented in three samples from Ku‘ele and Palaloo. *Hō‘awa* wood was used to manufacture canoe gunwales. *Lama* was found in three samples from Ku‘ele, Halepoki, and Palaloo. *Lama* had many uses in ancient Hawai‘i (Krauss 1993). Fruit was eaten, wood was fashioned into fish traps and sacred structures within *heiau*. *Lama* wood was also crushed and used for medicinal purposes. *Syzygium* sp. (‘*ōhi‘a hā*, Java plum, rose apple, mountain apple, etc.) was found in three samples from Ku‘ele, Eliali‘i, and Palaloo. This could represent any of the species of *Syzygium*, which include native taxa, Polynesian introductions, and historic introductions. ‘*Akoko* was found in two samples from Ku‘ele and Palaloo. ‘*Akoko* sap was used as a paint or stain for canoe hulls in ancient Hawai‘i. *Olomea* was represented in two samples from Ku‘ele and Palaloo. *Olomea* was used for starting fires by rubbing it with the softer *hau* wood (Malo 1951; Rock 1974). *Hao* was found in two samples from Ku‘ele and Halepoki. No traditional uses for *hao* could be found.

The remaining taxa each occurred in a single sample. Native plants included ‘*a‘ali‘i*, *hōlei*, *naupaka*, and ‘*ilima*. These were all from Eliali‘i, except the ‘*ilima*, which was found in Palaloo. The fruit of the ‘*a‘ali‘i* was used for red dye, the leaves and fruit fashioned into *lei*, and the hard, heavy wood made into bait sticks and house posts (Bohm 2004; Krauss 1993). The wood of the *hōlei* was used in canoe gunwales, and the bark made into yellow dye (Krauss 1993). The berries of the *naupaka kahakai*, or beach *naupaka*, were sometimes eaten, while the fruit of the *naupaka kuahiwi*, or mountain *naupaka*, produced a purplish black dye (Krauss 1993). ‘*Ilima* flowers were made into *lei*, and the sap was used for medicinal purposes (Krauss 1993).

Polynesian introductions occurring in a single sample included ‘*ulu*, *kī*, *niu*, and *kamani*. The ‘*ulu* was found in central Ku‘ele, while the *kī*, *niu*, and *kamani* all came from hearth C-18 in western Ku‘ele. ‘*Ulu*, or breadfruit was eaten in ancient Hawai‘i. Its flowers were made into a yellow to brown dye and its wood was used to manufacture musical instruments. The game ‘*ulu maika* gets its name from the ‘*ulu*, whose wood was used for the first game pieces, later made of stone (Krauss 1993). *Kī*, or ti had many uses in ancient Hawai‘i (Krauss 1993). Leaves were used in medicine, in the preparation of *kapa*, as a wrapping for food, as thatching for houses, and were fashioned into raincoats, sandals, and toy whistles. Fibers were used in cordage, and roots were made into a stain for surfboards and canoe hulls and occasionally eaten. *Niu*, or coconut, was also a widely utilized plant in traditional times (Krauss 1993). The fruit was eaten, the leaves were used in basketry, thatching, and for game implements, fiber was used as fire kindling and for making cordage, and the mesh-like sheath found at the base of the leaves served as a

strainer. Coconut shells were made into utensils, containers, hula implements, and musical instruments, and coconut oil was used as a polish for wooden containers. *Kamani* also had many uses (Krauss 1993). Nuts were fashioned into whistles, nut oil was used as a polish for wooden containers and as a fuel for lamps. Flowers were used for scenting *kapa*, fruit husks were made into a brownish mauve dye, and wood was manufactured into bowls. Other taxa found within a single sample include *hibiscus*, found in *lo'i* terrace C-22, and *kolomona*, from *lo'i* terrace M-22. Both of these could represent either native or introduced plants.

Historically introduced taxa include mangrove, found in Makea, and pine, from Lahokea. These plants provide useful information for dating the features with which they are associated. Mangrove is a very recent introduction, brought to Hawai'i in the early Twentieth Century (Wagner et al. 1999), and this could indicate a recent age for terrace M-9. Since the mangrove was not collected from beneath the wall foundation, it cannot be argued that the sample predates the construction of the terrace (see Chapter 4). The other historic introduction was pine, found below the wall of *lo'i* terrace L-2. Even though it was historically introduced, the pine could have come to the valley during the pre-contact era as driftwood. Large logs often find their way to Hawai'i from the Pacific Northwest and elsewhere on the mainland U.S. If a large pine log washed ashore in Wailau, it may have been chopped into smaller pieces on the beach and then transported to inland locations in the valley, such as Lahokea, and ended up as fuel for a fire. Alternatively, the pine could have arrived during the historic era as lumber or in other forms.

Radiocarbon Dating

A total of 21 charcoal samples were submitted for AMS radiocarbon dating (Table 5.6). Of these one specimen did not produce enough carbon for accurate counting, and one specimen dissolved during pretreatment, thus only 19 dates were obtained. With the one date reported previously (McElroy 2004), this brings the total number of dates for Wailau Valley to 20. One dated sample came from the *ahupua'a* boundary wall at Keiu, two from the *lo'i* at Pawa'a, two from Ku'e Central, one from the Ku'e West hearth, one from the Ku'e West *lo'i* complex, two from the Makea *lo'i*, one from the *lo'i* at Kukuinui Mauka, two from the Upper Eliali'i *lo'i*, one from the Lower Eliali'i *heiau*, one from the Lower Eliali'i *lo'i*, one from each of the Halepoki *lo'i* complexes, one from the *lo'i* at Lahokea, and one from the Palaloe hearth. The previously reported date came from the Keiu *lo'i* system (McElroy 2004). These dates begin to illustrate the timing of *lo'i* cultivation in different parts of the valley.

Sample AA71544 came from TU 12 in Keiu. TU 12 was placed at the base of the *ahupua'a* boundary wall, feature K-11, and the sample was from scattered charcoal found at a depth lower than the wall foundation. The charcoal was identified as the native shrub-tree *kōpiko* and it returned a conventional radiocarbon age of 735 ± 61 BP, which calibrates to AD 1160–1400 (Figure 5.78).

Sample AA71121 came from TR 14, which was placed at the base of *lo'i* terrace P-1 in Pawa'a. The sample consisted of scattered charcoal collected from the face of the excavation, directly beneath the foundation stones of the terrace (see Figure 4.5). It

Table 5.6: Radiocarbon Laboratory Results, Arizona AMS Laboratory and Beta Analytic

Study Area	Lab No.	Material	Conventional C ₁₄ Age (BP)	C ₁₃ /C ₁₂ Ratio	2 sigma Calibration (Cal AD)
Keiu	AA71544	<i>Kōpiko</i>	735 ± 61	-26.4	1160–1400
Pawa‘a	AA71121	Unidentified Parenchyma	158 ± 35	-24.9	1660–1960
Pawa‘a	AA72161	<i>Kōpiko</i>	119 ± 33	-25.4	1670–1940
Ku‘ele Central	AA71546	<i>Hō‘awa</i>	219 ± 39	-25.9	1520–1960
Ku‘ele Central	AA71549	<i>Kōpiko</i>	646 ± 34	-26.6	1280–1400
Ku‘ele West	AA71547	<i>Kī</i>	204 ± 33	-25.1	1640–1960
Ku‘ele West	AA71122	<i>Kōpiko</i>	566 ± 37	-28.7	1300–1430
Makea Lowland	AA71543	<i>‘Ala‘a</i>	695 ± 42	-24.7	1220–1400
Makea Slope	AA71548	Unidentified Vine	Post-bomb	-31.5	Modern
Kukuinui	AA71541	<i>Kōpiko</i>	649 ± 45	-26.0	1270–1400
Lower Eliali‘i	AA70408	<i>Ūlei</i>	313 ± 46	-26.7	1460–1660
Lower Eliali‘i	Beta- 213276	<i>Naupaka</i>	790 ± 40	-26.3	1170–1290
Upper Eliali‘i	Beta- 213274	<i>A‘ali‘i</i>	730 ± 40	-27.7	1210–1390
Upper Eliali‘i	AA71545	<i>Kōpiko</i>	157 ± 58	-27.2	1650–1960
Halepoki Makai	AA71542	<i>Kōpiko</i>	Dissolved in pretreatment	N/A	N/A
Halepoki Makai	AA71542b	<i>Kōpiko</i>	672 ± 34	-26.4	1270–1400
Halepoki Central	AA71550	Unidentified Bark	450 ± 34	-28.0	1410–1610
Halepoki Mauka	AA72162	<i>Kukui</i>	91 ± 33	-25.2	1680–1940
Lahoeka	Beta- 213275	Pine	Not enough carbon	N/A	N/A
Lahoeka	Beta- 215407	<i>Ūlei</i>	190 ± 40	-23.9	1660–1960
Palaloa	AA71551	<i>‘Ilima</i>	283 ± 33	-27.3	1490–1800

consisted of unidentified parenchyma and returned a conventional radiocarbon age of 158 ± 35 BP, which calibrates to AD 1660–1960 (Figure 5.79).

Sample AA72161 came from TU 15, in *lo‘i* terrace P-6 in Pawa‘a. The sample came from scattered charcoal collected from directly under the foundation stones of the terrace wall. It consisted of the native shrub-tree *kōpiko* and returned a conventional radiocarbon age of 119 ± 33 BP, which calibrates to AD 1670–1940 (Figure 5.80).

Sample AA71546 came from TU 26, excavated within terrace C-6 in Ku‘ele Central. The sample came from scattered charcoal from directly under the foundation stones of the terrace (see Figure 4.13). It consisted of the native shrub-tree *hō‘awa* and returned a conventional radiocarbon age of 219 ± 39 BP, which calibrates to AD 1520–1960 (Figure 5.81).

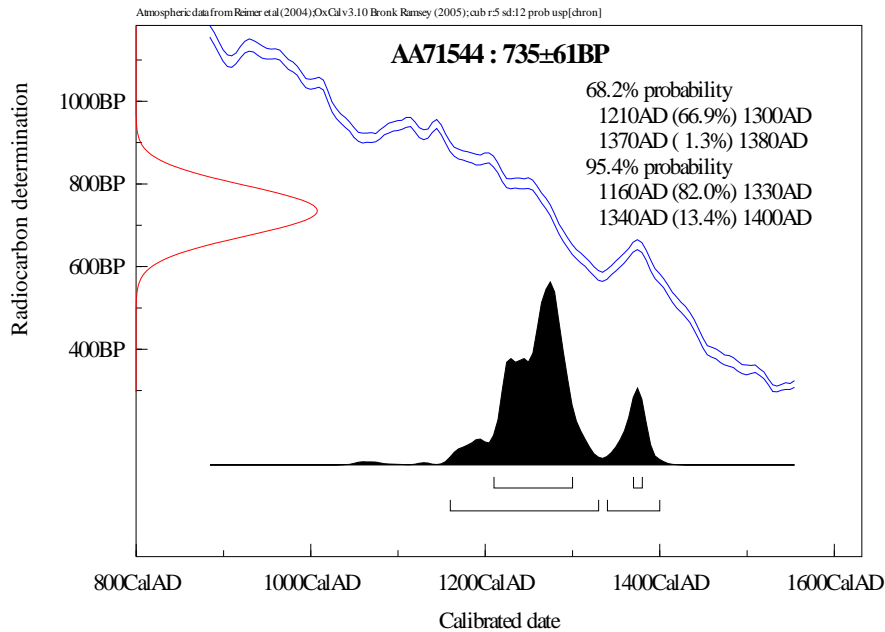


Figure 5.78: Calibrated radiocarbon age for sample AA71544.

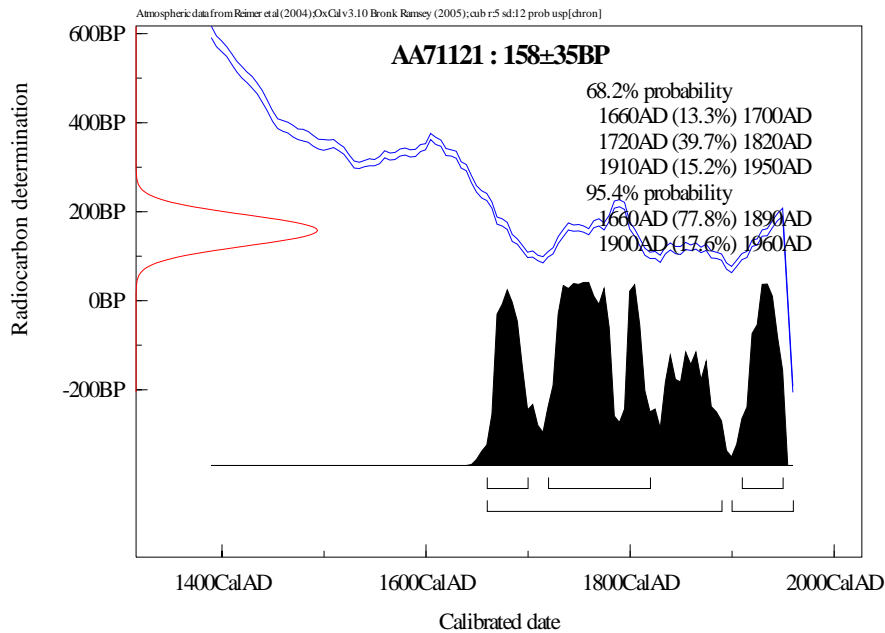


Figure 5.79: Calibrated radiocarbon age for sample AA71121.

Sample AA71549 was collected from TR 16, which was located within *lo'i* terrace C-9 in Ku'e Central. The unit was placed at the base of the terrace wall, and the sample came from scattered charcoal recovered from directly beneath the wall foundation stones (see Figure 4.16). The sample was identified as the native shrub-tree *kōpiko*. It

returned a conventional radiocarbon age of 646 ± 34 BP, which calibrates to AD 1280–1400 (Figure 5.82).

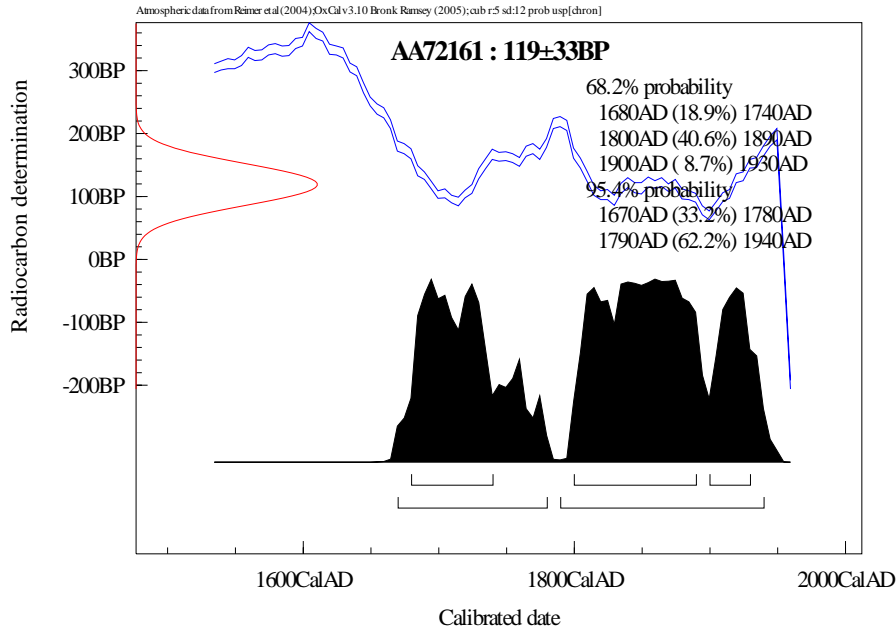


Figure 5.80: Calibrated radiocarbon age for sample AA72161.

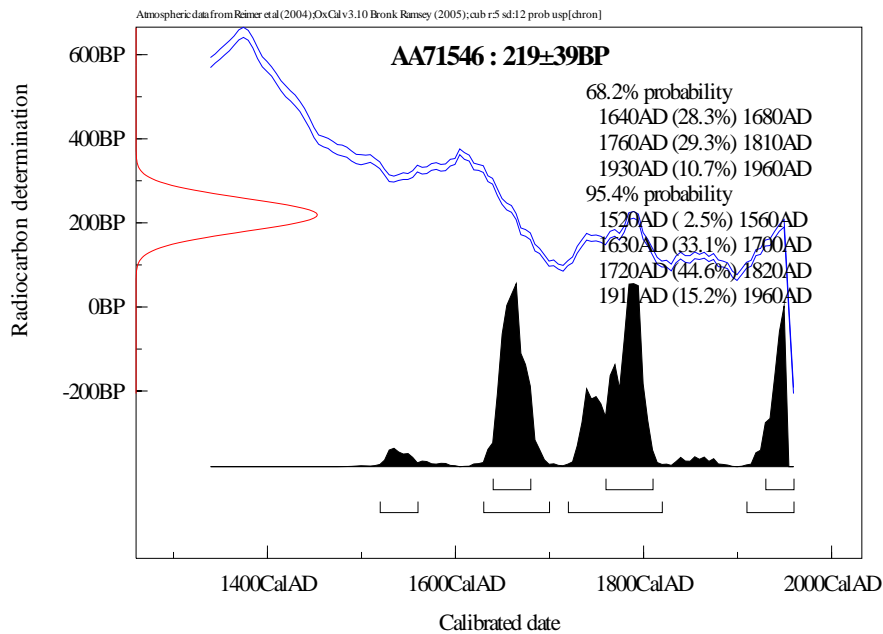


Figure 5.81: Calibrated radiocarbon age for sample AA71546.

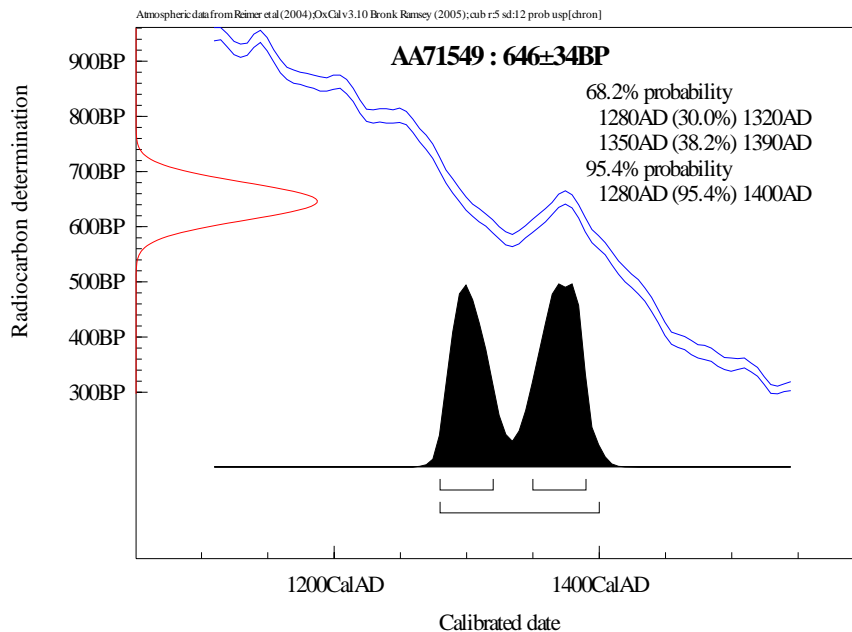


Figure 5.82: Calibrated radiocarbon age for sample AA71549.

Sample AA71547 came from TU 22 in Ku‘ele West. The unit bisected hearth feature C-18, and the sample was from charcoal found at the base of the feature. It was identified as the Polynesian-introduced shrub *kī*, commonly known as ti leaf. This sample returned a conventional radiocarbon age of 204 ± 33 BP, which calibrates to AD 1640–1960 (Figure 5.83).

Sample AA71122 was collected from TR 2 in the Ku‘ele West *lo‘i* system. The trench was placed at *lo‘i* terrace C-34, and the sample was from scattered charcoal found directly under the terrace foundation stones (see Figure 4.24). It was identified as the native shrub-tree *kōpiko* and returned a conventional radiocarbon age of 566 ± 37 BP, which calibrates to AD 1300–1430 (Figure 5.84).

Sample AA71543 came from TR 8, which was placed at the base of *lo‘i* terrace M-9 in Makea. The sample was collected from the lowest level of excavation, from 56-66 cmbd, at a depth lower than the wall foundation stones. It consisted of the native shrub ‘āla‘a and returned a conventional radiocarbon age of 695 ± 42 BP, which calibrates to AD 1220–1400 (Figure 5.85).

Sample AA71548 came from TR 6, excavated within terrace M-24 in the barrage *lo‘i* system in Makea. The sample came from scattered charcoal from directly under the foundation stones of the terrace (see Figure 4.39). It consisted of an unidentified vine fragment and returned a conventional radiocarbon age of post-bomb (modern).

Sample 71541 came from TR 25, which was placed within a *lo‘i* terrace located in Kukuinui Mauka, where feature numbers were not assigned (see Figure 4.48). The sample consisted of scattered charcoal collected from the face of the excavation, directly under the foundation stones of the terrace (see Figure 4.50). It consisted of the native

shrub-tree *kōpiko* and returned a conventional radiocarbon age of 649 ± 45 BP, which calibrates to AD 1270–1400 (Figure 5.86).

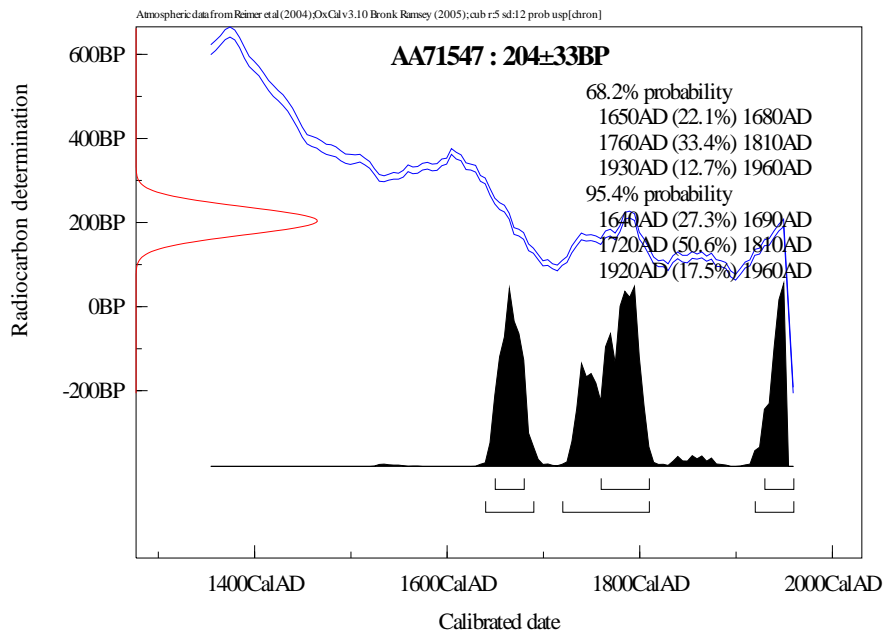


Figure 5.83: Calibrated radiocarbon age for sample AA71547.

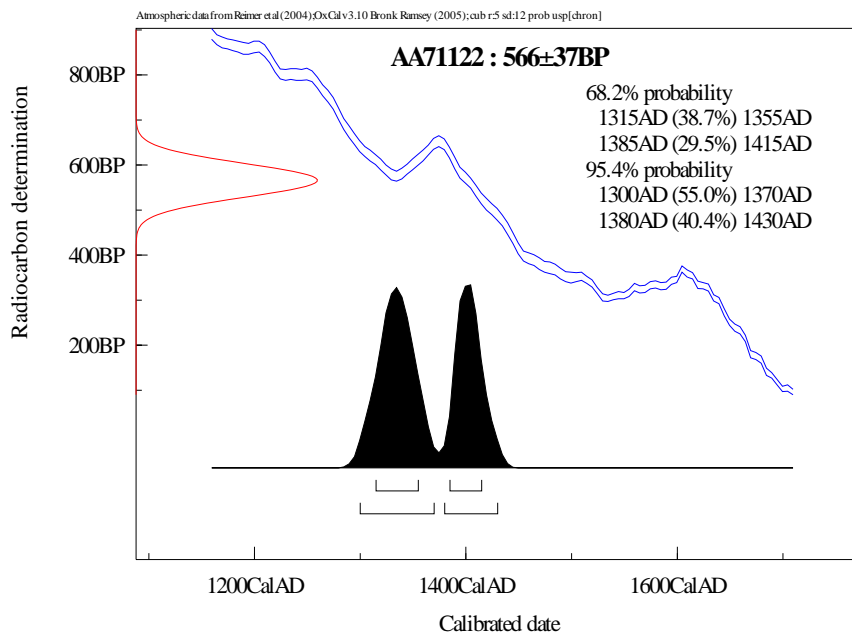


Figure 5.84: Calibrated radiocarbon age for sample AA71122.

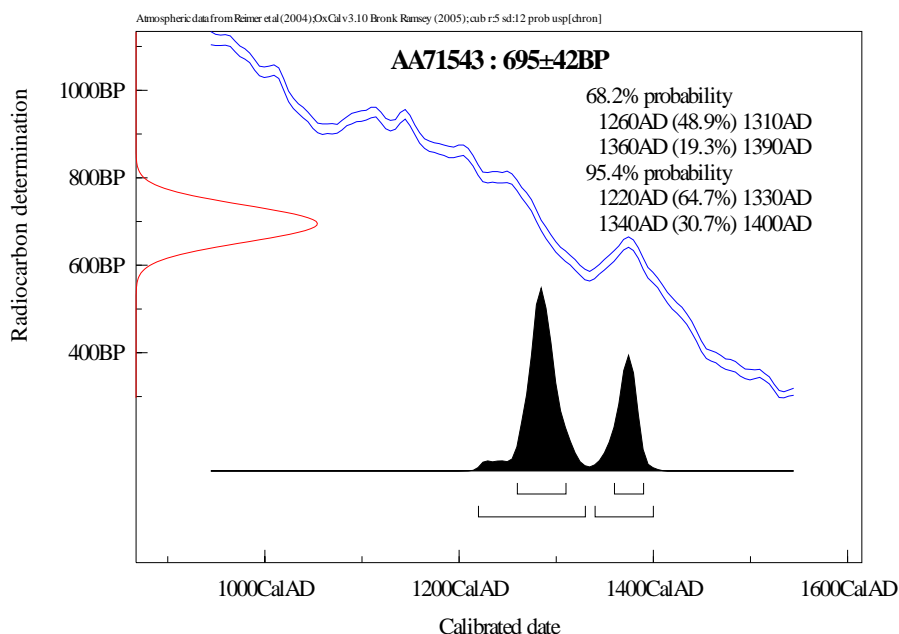


Figure 5.85: Calibrated radiocarbon age for sample AA71543.

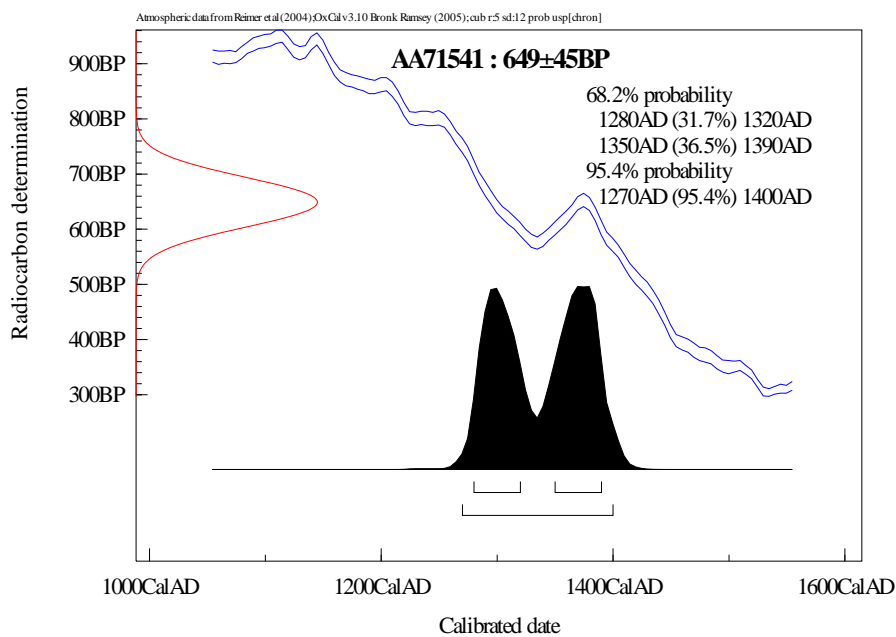


Figure 5.86: Calibrated radiocarbon age for sample AA71541.

Sample AA70408 was collected from TU 5, which was located just outside feature E-1, the Eliali'i *heiau*. The unit was placed at the base of the east wall of the *heiau*, and the sample came from scattered charcoal recovered from a level deeper than the wall foundation. The sample, identified as the native shrub 'ūlei, returned a

conventional radiocarbon age of 313 ± 46 BP. This calibrates to AD 1460–1660 (Figure 5.87).

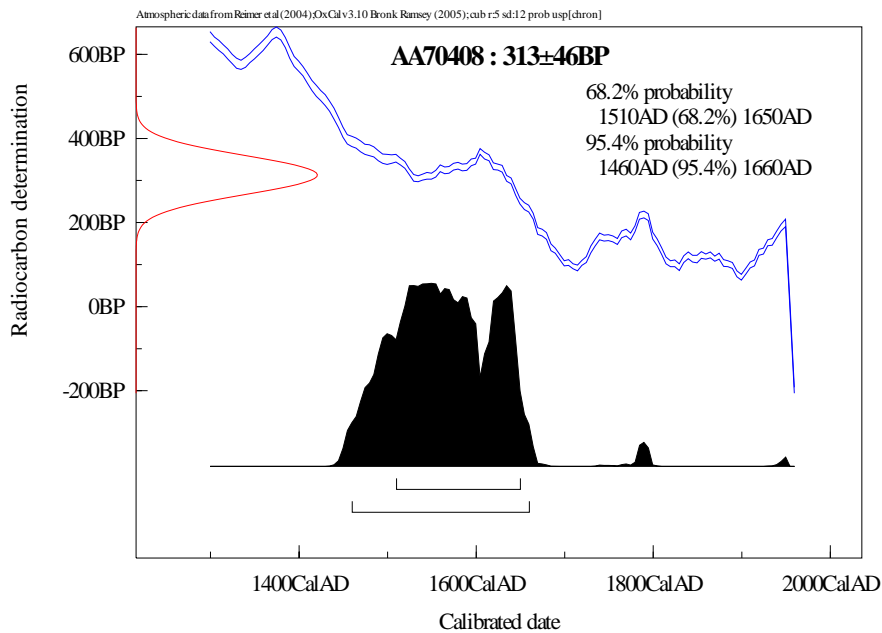


Figure 5.87: Calibrated radiocarbon age for sample AA70408.

Sample Beta-213276 came from TU 19, which was placed against the west wall of *lo'i* terrace E-23. The sample consisted of scattered charcoal collected from the face of the excavation, directly below the foundation stones of the terrace (see Figure 4.52). It returned a conventional radiocarbon age of 790 ± 40 , which calibrates to AD 1170–1290 (Figure 5.88).

Sample Beta-213274 came from TU 2, which was placed against the west wall of *lo'i* E-33, a terrace near the top of the Upper Eliali'i *lo'i* system. The sample consisted of scattered charcoal collected from the face of the excavation, directly below the foundation stones of the terrace (see Figure 4.56). It returned a conventional radiocarbon age of 730 ± 40 , which calibrates to AD 1210–1390 (Figure 5.89).

Sample AA71545 came from TU 4, which was located within terrace E-89 in Upper Eliali'i. The sample was collected from a charcoal concentration identified in the east face of the unit (see Figure 4.59). The charcoal consisted of the native shrub-tree *kōpiko*. It returned a conventional radiocarbon age of 157 ± 58 BP, which calibrates to AD 1650–1960 (Figure 5.90).

Samples AA71542 and AA71542b came from TR 30 in the Halepoki Makai *lo'i* complex. The former sample dissolved in pretreatment, and the latter sample was sent as a replacement. Both were fragments of *kōpiko* found directly under the wall foundation of *lo'i* terrace H-57 (see Figure 4.64). Sample AA71542b returned a conventional radiocarbon age of 672 ± 34 BP, which calibrates to AD 1270–1400 (Figure 5.91).

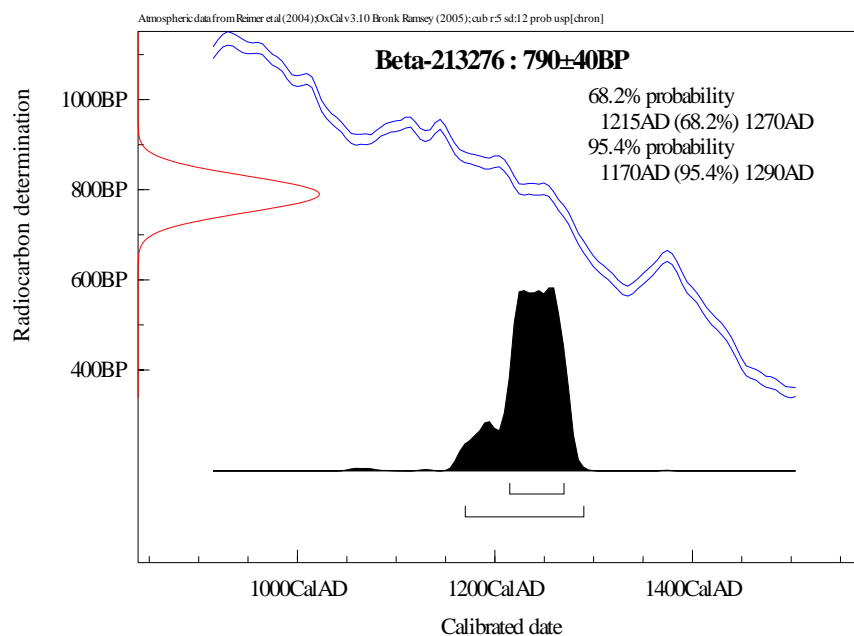


Figure 5.88: Calibrated radiocarbon age for sample Beta-213276.

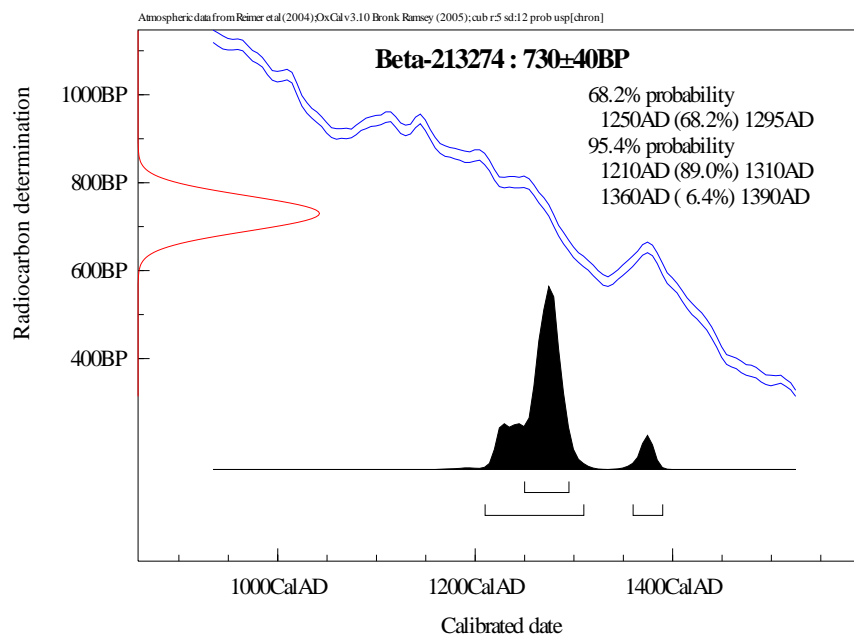


Figure 5.89: Calibrated radiocarbon age for sample Beta-213274.

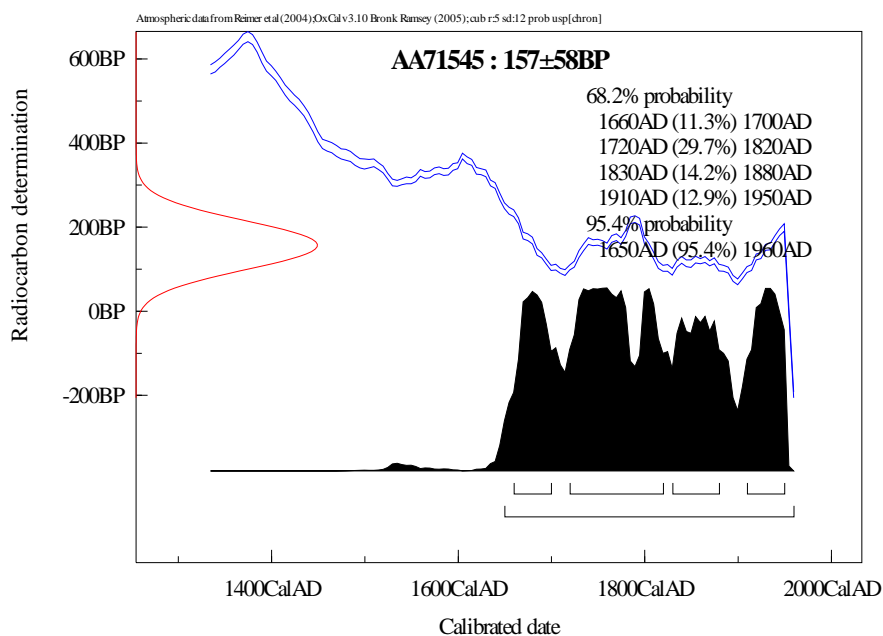


Figure 5.90: Calibrated radiocarbon age for sample AA71545.

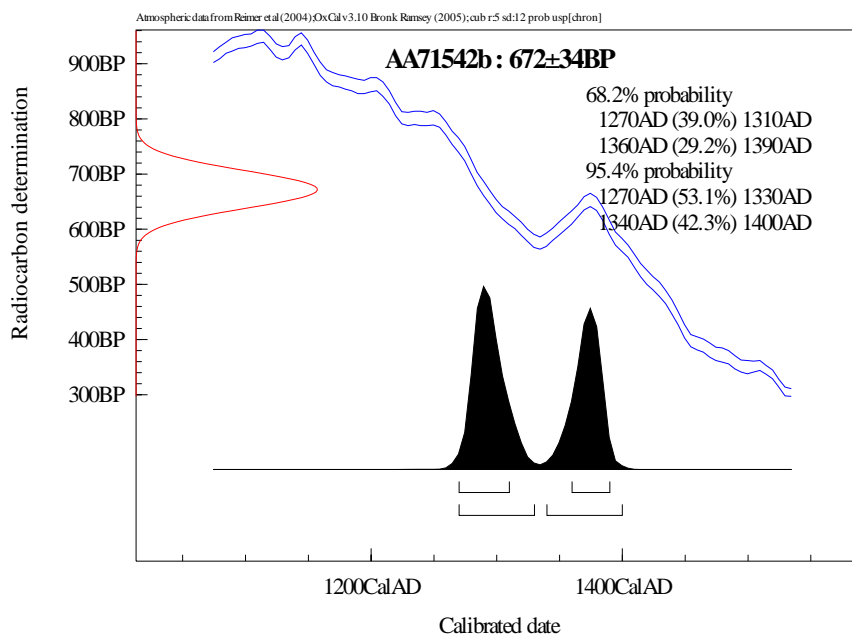


Figure 5.91: Calibrated radiocarbon age for sample AA71542b.

Sample AA71550 came from TR 32, which was placed within a *lo'i* terrace in Halepoki Central, where feature numbers were not assigned (see Figure 3.12). The sample came from scattered charcoal collected from directly under the foundation stones of the terrace wall (see Figure 4.65). It consisted of unidentified bark and returned a

conventional radiocarbon age of 450 ± 34 BP, which calibrates to AD 1410–1610 (Figure 5.92).

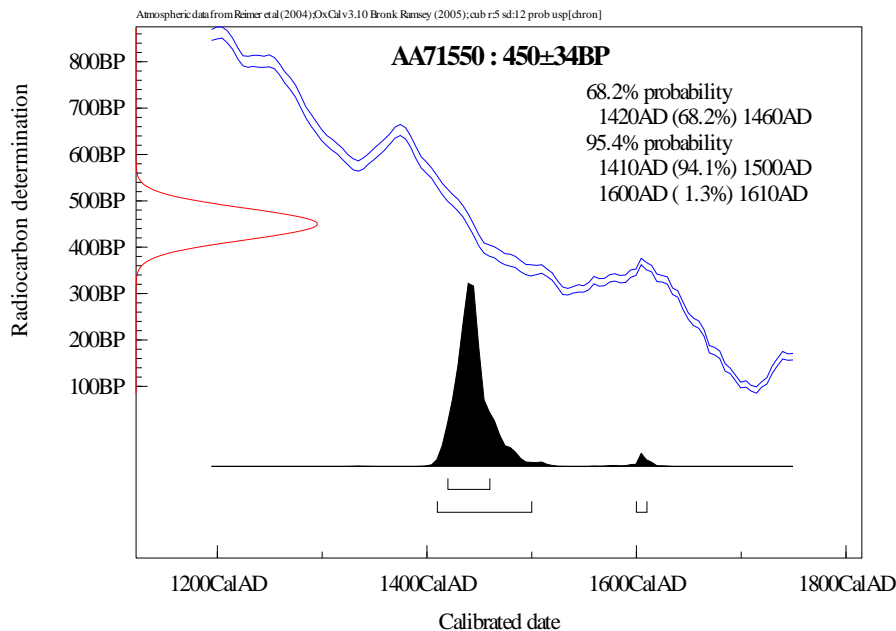


Figure 5.92: Calibrated radiocarbon age for sample AA71550.

Sample AA72162 came from TR 33, excavated within a *lo'i* terrace in Halepoki Mauka, where feature numbers were not assigned (see Figure 3.13). The sample came from scattered charcoal from directly under the foundation stones of the terrace (see Figure 4.67). It consisted of the Polynesian-introduced tree *kukui* and returned a conventional radiocarbon age of 91 ± 33 BP, which calibrates to AD 1680–1940 (Figure 5.93). Because *kukui* is a long-lived taxa, this date might be affected by in-built age, although the relatively recent radiocarbon age makes this is unlikely. However, as a Polynesian introduction, the *kukui* sample undeniably dates human presence in this area of the valley.

Samples Beta-213275 and Beta-215407 came from TU 18, which was excavated at the east wall of *lo'i* terrace L-2. The sample was collected from the lowest level of excavation, from 36–38 cmbd, at a depth lower than the wall foundation stones. Four taxa were identified from this sample: 'ūlei, pine, 'ahakea, and an unidentified specimen. The pine was initially selected for dating to determine if it originated as driftwood in the pre-contact era or entered the valley in the historic period. The pine, despite being an adequately sized piece of charred material (6.8 mg) reacted strongly to pretreatment and degraded, reducing to a small amount, which upon combustion did not yield adequate CO₂ for AMS dating. This might indicate that the charring was done at a higher oxygen level, with more ash content, or that the internal structure of the fragment was weakened by repeated wet and dry episodes, where the structure remained but the internal integrity had been compromised due to repeated expansion and contraction (R.E. Hatfield pers.

comm. 2006). Because the pine could not be dated, sample Beta-215407, a portion of the *‘ūlei*, was submitted as a replacement. This sample returned an age of 190 ± 40 , which calibrates to AD 1640–1960 (Figure 5.94) suggesting that the pine was brought to the valley relatively recently and the Lahokea *lo‘i* complex is a recent construction.

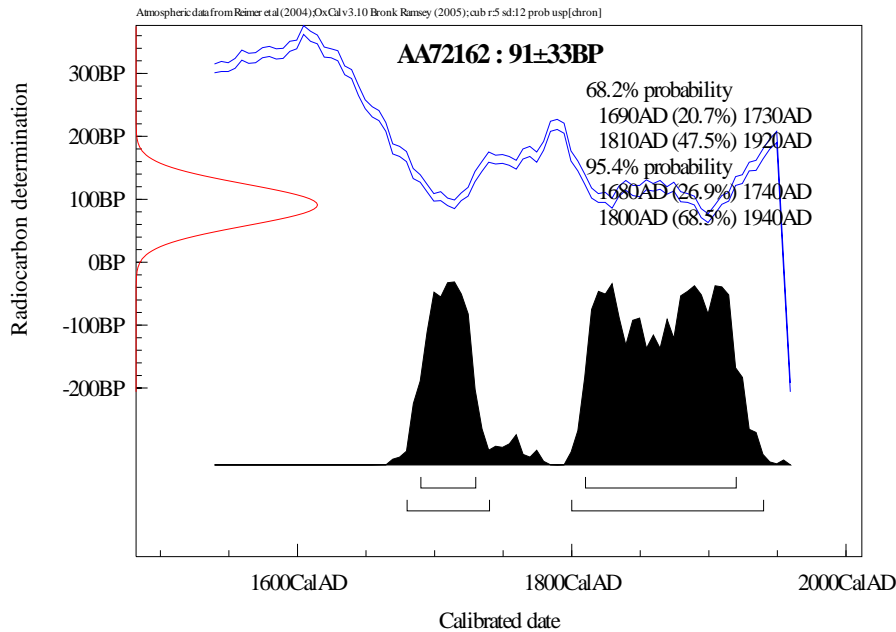


Figure 5.93: Calibrated radiocarbon age for sample AA72162.

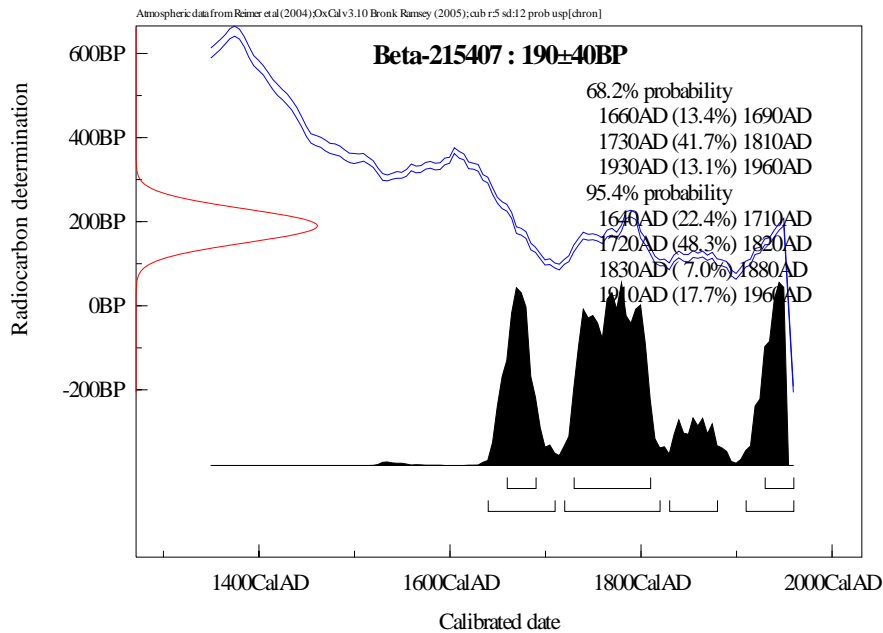


Figure 5.94: Calibrated radiocarbon age for sample Beta-215407.

Sample AA71551 came from TU 28. The unit bisected a hearth feature in Palaloa, where feature numbers were not assigned (see Figure 3.15). The sample was from charcoal found at the base of the feature and was identified as the native shrub *'ilima*. This sample returned a conventional radiocarbon age of 283 ± 33 BP, which calibrates to AD 1490–1800 (Figure 5.95).

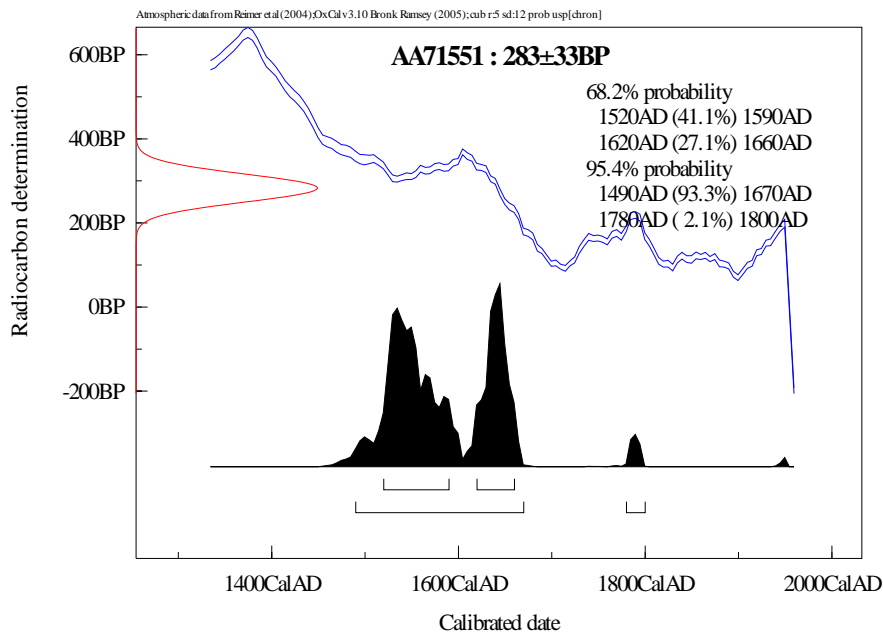


Figure 5.95: Calibrated radiocarbon age for sample AA71551.

Discussion of Radiocarbon Dates

One date, Beta-193986, has been previously obtained in Wailau (McElroy 2004), and together with those reported here, provide a total of 20 dates for the valley (Figure 5.96). Of the 20 dates, 15 were obtained from scattered charcoal beneath *lo'i* walls. These can be grouped into three temporal units: Phase I (pre AD 1400), Phase II (post AD 1400), and Phase III (post AD 1650).

Eight *lo'i* complexes returned early dates and fell within the Phase I time period. The earliest features were the *ahupua'a* boundary wall in the Keiu *lo'i* system and the Eliali'i *lo'i*. These date to the 12th to 14th Centuries AD. The Eliali'i dates (790 BP and 730 BP) are very close together in time and similar to Kirch's (2002) date of 770 BP for a coastal *lo'i* in Waikolu Valley, just east of Kalaupapa. With a date of 735 BP, the *ahupua'a* boundary wall in Keiu was constructed at this time as well. In Keiu, a buried *lo'i* occurred beneath the complex found on the surface. The buried portion and the parts of the complex near the *ahupua'a* boundary were likely constructed during Phase I, while the rest of the complex was built at a later time. The Makea Lowland *lo'i* (695 BP), Halepoki Makai *lo'i* (672 BP), Kukuinui Mauka *lo'i* (649 BP), Ku'ele Central *lo'i* (646 BP), and Ku'ele West *lo'i* (566 BP) also date to this early period of agricultural expansion, prior to AD 1400.

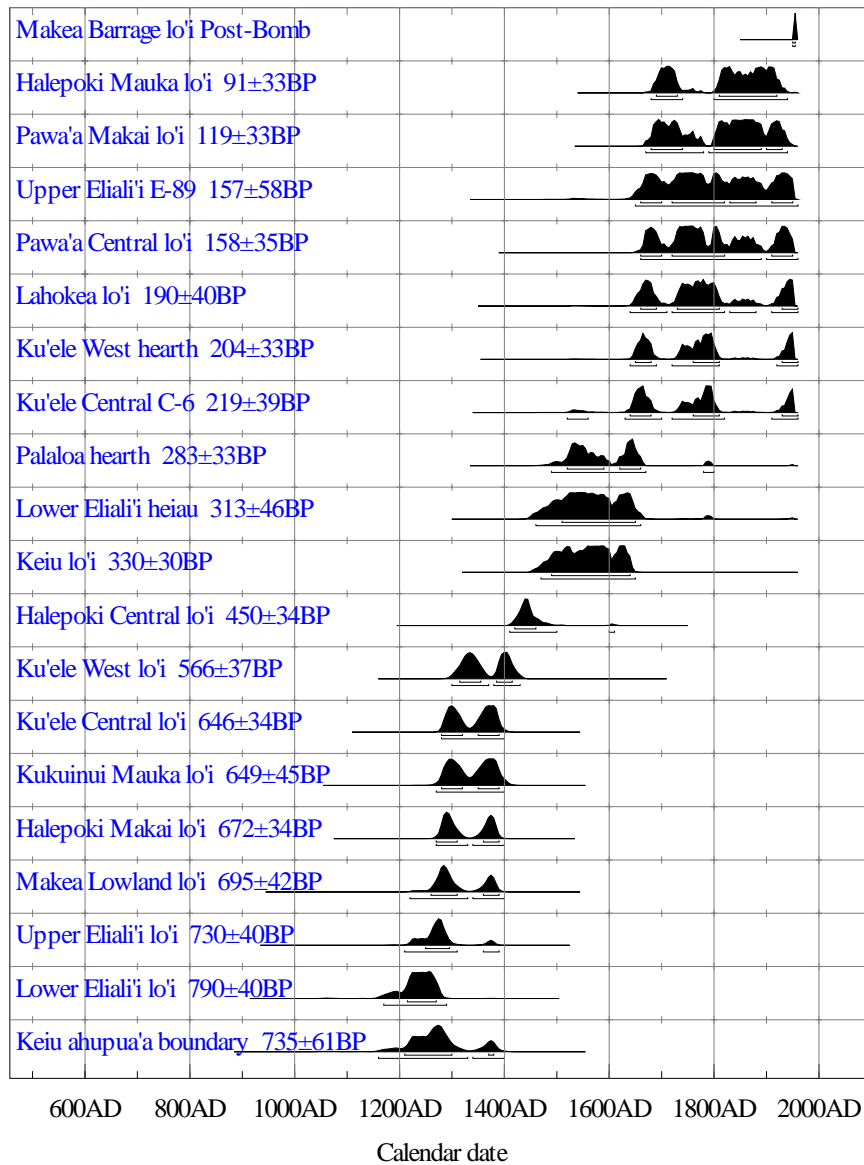


Figure 5.96: Calibrated radiocarbon dates for Wailau Valley.

Subsequent construction of *lo'i* occurred after AD 1400, within the Phase II time period. Phase II complexes include the Halepoki Central *lo'i* (450 BP) and the remainder of the Keiu *lo'i* (McElroy 2004 previously obtained date of 330 BP). The Palaloo complex probably dates to this time as well. A hearth within the Palaloo *lo'i* returned a date of 283 BP. Since the *lo'i* was constructed and used before the hearth feature was built, the Palaloo complex probably dates to around AD 1400.

Phase III *lo'i* were built after AD 1650. These include Lahokea (190 BP), Pawa'a Central (158 BP), Pawa'a Makai (119 BP), and Halepoki Mauka (91 BP). The Makea

barrage complex returned a modern date, but because of the dynamic nature of the barrage system, it is likely that the dated charcoal was introduced after the terraces were constructed.

The non-*lo'i* dates are from hearths, a *heiau*, and terraces with undetermined functions. The Ku'e West hearth returned a date of 204 BP, much later than the Ku'e West *lo'i* complex, suggesting that the hearth is unassociated with the *lo'i*. The Palaloo hearth dated to 283 BP. No dates were obtained from the Palaloo *lo'i* complex itself, although the *lo'i* had to have been constructed before the hearth was used. The Eliali'i *heiau* returned a date of 313 BP, which is much more recent than the *lo'i* it is associated with. This calibrates to the late 1500s, the same time period as the coral thorium dates recently reported by Weisler et al. (2005), and Kirch and Sharp (2005) for leeward Moloka'i *heiau*. Terrace C-6 in Ku'e Central was detached from the Ku'e Central *lo'i* system. It dated to 1520–1960, much later than the *lo'i* complex just inland. This terrace is likely a habitation area occupied by later cultivators of the *lo'i*. Terrace E-89 in Upper Eliali'i was an uncharacteristically small, square terrace, the function of which was uncertain. A charcoal concentration within the terrace returned a date of 157 BP, significantly later than the *lo'i* above, indicating that this area was used for a substantial period of time.

Discussion and Summary of Laboratory Results

Materials collected from surface survey and excavation include traditional artifacts, historic artifacts, midden, botanics, and charcoal. The main goal of this project was to collect data on traditional irrigated agriculture, thus the features targeted for excavation yielded few artifacts.

Traditional artifacts included basalt tools, debitage, and volcanic glass. These were found in every land division but Kukuinui, possibly indicating an historic age for the Kukuinui *lo'i*. Basalt tools included such items as an adze, adze blanks, adze fragments, awls, a chisel fragment, a cutting tool, hammerstones, and a whetstone. Debitage consisted of basalt flakes and cores. Basalt flakes were the most frequently occurring artifact in excavations. Volcanic glass was found in Keiu, Ku'e, Makea, Eliali'i, Halepoki, Lahokea, and Palaloo. Although relatively few fragments were recovered, they were found throughout the entire west side of the valley.

Historic material was collected during surface survey and in excavation of historic house platform M-17, habitation platform C-2, terrace C-6, *lo'i* terrace C-9, and *lo'i* terrace L-2. Analysis of the non-traditional artifacts recovered from Wailau generated useful information about post-contact use of the valley. Historic items came from Pawa'a, Ku'e, Makea, Eliali'i, Halepoki, and Lahokea, and indicated a peak period of occupation from the late 1800s to early 1900s. Mostly domestic items were found, including tableware, bakeware, food and beverage containers, buttons, doorknobs, lamps, and slate chalkboards. Glass alcohol bottles were the most common historic material. Large serving vessels and soup plates were also common, and these types of dishes would have been well-suited for traditional Hawaiian foods and the traditional style of communal serving. Most ceramics came from England or America, with a few Chinese

and Japanese items represented, indicating a multi-ethnic community or a community with multiple ethnic influences. A few horse or mule-related items demonstrate that these animals were present in the valley and were being used by humans.

The frequency of materials collected from *lo'i* terraces is illustrated in Figure 5.97. Basalt tools include adze blanks, adze fragments, an awl, a pounder fragment, abrading stones, a cutting tool, and a hammerstone. Most of these artifacts were used in resource procurement and processing. Basalt flakes were the most common artifacts found in the *lo'i*, by far. The presence of flakes could indicate that some degree of tool manufacture and/or re-sharpening was occurring in the *lo'i* or that these activities occurred upslope, where flakes could be washed in during flooding. Tiny fragments of volcanic glass were also common among the *lo'i* artifacts, and these might represent fine cutting or resource processing activity. Midden remains were surprisingly sparse, represented by a few fragments of deteriorated *hihiwai* shell and bits of unidentified shell or bone. This could indicate that food was generally not consumed in or near the *lo'i*, or that food remains did not preserve in the wet soils. Midden was scarce at non-*lo'i* features as well, suggesting that food remains did not preserve over time in the Wailau environment. Historic artifacts were relatively sparse in the *lo'i*, although they were numerous at non-agricultural features.

Artifacts were distributed unequally over the various *lo'i* systems (Table 5.7). The Ku'e Central complex yielded the largest number of artifacts by far. These consisted mostly of basalt flakes, although basalt tools and volcanic glass were most prevalent there as well. Basalt flakes were also common in the non-*lo'i* excavations in Ku'e Central, and this area might have been a favored tool-making locale in the valley, possibly for its proximity to the coast and its marine resources. Alternatively, a high-quality source of raw material may have been nearby. Geochemical analysis suggests that two main local sources of basalt were being utilized, and the few items not from these sources were mostly found in Ku'e (see Appendix C). The water-rounded basalt strewn across the boulder beach would have offered the best selection of raw material for tool making in the valley, and the anomalous items might have come from these boulders or from a source outside the valley. Further analysis of the Wailau lithic assemblage is in progress, and results will shed more light on the source of material for these artifacts.

As noted earlier, midden was scarce in the *lo'i*. This was largely represented by *hihiwai* shell. The largest number of specimens was found in the Lahokea *lo'i* system, which was likely constructed in the historic era. The Halepoki Makai *lo'i* system yielded the largest number of historic artifacts. It is possible that some of the terraces designated as *lo'i* in this system were not used for irrigated agriculture in the historic era. The presence of a tangerine tree within terrace H-52 supports this hypothesis.

Non-*lo'i* excavations were conducted at habitation platform C-2 and terrace C-6 in Ku'e Central, hearth C-18 in Ku'e West, historic house platform M-17 and enclosure M-31 in Makea, *heiau* E-1 and terrace E-89 in Eliali'i, and a hearth with no feature number in Palaloo. Most of these excavations provided clues as to what activities took place in these areas. Table 5.8 shows that artifacts were much more prevalent in

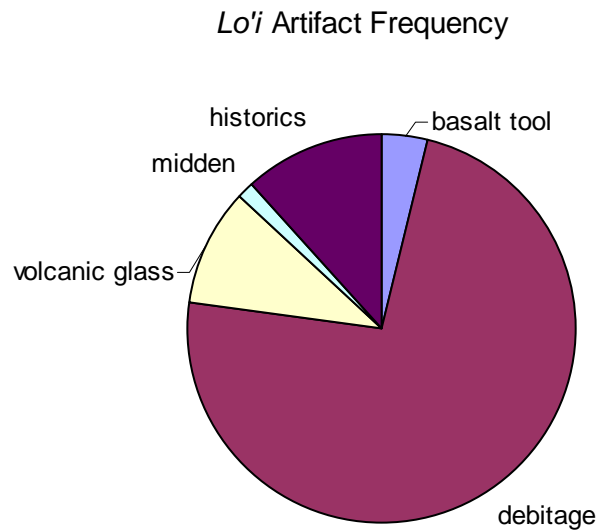


Figure 5.97: Frequency of artifacts found in agricultural terraces, by count (n=326).

Table 5.7: Number of Artifacts by *Lo'i* System (n=326)

<i>Lo'i</i> System	Basalt Tool	Debitage	Volcanic Glass	Midden	Historics	m ² of <i>Lo'i</i> Excavated
Keiu	0	0	1	1	0	2.00
Pawa'a	0	0	0	0	0	3.25
Ku'e Central	7	179	16	0	1	2.00
Ku'e West	2	19	1	0	0	3.00
Makea Lowland	2	29	6	0	0	5.00
Makea Slope	0	1	0	0	0	1.25
Kukuinui	0	0	0	0	1	2.50
Upper Eliali'i	0	3	3	1	0	3.00
Lower Eliali'i	0	0	0	0	0	1.50
Halepoki Makai	1	5	2	0	31	2.00
Halepoki Central	0	0	1	0	0	1.00
Halepoki Mauka	0	0	0	0	0	1.00
Lahokea	1	3	1	3	5	1.50
Palaloa	0	0	0	0	0	0.50

non-*lo'i* excavations, even though the area excavated was significantly less. Basalt tools, flakes, and historics were relatively abundant in the Ku'e features, suggesting an early-historic age for these areas, and possibly a habitation function for terraces C-2 and C-6. Debitage was common around the hearths, indicating that tool-making took place there. A multitude of historic items were found in house platform M-17, confirming the historic age of this feature. A single basalt flake was found at enclosure M-31, providing little

Table 5.8: Number of Artifacts from Non-Lo'i Excavations (n=602)

Feature	Basalt Tool	Debitage	Volcanic Glass	Midden	Historics	m ² of Lo'i Excavated
C-2	6	39	3	0	20	0.50
C-6	5	75	3	1	25	1.00
C-18	0	19	0	0	0	0.25
M-17	1	10	0	19	367	1.00
M-31	0	1	0	0	0	0.50
E-1	0	0	1	0	0	0.50
E-89	0	0	0	0	0	0.50
Palaloea Hearth	0	6	2	0	0	0.25

information about the enclosure's function. A single piece of volcanic glass was collected from *heiau* E-1, yielding little information about ritual activity at the *heiau*. No artifacts were recovered from terrace E-89, thus the function of this terrace is still uncertain.

Basalt flakes and a stone adze were found along with non-traditional items at historic house platform M-17, and a variety of traditional items were found along with historic material at habitation platform C-2 and terrace C-6. This reflects the persistence of traditional tools in the post-contact era, even when metal tools were available. The abundance of glass and ceramics at feature M-17 establishes that the M-17 household did have the ability to obtain western items, so availability clearly was not a factor in the choice to retain traditional tools. Bayman (2003) notes that stone adzes were favored by traditional Hawaiian canoe builders for certain tasks, even when comparable metal tools were available. Shortly after contact, however, economic circumstances compelled craftsmen to select metal tools for expediency over the traditional stone tools that could produce high quality canoes. Nevertheless, stone adzes persisted into the late 1800s, at least for fine finishing work, as witnessed by Brigham (1902). The M-17 household dates to this dynamic period, when traditional technology was used in concert with imported items.

The small botanic assemblage was dominated by *kukui* nutshell, and these likely washed into the excavations without the aid of humans. A diverse array of charred plant material was identified, however, possibly illustrating what the natural environment was like before the valley was cultivated. An historically-introduced wood found near the base of one of the Makea *lo'i* walls might indicate that the terraces there were divided into smaller plots in the post-contact era, a pattern documented for dryland fields elsewhere in Hawai'i (e.g., Ladefoged and Graves 1996).

Nineteen charcoal samples returned radiocarbon dates, revealing that the Upper and Lower Eliali'i agricultural terraces and *ahupua'a* boundary wall were constructed around the same time, probably around the Thirteenth Century AD. The Makea Lowland *lo'i*, Halepoki Makai *lo'i*, Kukuinui Mauka *lo'i*, Ku'ele Central *lo'i*, and Ku'ele West *lo'i* were also constructed early in time, probably before AD 1400. The next *lo'i* complexes to be built were Palaloea, Halepoki Central, and parts of Keiu. These were constructed sometime after AD 1400. Finally, Pawa'a Makai, Pawa'a Central, Halepoki Mauka, and Lahokea were built sometime after AD 1650. Dating of the Makea Barrage complex was

problematic because of the dynamic nature of the system. Although the complex returned a modern date, it is still believed to be one of the earliest *lo'i* in the valley. Non-*lo'i* features dated to a later time. These included the Eliali'i Heiau, two hearths, and two non-*lo'i* terraces.

The radiocarbon dating results, together with information from the historic literature, demonstrate that Wailau Valley was cultivated for a substantial period of time, roughly 700 years, from the Thirteenth Century AD to the 1930s (Figure 5.98). It appears

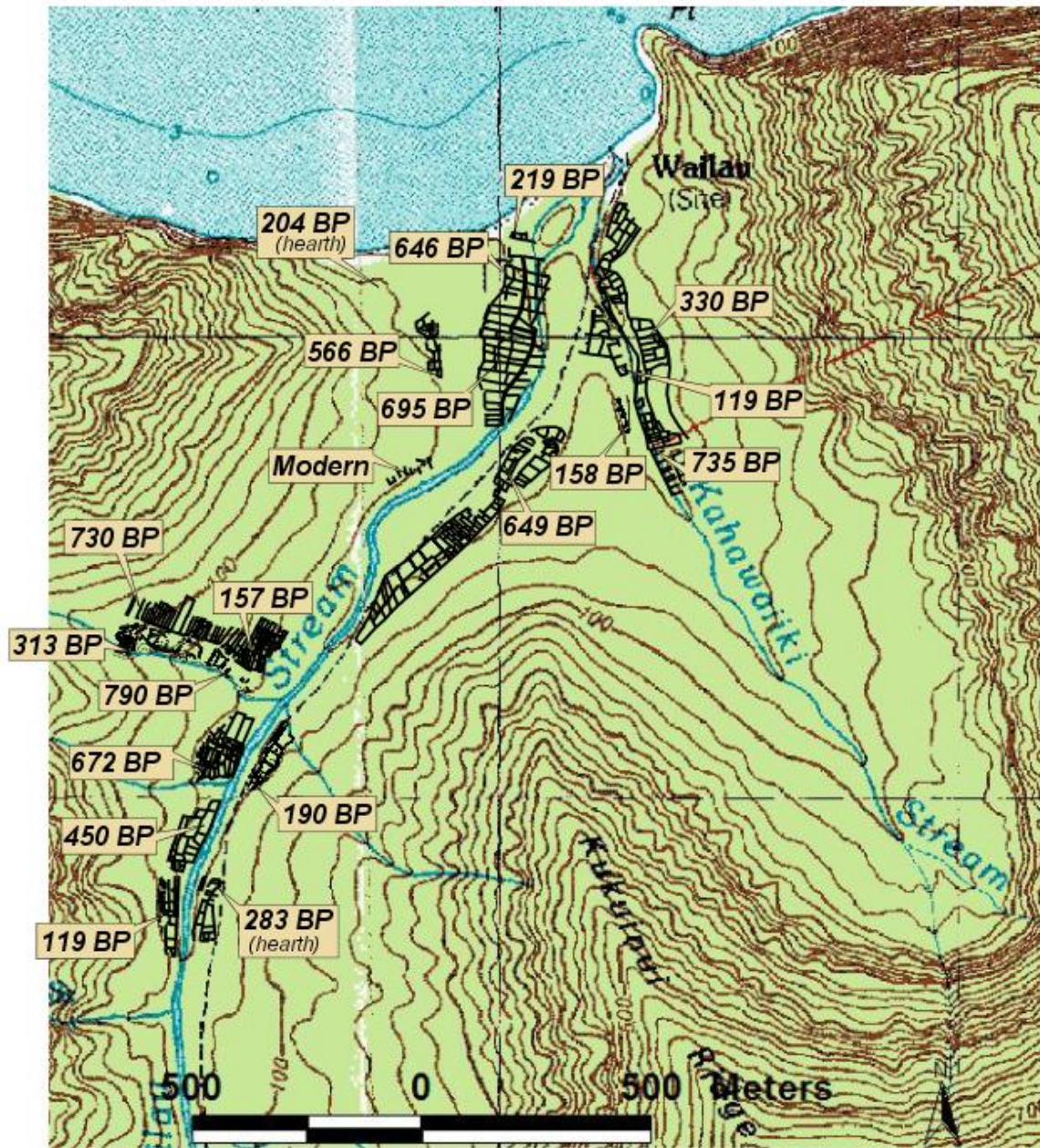


Figure 5.98: Dates for Wailau agricultural systems; only the dated *lo'i* complexes are shown.

that the largest systems offering greatest output were constructed earliest in time (McElroy 2007). These early complexes occurred both inland and near the coast, on steep slopes, and on the broad flat plains. After these large complexes were established, smaller *lo'i* systems were built, until every cultivable piece of land was under production. The Pawa'a Central and Halepoki Mauka complexes are good examples, in which a tiny bit of flat land along the stream was converted into a *lo'i* system late in time.



CHAPTER 6: CONCLUSION

Hawaii's prehistory increasingly is buried beneath or has been lost to modern land development, especially that history pre-dating western contact. Isolated areas, however, exist where tangible aspects of this history might be found, and Wailau Valley provides a prime example. Wailau offers a pristine archaeological record within a sizeable valley that has not been previously studied. Wailau is unique for its varied and well preserved archaeological sites, as well as for the former presence of two *ahupua'a* within a single valley. This is the ideal setting to realize the goals of the Wailau Archaeological Research Project: to collect data for an examination of agricultural development, while at the same time providing archaeological training to the residents of Moloka'i.

During this project 260 acres of Wailau Valley were covered in reconnaissance, 33 acres were systematically surveyed, and 66 excavation units were opened. Nineteen *lo'i* complexes were recorded in the land divisions of Keiu, Pawa'a, Kahiwa, Ku'ele, Makea, Ahiki, Kukuinui, Kopena, Eliali'i, Halepoki, Lahokea, and Palaloa. During the systematic survey 305 surface archaeological features were recorded in the eight land divisions of Keiu, Pawa'a, Ku'ele, Makea, Kukuinui, Eliali'i, Halepoki, and Lahokea (see Appendix A). These features are all part of the Wailau Agricultural Complex, Site 50-60-04-272. The complex is significant under criteria *c* and *d* of § 13-275-6(b) for being representative of a traditional agricultural system and for the information the site may yield on Hawaiian history and prehistory (McElroy 2004:25).

Four large *lo'i* complexes were mapped in detail, and GPS positions were obtained from every survey area. Cross-sections were taken down the center of each *lo'i* system, and a sample of walls were drawn in profile. Traditional and historic artifacts were photographed and analyzed, 41 charcoal samples were taxonomically identified, and 19 samples produced radiocarbon dates. Maps, metric data, and results of the dating analyses will be integrated into a GIS database that will be used to examine the agricultural systems with regard to environmental variables, such as soils, rainfall, proximity to the coast, proximity to streams, and terrain to obtain a better understanding of agricultural development in Wailau (McElroy 2007).

In Keiu, parts of a large *lo'i* complex were documented on the east side of Kahawai'iki Stream. This complex was mapped in the early Twentieth Century (Podmore 1915), and the current survey confirmed that the system remains largely unchanged. The three excavations in this area yielded little cultural material. Two of the excavations were placed at the *ahupua'a* boundary, and charcoal from beneath the boundary wall returned a date of 735 ± 61 BP. This date, along with results of previous research (McElroy 2004) demonstrate that buried portions of the *lo'i* complex were probably constructed before AD 1400, while other parts of the system were built at a later time.

In Pawa'a, a 12-terrace *lo'i* system was found in the *mauka* portion of the land division. A small 4-terrace *lo'i* system occurred in Pawa'a Central, and part of a larger system was found to the north, in Pawa'a Makai. A number of historic features were scattered throughout a slope above the *makai* and central *lo'i* complexes. The Pawa'a Mauka complex was not intensively surveyed and is in need of further study. Excavation of the *makai* and central *lo'i* yielded little cultural material, but charcoal recovered from

beneath the terrace walls dated to 119 ± 33 BP for Pawa'a Makai and 158 ± 35 BP for Pawa'a Central, thus both were constructed after AD 1650. A variety of surface artifacts were found in the vicinity of the non-*lo'i* features on the slope. Historic artifact analysis indicates that habitation complex P-8, at the base of the slope, probably dates from the mid-1800s to the mid-1900s. Only domestic items were found here. House complex P-12, farther up the slope was probably occupied at the turn of the Twentieth Century, and both household items and animal husbandry materials were recovered. Artifacts collected from elsewhere on the slope date to the turn of the Twentieth Century. It is possible that the *lo'i* complexes in Pawa'a were built and used during the historic era as well.

A substantial *lo'i* complex was found in the land division of Kahiwa. This complex was not intensively surveyed or excavated. One of the *lo'i* walls exhibited a step or bench in front, and this deserves further study.

Ku'ele features were found in two discrete areas. An extensive *lo'i* complex, coastal habitation features, and historic structures occurred in Ku'ele Central. The *lo'i* extended out of the survey block to connect with the Makea Lowland system. One of the northern terraces in this system dated to 646 ± 34 BP. A terrace between the *lo'i* and the coastal habitation dated to 219 ± 39 BP. Artifacts were abundant in the Ku'ele Central survey area, with a multitude of basalt flakes, basalt tools, and historic items found. In Ku'ele West, an unfinished *lo'i* and a hearth feature were documented. The *lo'i* is thought to be unfinished because it exhibited little stonework, was not yet connected to the 'auwai, and yielded no pondfield soils. Charcoal from beneath one of the terrace walls dated to 566 ± 37 BP, refuting the hypothesis that this system was constructed late in time. The hearth was unassociated with the *lo'i* complex, dating to 204 ± 33 BP.

In Makea a large *lo'i* complex was found on the low, flat land abutting Wailau Stream, and barrage terraces and miscellaneous features occurred on a hill above the complex. Twelve *lo'i* terraces were recorded within the lowland survey block, and others extend north outside the survey boundaries, connecting with the Ku'ele Central complex. One of the lowland terraces dated to 695 ± 42 BP, and excavations revealed that one of the terraces might have been subdivided in the historic era. The barrage terrace system returned the latest date in the valley, although it is possible that modern charcoal was washed into the excavation unit. Artifacts from house platform M-17 on the slope above the *lo'i* indicate that both traditional and modern technology was being utilized by this household at the end of the Nineteenth Century. In addition to domestic items, a horse bit was found, demonstrating that animal husbandry took place here as well.

A *lo'i* system was found in Ahiki, on the west side of Wailau Stream. This system, fed partially by spring water, was identified during reconnaissance and not further investigated.

Two *lo'i* complexes, separated by an historic road, occurred in Kukuinui. Kukuinui Makai was the smaller of the two. This complex was mapped and excavated but not dated. One of the terraces of the extensive Kukuinui Mauka system dated to 649 ± 45 BP. Kukuinui excavations yielded very little cultural material.

A small *lo'i* complex was found in Kopena, just south of Kukuinui Mauka. This complex was not intensively surveyed or excavated.

Eliali'i features occurred within two survey blocks: Lower and Upper Eliali'i. In Lower Eliali'i, a *heiau* stands on the banks of a small side stream, and various features surround it. Below this is an eroded *lo'i* complex, with at least 20 terraces identified. Excavations at the *heiau* and *lo'i* yielded little cultural material, and a sample of charred *naupaka* from the *lo'i* returned a date of 790 ± 40 BP. A large *lo'i* system encompassing more than 60 terraces steps down the slope in Upper Eliali'i. An historic house platform stands at the base of the system, within one of the terraces. *Lo'i* excavations produced few items of interest, although surface collections from the house site indicated a peak period of use around 1880 and possible ties to Pawa'a households. A fragment of charred 'a'ali'i from a terrace near the upper reaches of the *lo'i* complex returned a date of 730 ± 40 BP, demonstrating that the Upper and Lower Eliali'i *lo'i* were probably constructed around the same time. Charcoal from a concentration in a terrace with an uncertain function returned a date of 157 ± 58 BP, and the *heiau* dated to 313 ± 46 BP. Both features are much later than the *lo'i* they are associated with.

Three *lo'i* complexes occurred in Halepoki. The most extensive, Halepoki Makai, was intensively surveyed, and 62 terraces, an *'auwai*, and a wall were documented. Charcoal from beneath one of the terrace walls returned a date of 672 ± 34 BP. The Halepoki Central and Mauka complexes were excavated but not intensively surveyed. One of the Halepoki Central terraces dated to 450 ± 34 BP, while a Halepoki Mauka terrace dated to 91 ± 33 BP. Artifacts were generally scarce in Halepoki, although a number of historic items were found just outside one of the terraces in Halepoki Makai.

In Lahokea a 24-terrace *lo'i* complex stands on the east bank of Wailau Stream. Excavations produced both traditional and historic items, and a fragment of charred *'ūlei* returned a date of 190 ± 40 BP, indicating that this *lo'i* dates to a much later time than many others in the valley.

A *lo'i* complex and hearth were identified in Palaloa. Excavation of the *lo'i* did not generate any material suitable for dating. Charcoal from the base of the hearth returned a date of 283 ± 33 BP, providing a *terminus ante quem* for the *lo'i*.

In sum, Wailau Valley was extensively cultivated in both the pre-contact and historic periods. Many of the *lo'i* complexes dated to the period prior to AD 1400, indicating a long period of use for the valley. Ritual and ceremonial activities took place at the *heiau* and *pu'uhonua*, at least three of which remain standing on the valley slopes. The *ahupua'a* boundary was established early in time, although the *heiau* was constructed at a later date. Historic house sites were located near the *lo'i* complexes, and animal husbandry played a part in the livelihood of at least two of the households. Evidence of pre-contact habitation was more elusive, but with further investigation would likely be found near the coast and in the vicinity of the inland agricultural complexes.

This study demonstrates the extraordinary value of the archaeological resources of Wailau Valley. A wealth of information can be learned about traditional and historic ways of life, including aspects of agriculture, habitation, and ritual. It is of utmost importance that this precious site be preserved so that future generations may learn about the past.



REFERENCES

- American Board of Commissioners for Foreign Missions
1937 *Molokai Station Reports 1833-1849*. Typescript on file at the Hawaiian Mission Children's Society, Honolulu.
- Anonymous
1908 "Locals and Personals," in *Maui News*, August 22, 1908 5:2.
1935 "Wailau Area May Relieve Poi Shortage," in *Maui News*, July 13, 1935 1:1.
1939 "Buffalo Herd is Recalled by Aged Chinese Settler," in *Maui News*, September 9, 1939 3:3.
- Barrerra, William M. and Patrick Vinton Kirch
1973 Basaltic-Glass Artefacts from Hawaii: Their Dating and Prehistoric Uses. *The Journal of the Polynesian Society* 82(2):176-187.
- Bayman, James M.
2003 "Stone Adze Economies in Post-Contact Hawai'i," in *Stone Tool Traditions in the Contact Era*. Edited by Charles R. Cobb, pp. 94-108. Tuscaloosa and London: The University of Alabama Press.
- Beckwith, Martha
1970 *Hawaiian Mythology*. Honolulu: University of Hawai'i Press.
- Bohm, Bruce A.
2004 *Hawai'i's Native Plants*. Honolulu: Mutual Publishing.
- Brigham, William T.
1902 *Stone Implements and Stone Work of the Ancient Hawaiians*. Memoirs of the Bernice P. Bishop Museum. Vol. I, No. 4. Honolulu: Bishop Museum Press.
- Clark, John R.K.
1989 *The Beaches of Maui County*. Honolulu: University of Hawai'i Press.
- Cleghorn, Paul
1992 Hawaiian Adze Sequence or Just Different Kinds of Adzes. *New Zealand Journal of Archaeology* 14:129-149.
- Coelho, W.J.
1922 "A Trip to Molokai," in *Nupepa Kuokoa*, July 3, 1922.
- Costello, Julia G. and Mary L. Maniery
1988 *Rice Bowls in the Delta: Artifacts Recovered from the 1915 Asian Community of Walnut Grove, California*. Occasional Paper 16. Los Angeles: Institute of Archaeology, University of California, Los Angeles.
- Curtis, Dorothe
1973 Rachel Naki Interview, Unpublished Audiotape. August 19, 1973.
- Davis, Kai
n.d. 'Aina Moloka'i. Lyrics from http://www.huapala.org/ah/Aina_Molokai.html.
- Earle, Timothy
1978 *Economic and Social Organization of a Complex Chieftdom: The Halelea District, Kaua'i, Hawaii*. Ann Arbor: Regents of the University of Michigan.
- Foote, Donald, Elmer Hill, Sakuichi Nakamura, and Floyd Stephens

- 1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*. Washington, D.C.: United States Department of Agriculture, Soil Conservation Service.
- Fornander, Abraham
1996 *An Account of the Polynesian Race*. Rutland, Vermont: Charles E. Tuttle Company.
- Godden, Geoffrey A.
1964 *Encyclopaedia of British Pottery and Porcelain Marks*. London: Herbert Jenkins.
- Goodhue, Anna D.
1993 "Talking Story with Rachel Naki," in *The Dispatch*, February 18, 1993:16.
- Handy, E.S. Craighill
1940 *The Hawaiian Planter*. Honolulu: Department of Anthropology, Bernice P. Bishop Museum.
- Handy, E.S. Craighill and Elizabeth Handy
1972 *Native Planters of Old Hawaii: Their Life, Lore, and Environment*. Honolulu: Department of Anthropology, Bernice P. Bishop Museum.
- Hatfield, Ron E. (deputy director, Beta Analytic, Miami Florida)
2006 Personal communication with the author.
- Hogan, Devin
2006 "Bennett's Back With Many Molokai Mugs," in *Molokai Dispatch*, November 29, 2006.
- Hyde, C.M.
1885 "A Visit to Molokai," in *Hawaiian Gazette*, September 16, 1885. 3:4.
- Judd, Henry P.
1938 "A Visit to Wailau, Molokai," in *Paradise of the Pacific*, March 1938. 50:6.
- Juvik, Sonia and James Juvik
1998 *Atlas of Hawaii* (Third edition). Honolulu: University of Hawai'i Press.
- Kamakahi, Dennis
n.d. *Nā Makani 'Ehā*. Lyrics from http://www.huapala.org/Na_Makani_Eha.html.
1978 *E Hihiwai*. Lyrics from http://www.huapala.org/E/E_Hihiwai.html.
- Kamakau, Samuel M.
1992 *Ruling Chiefs of Hawaii*. Honolulu: The Kamehameha Schools Press.
- Kawaharada, Dennis (editor)
1992 *Hawaiian Fishing Traditions*. Honolulu: Kalamakū Press.
- Keola, James N.K.
1893 "Molokai, A Local Tourist's Impression," in *Pacific Commercial Advertiser*, June 7, 1893.
- Kirch, Patrick Vinton
1971 Halawa Valley: Two Field Seasons in Retrospect. *New Zealand Archaeological Association Newsletter* 14:47-61.
1985 *Feathered Gods and Fishhooks*. Honolulu: University of Hawai'i Press.
2002 *From the 'Cliffs of Keōlewa' to the 'Sea of Papaloa' An Archaeological Reconnaissance of Portions of the Kalaupapa National Historical Park*,

- Moloka'i, Hawaiian Islands*. Berkeley: Oceanic Archaeological Laboratory, Archaeological Research Facility, University of California Berkeley.
- Kirch, Patrick and Marion Kelly (editors)
 1975 *Prehistory and Ecology in a Windward Hawaiian Valley: Halawa Valley, Molokai*. Pacific Anthropological Records 24. Honolulu: Department of Anthropology, Bernice P. Bishop Museum.
- Kirch, Patrick and Warren Sharp
 2005 Coral ²³⁰Th Dating of the Imposition of a Ritual Control Hierarchy in Precontact Hawaii. *Science* 307:102-104.
- Kolb, Michael J. and Gail M. Murakami
 1994 Cultural Dynamics and the Ritual Role of Woods in Pre-Contact Hawai'i. *Asian Perspectives* 33(1):58-78.
- Krauss, Beatrice H.
 1993 *Plants in Hawaiian Culture*. Honolulu: University of Hawai'i Press.
- Kuda, Kimu
 1912 "Tramping on Molokai," in *Mid-Pacific*, April 1, 1912. 3(4):327.
- Lebo, Susan A.
 1997 *Native Hawaiian and Euro-American Culture Change in Early Honolulu*. Honolulu: Bernice Pauahi Bishop Museum.
- Leun, Wong Ho
 1987 *An American Chinatown*. Volume Two. San Diego: Great Basin Foundation.
- Lister, Florence C. and Robert H. Lister
 1989 *The Chinese of Early Tucson: Historic Archaeology from the Tucson Urban Renewal Project*. Anthropological Papers 52. Tucson: University of Arizona Press.
- Malo, David
 1951 *Hawaiian Antiquities (Moolelo Hawaii)*. Translated by Nathaniel B. Emerson, 1898. Bishop Museum Special Publication 2 (2nd ed.). Honolulu: Bernice P. Bishop Museum
- Martin, Kaiulani Kanoa
 1997 *Huapala: Hawaiian Hula and Music Archives*. <http://www.huapala.org>.
- McElroy, Windy K.
 2004 *Archaeological Inventory Survey of TMK:(2)-5-9-005:007 & 081, Wailau Valley, Halawa Ahupua'a, Ko'olau District, Moloka'i Island*. Honolulu: T.S. Dye & Colleagues, Archaeologists, Inc.
 2007 *The Development of Irrigated Agriculture in Wailau Valley, Moloka'i, Hawai'i*. Ph.D. Dissertation. Honolulu: University of Hawai'i.
- McElroy, Windy K., Steven Eminger, and Theresa Donham
 2005 *University of Hawai'i Moloka'i Archaeological Training Project 2004-2005 Results Kamalō, Moloka'i, Hawai'i*. Prepared for Kamehameha Schools Bishop Estate and the Moloka'i Rural Development Project. Honolulu: University of Hawai'i.
- Monsarrat, M.D.
 1903 Part of Wailau Valley Molokai, August 1903. Scale 1 in. = 200 ft.

- Ne, Harriet
 1970 *Tales of Molokai*. Lā'ie: The Institute for Polynesian Studies.
- 'Onipa'a Nā Hui Kalo
 2004 *Guidelines for Grassroots Lo'i Kalo Rehabilitation*. Kaunakakai: Queen Lili'uokalani Children's Center.
- Podmore, G.
 1915 Portion of Wailau Valley, Halawa, Molokai, August 1915. Bishop Estate Survey Map. Scale 1:600.
- Pukui, Mary Kawena
 1983 *'Ōlelo No'eau Hawaiian Proverbs and Poetical Sayings*. Bernice P. Bishop Museum Special Publication No. 71. Honolulu: Bishop Museum Press.
- Pukui, Mary Kawena, Samuel H. Elbert, and Esther T. Mookini
 1974 *Place Names of Hawaii*. Honolulu: The University of Hawai'i Press.
- Reeve, Rowland
 1973 Ms. *Wailau: An Archaeological Site Survey of Wailau Valley, Molokai*. Unpublished manuscript on file with the Bernice P. Bishop Museum, Honolulu.
- Remy, Jules
 1893 *The Island of Molokai Before Leprosy*. Arcus-sur-Aube. Translated by Mildred Knowlton, Oct. 1975.
- Reppun, Molly
 1951 "Molokai-A-Hina," in *Ka Leo O Molokai*, November 23, 1951:2.
- Riley, Thomas
 1973 *Wet and Dry in a Hawaiian Valley: The Archaeology of an Agricultural System*. Ph.D. Dissertation. Honolulu: University of Hawai'i.
- Robacker, Earl F., and Ada F. Robacker
 1978 *Spatterware and Sponge: Hardy Perennials of Ceramics*. South Brunswick and New York: A. S. Barnes and Company.
- Rock, Joseph
 1913 *The Indigenous Trees of the Hawaiian Islands*. Published privately, Honolulu. (Reprint. Rutland: Charles E. Tuttle Co., 1974.)
- Stearns, Harold
 1985 *Geology of the State of Hawaii*. (Second edition) Palo Alto: Pacific Books, Publishers.
- Stevenson, Robert Louis
 1973 *Travels in Hawaii*. Honolulu: The University of Hawai'i Press.
- Stokes, John F.G.
 1909 Ms. "Heiau of Molokai," In *The Ancient Worship of the Hawaiian Islanders*. Edited by William T. Brigham. Unpublished manuscript on file with the Bernice P. Bishop Museum, Honolulu.
- Stone, John Franklin
 1919 "Glimpses of Windward Molokai," in *Paradise of the Pacific*, December 1919: 98-100.
- Summers, Catherine

- 1971 *Molokai: A Site Survey*. Pacific Anthropological Records Number 14. Honolulu: Department of Anthropology, Bernice P. Bishop Museum.
- Sutherland, Audrey
1978 *Paddling My Own Canoe*. Honolulu: University of Hawai'i Press.
- Thien, S.
1979 A Flow Diagram for Teaching Texture-By-Feel Analysis. *Journal of Agronomic Education* 8:54-55.
- Thrum, Thomas G.
1907 *Hawaiian Folk Tales*. Chicago: A.C. McClurg & Co.
- Titcomb, Margaret
1978 Native Use of Marine Invertebrates in Old Hawaii. *Pacific Science* 32(4):325-391.
- U.S. Department of the Interior, Bureau of Reclamation
1941 *Final Report on Water Supply Studies, Hawaii. F.P. No. 45, Island of Molokai (1938)*. Wailuku: Maui Publishing Co., Ltd.
- Wagner, Warren L., Derral R. Herbst, and S.H. Sohmer
1999 *Flowering Plants of Hawai'i*. Bishop Museum Special Publication 83. Honolulu: University of Hawai'i and Bishop Museum Press.
- W.C.H.
1934 Por. Wailau, Molokai. Hawai'i State Survey Map No. 2124, August 1934. Scale 1:2400.
- Weisler, Marshall, Kenneth Collerson, Yue-Xing Feng, Jian-Xin Zhao, and Ke-Fu Yu.
2005 Thorium-230 Coral Chronology of a Late Prehistoric Hawaiian Chiefdom. *Journal of Archaeological Science* 33 (3):273-282.
- Williams, John
1935 "Halawa," in *Honolulu Star-Bulletin*, May 18, 1935.

GLOSSARY

- ‘akoko** One of 15 endemic shrubs and trees of the genus *Chamaecyse* spp., the sap of which was made into a paint for canoes in traditional Hawai‘i.
- ‘a‘ali‘i** *Dodonaea viscosa*, the fruit of which were used for red dye, the leaves and fruits fashioned into *lei*, and the hard, heavy wood made into bait sticks and house posts.
- ‘ahakea** The native tree, *Bobea* sp., the wood of which was used for canoe gunwales, house doors, and door frames, and bark used medicinally in traditional Hawai‘i.
- ali‘i** Chief, chiefess, monarch.
- AMS** Accelerator Mass Spectrometry, a radiocarbon dating technique that requires a smaller sample size and produces a smaller error range than conventional radiocarbon dating.
- ‘ape** The large plants *Alocasia macrorrhiza* or *Xanthosoma roseum*, that resemble taro. In traditional Hawai‘i, ‘ape was planted near gates, and leaves were placed under the sick because they were believed to deter evil spirits. They were not planted near houses.
- ‘auwai** Ditch, often for irrigated agriculture.
- bamboo** The shrub or tree *Dendrocalamus*, *Phyllostachys*, *Schizostachyum*, or *Bambusa*. The species native to Hawai‘i are *Bambusa vulgaris* and *B. aureovariegata*. These were traditionally used for many items, including knives, hula implements, nose flutes, water containers, and tapa-decorating equipment.
- banana** The *mai‘a*, or *Musa* sp., whose fruit was eaten and leaves used traditionally as a wrapping for cooking food in earth ovens.
- clidemia** *Clidemia hirta*, also known as Koster’s curse, an introduced, invasive shrub.
- ginger** The plant *Zingiber*, that produces fragrant flowers.
- GPS** Global Positioning Systems.
- guava** The invasive tree or shrub *Psidium guajava*, which forms dense thickets in disturbed areas.
- hala** The indigenous pandanus tree, or *Hibiscus tiliaceus*, which had many uses in traditional Hawai‘i. Leaves were used in mats, house thatch, and basketry; flowers were prized for their perfume; keys were utilized in *lei* and as paint brushes; roots and leaf buds were used medicinally; and wood was fashioned into bowls and other items.
- hale** House.
- hame** The native tree, *Antidesma pulvinatum*, whose fruit was used traditionally in dyes.
- Hao** The native tree *Rauvolfia sandwicensis*.
- hau** The indigenous tree *Hibiscus tiliaceus*, which had many uses in traditional Hawai‘i. Sandals were fashioned from the bark and cordage was made from fibers. Wood was shaped into net floats, canoe booms, and various sports equipment and flowers were used medicinally.
- heiau** Place of worship and ritual in traditional Hawai‘i.
- hihiwai** The freshwater gastropod, *Neritina granosa*, which is eaten raw or cooked.

hōlei The native tree *Ochrosia compta*, which was used traditionally in canoe gunwales and in yellow dyes.

hō‘awa *Pittosporum* spp., a native tree, the wood of which was used to manufacture canoe gunwales.

‘ilima *Sida fallax*, the native shrub whose flowers were made into *lei*, and sap was used for medicinal purposes in traditional Hawai‘i.

imu Underground pit or oven used for cooking.

iwi Bone.

Java plum The introduced tree or shrub of the genus *Eugenia* or *Syzygium*, common in dry to mesic forests.

kahu Honored attendant, guardian, nurse, keeper, administrator, pastor.

kākā lā‘au A traditional Hawaiian sport involving fencing with a wooden spear.

kalo The Polynesian-introduced *Colocasia esculenta*, or taro, the staple of the traditional Hawaiian diet.

kamani The Polynesian-introduced tree, *Calophyllum inophyllum*, that had many uses in ancient Hawai‘i. Nuts were fashioned into whistles, nut oil was used as a polish for wooden containers and as a fuel for lamps. Flowers were used for scenting *kapa*, fruit husks were made into a brownish mauve dye, and wood was manufactured into bowls.

kapa Tapa cloth.

kolomona *Senna* sp., which includes native and historically-introduced trees.

kōpiko The native shrub-tree, *Psychotria* sp., four species of which are known to Moloka‘i. Its wood was previously used as firewood and to make *kapa* logs.

kukui The candlenut tree, or *Aleurites moluccana*, the nuts of which were eaten as a relish and used for lamp fuel in traditional times.

ku‘ula A stone god used to attract fish, an altar near the sea, or a hut where fishing gear was kept with *ku‘ula* images to invoke their power.

lama The native tree, *Diospyros sandwicensis*, that had many uses in traditional Hawai‘i. Fruit was eaten, wood was fashioned into fish traps and sacred structures within *heiau*. *Lama* wood was also crushed and used for medicinal purposes.

lo‘i Irrigated terrace for the cultivation of taro.

loulou The fan palm (*Pritchardia* spp.), endemic to Hawai‘i.

māhele The 1848 division of land.

makai Toward the sea.

mango Trees of the genus *Mangifera*, introduced to Hawai‘i in the Nineteenth Century and well known for their edible fruit.

mangrove The tree *Rhizophora mangle*, brought to Hawai‘i in the early Twentieth Century, known to infest coastal marshes and streams.

Maui rose The introduced shrub, *Rosa damascena*, or *lokelani*, the official flower of the island of Maui.

mauka Inland, upland, toward the mountain.

menehune Small people of legend who worked at night to build structures such as fishponds, roads, and *heiau*.

moa A traditional sport or game which involved the throwing of a short, blunt dart or javelin, also called *moa*.

mo‘o Lizard, dragon, water spirit.

mo‘olelo A story, myth, history, tradition, legend, or record.

mountain apple The tree ‘ōhi‘a ‘ai, or *Eugenia malaccensis*, that produces edible fruit.

naupaka The native shrub *Scaevola* sp., varieties of which are found both in the uplands and by the sea.

niu The Polynesian-introduced tree *Cocos nucifera*, or coconut.

noni *Morinda citrifolia*, the Indian mulberry, a tree or shrub known for its medicinal value in traditional Hawai‘i.

‘ohana Family.

‘ōhi‘a lehua The native tree *Metrosideros polymorpha*, the wood of which was utilized for carving images, as temple posts and palisades, for canoe spreaders and gunwales, and in musical instruments.

‘ōlapa The native tree *Cheirodendron trigynum*, the leaves of which were used in *lei*, and fruit, leaves, and bark made into dye.

olomea The native shrub-tree *Perrottetia sandwicensis*, used for starting fires in traditional times.

ō‘ō ihe Spear throwing, as practice for warriors.

o‘opu Fish of the families *Eleotridae*, *Gobiidae*, and *Bleniidae*.

‘ōpae Shrimp.

pahe‘e A sport or game which involved the throwing of an *ihe pahe‘e*, a long dart or javelin with one blunt end and one pointed end.

pa‘i‘ai Undiluted poi, left in a hardened state for ease in transport.

pali Cliff, steep hill.

papaya The introduced plant *Carica papaya*, known for its edible fruit.

pine Trees of the genus *Pinus*, historically introduced to Hawai‘i.

pōhaku Rock, stone.

pu‘uhonua Place of refuge.

sugarcane The Polynesian-introduced *Saccharum officinarum*, or *kō*, a large grass traditionally used as a sweetener and for black dye.

ti leaf Leaves of the plant *Cordyline terminalis*, which were traditionally used in house thatching, raincoats, sandals, whistles, and as a wrapping for food.

‘ua‘u *Pterodroma phaeopygia*, known commonly as the dark-rumped petrel, an endangered seabird.

‘ūlei The native shrub *Osteomeles anthyllidifolia*, the berries of which were eaten, sewn into *lei*, and used to make lavender dye, and its hard wood used to produce a variety of implements.

‘ulu The Polynesian-introduced tree *Artocarpus altilis*, or breadfruit.

wauke The paper mulberry, or *Broussonetia papyrifera*, which was made into tapa cloth in traditional Hawai‘i.

APPENDIX A: LIST OF FEATURES

Study Area	Feature	Description	Notes	GPS Position
Keiu	K-1	<i>'auwai</i>	formerly 272-a (McElroy 2004)	
	K-2	terrace	<i>lo'i</i> , formerly 272-b (McElroy 2004)	
	K-3	terrace	<i>lo'i</i> , formerly 272-c (McElroy 2004)	
	K-4	terrace	<i>lo'i</i> , formerly 272-d (McElroy 2004)	
	K-5	terrace	<i>lo'i</i> , formerly 272-e (McElroy 2004)	
	K-6	terrace	<i>lo'i</i> , formerly 272-f (McElroy 2004)	
	K-7	terrace	<i>lo'i</i> , formerly 272-g (McElroy 2004)	
	K-8	terrace	<i>lo'i</i>	
	K-9	terrace	<i>lo'i</i>	
	K-10	terrace	<i>lo'i</i>	
	K-11	terrace	<i>lo'i</i> at <i>ahupua'a</i> boundary	
	K-12	terrace	<i>lo'i</i> at <i>ahupua'a</i> boundary	
Pawa'a	P-1	terrace	<i>lo'i</i>	2341408.85N 725605.34E
	P-2	terrace	<i>lo'i</i>	2341420.53N 725599.29E
	P-3	terrace	<i>lo'i</i>	2341434.88N 725591.04E
	P-4	terrace	<i>lo'i</i>	2341466.80N 725576.33E
	P-5	<i>'auwai</i>		
	P-6	terrace	<i>lo'i</i>	2341559.70N 725569.16E
	P-7	terrace	<i>lo'i</i>	2341566.16N 725545.12E
	P-8	historic house complex	two terraces, one wall	
	P-9	terrace	function undetermined	
	P-10	terrace	function undetermined	2341560.06N 725488.45E
	P-11	wall		
	P-12	historic house complex	<i>'auwai</i> , platform, two pits, historic artifact scatter	
	P-13	stone alignment		
	P-14	stone mound		
	P-15	wall		
	P-16	stone alignment		
	P-17	possible burial complex	six stone-lined depressions, one low stone mound	

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Pawa'a (cont.)	P-18	wall		
	P-19	historic house platform		2341435.60N 725502.08E
Ku'e Central	C-1	platform	possible habitation	
	C-2	platform	possible habitation	2341851.21N 725304.45E
	C-3	historic complex	5 walls, platform, stone mound, concrete crypt	
	C-4	terrace	function undetermined	
	C-5	terrace	function undetermined	
	C-6	terrace	function undetermined	2341830.65N 725326.06E
	C-7	terrace	function undetermined	
	C-8	terrace	function undetermined	2341780.12N 725343.60E
	C-9	terrace	<i>lo'i</i>	2341765.13N 725295.24E
	C-10	terrace	<i>lo'i</i>	
	C-11	terrace	<i>lo'i</i>	
	C-12	terrace	<i>lo'i</i>	
	C-13	terrace	<i>lo'i</i>	
	C-14	terrace	<i>lo'i</i>	
	C-15	terrace	<i>lo'i</i>	
	C-16	terrace	<i>lo'i</i>	
	C-17	<i>'auwai</i>		
Ku'e West	C-18	hearth		2341729.78N 725025.92E
	C-19	terrace	possible unfinished <i>lo'i</i>	2341685.59N 725150.74E
	C-20	terrace	possible unfinished <i>lo'i</i>	2341691.71N 725150.74E
	C-21	terrace	possible unfinished <i>lo'i</i>	
	C-22	terrace	possible unfinished <i>lo'i</i>	2341662.25N 725135.93E
	C-23	terrace	possible unfinished <i>lo'i</i>	2341668.37N 725166.65E
	C-24	terrace	possible unfinished <i>lo'i</i>	
	C-25	terrace	possible unfinished <i>lo'i</i>	2341640.85N 725154.84E
	C-26	terrace	possible unfinished <i>lo'i</i>	
	C-27	terrace	possible unfinished <i>lo'i</i>	2341595.78N 725149.36E
	C-28	terrace	possible unfinished <i>lo'i</i>	2341636.19N 725178.82N

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Ku‘ele West (cont.)	C-29	terrace	possible unfinished <i>lo‘i</i>	
	C-30	terrace and alignment	possible unfinished <i>lo‘i</i>	2341564.64N 725167.79E
	C-31	terrace	possible unfinished <i>lo‘i</i>	2341587.92N 725176.30E
	C-32	terrace	possible unfinished <i>lo‘i</i>	2341532.41N 725162.13E
	C-33	terrace	possible unfinished <i>lo‘i</i>	
	C-34	terrace	possible unfinished <i>lo‘i</i>	2341515.68N 725202.64E
Makea	M-1	water control features	two wall segments, one <i>U</i> -shaped structure	
Lowland	M-2	terrace	<i>lo‘i</i>	2341451.00N 725256.49E
	M-3	terrace	<i>lo‘i</i>	
	M-4	terrace	<i>lo‘i</i>	
	M-5	terrace	<i>lo‘i</i>	
	M-6	terrace	<i>lo‘i</i>	2341499.43N 725256.42E
	M-7	terrace	<i>lo‘i</i>	2341525.10N 725249.66E
	M-8	terrace	<i>lo‘i</i>	2341551.92N 725248.30E
	M-9	terrace	<i>lo‘i</i>	2341568.40N 725274.94E
	M-10	terrace	<i>lo‘i</i>	
	M-11	<i>‘auwai</i>		2341466.09N 725280.78E
	M-12	terrace	<i>lo‘i</i>	
	M-13	terrace	<i>lo‘i</i>	
	M-14	terrace	<i>lo‘i</i>	
Makea Slope	M-15	stone alignment		2341444.57N 725240.60E
	M-16	stone alignment		2341424.48N 725182.50E
	M-17	historic house platform	platform and associated stone steps	2341385.38N 725181.42E
	M-18	terrace	function undetermined	
	M-19	terrace	function undetermined	
	M-20	terrace	function undetermined	
	M-21	terrace	<i>lo‘i</i>	
	M-22	terrace	<i>lo‘i</i>	
	M-23	terrace	<i>lo‘i</i>	
	M-24	terrace	<i>lo‘i</i>	

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Makea Slope (cont.)	M-25	terrace	<i>lo'i</i>	
	M-26	terrace	<i>lo'i</i>	
	M-27	terrace	<i>lo'i</i>	
	M-28	terrace	<i>lo'i</i>	
	M-29	terrace	<i>lo'i</i>	2341341.41N 725115.51E
	M-30	stone alignment	function undetermined	2341330.15N 725120.45E
	M-31	enclosure	possible habitation	2341349.00N 725121.08E
	M-32	stone mound	function undetermined	
	M-33	double alignment and wall	function undetermined	2341343.06N 725162.41E
	M-34	enclosure	function undetermined	2341357.77N 725148.78E
	M-35	wall	function undetermined	
	M-36	two parallel walls	function undetermined	
Kukuinui Makai	KU-1	terrace	<i>lo'i</i>	2341480.36N 725419.89E
	KU-2	terrace	<i>lo'i</i>	2341456.24N 725419.84E
	KU-3	terrace	<i>lo'i</i>	2341449.69N 725409.70E
	KU-4	terrace	<i>lo'i</i>	2341438.79N 725385.20E
	KU-5	terrace	<i>lo'i</i>	2341428.07N 725360.41E
	KU-6	terrace	<i>lo'i</i>	2341497.26N 725420.17E
	KU-7	terrace	<i>lo'i</i>	2341487.27N 725377.76E
	KU-8	terrace	<i>lo'i</i>	
	KU-9	terrace	<i>lo'i</i>	
	KU-10	terrace	<i>lo'i</i>	2341476.34N 725384.14E
	KU-11	terrace	<i>lo'i</i>	
	KU-12	terrace	<i>lo'i</i>	2341490.46N 725396.02E
	KU-13	terrace	<i>lo'i</i>	2341502.42N 725396.52E
	KU-14	terrace	<i>lo'i</i>	
	KU-15	terrace	<i>lo'i</i>	2341492.67N 725380.62E
	KU-16	terrace	<i>lo'i</i>	2341464.92N 725367.84E
Lower Eliali'i	E-1	<i>heiau</i>	Heiau at Kanane, Site 273 (Stokes 1909)	
	E-2	two walls		

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Lower Eliali'i (cont.)	E-3	wall	<i>L</i> -shaped	
	E-4	stone mound		
	E-5	wall and alignment		
	E-6	wall		
	E-7	wall		
	E-8	wall	<i>U</i> -shaped	
	E-9	terrace	<i>'ili'i</i> li and large boulder on top	
	E-10	terrace	<i>lo'i</i>	
	E-11	terrace	<i>lo'i</i>	
	E-12	<i>'auwai</i>		
	E-13	terrace	<i>lo'i</i>	
	E-14	terrace	<i>lo'i</i>	
	E-15	terrace	<i>lo'i</i>	
	E-16	terrace	<i>lo'i</i>	
	E-17	terrace	<i>lo'i</i>	
	E-18	terrace	<i>lo'i</i>	
	E-19	terrace	<i>lo'i</i>	
	E-20	terrace	<i>lo'i</i>	
	E-21	terrace	<i>lo'i</i>	
	E-22	terrace	<i>lo'i</i>	
	E-23	terrace	<i>lo'i</i>	2340894.92N 724659.18E
	E-24	terrace	<i>lo'i</i>	2340892.05N 724670.94E
	E-25	terrace	<i>lo'i</i>	2340902.09N 724671.23E
	E-26	terrace	<i>lo'i</i>	
	E-27	terrace	<i>lo'i</i>	
	E-28	terrace	<i>lo'i</i>	
	E-29	terrace	<i>lo'i</i>	
	E-30	terrace	<i>lo'i</i>	
	E-31	wall	possibly an eroded <i>lo'i</i> terrace	
	E-32	wall	possibly an eroded <i>lo'i</i> terrace	

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Upper	E-33	terrace	<i>lo'i</i>	
Eliali'i	E-34	terrace	<i>lo'i</i>	
	E-35	terrace	<i>lo'i</i>	
	E-36	terrace	<i>lo'i</i>	
	E-37	terrace	<i>lo'i</i>	
	E-38	terrace	<i>lo'i</i>	
	E-39	terrace	<i>lo'i</i>	
	E-40	terrace	<i>lo'i</i>	
	E-41	terrace	<i>lo'i</i>	
	E-42	terrace	<i>lo'i</i>	
	E-43	terrace	<i>lo'i</i>	
	E-44	terrace	<i>lo'i</i>	2340975.84N 724578.95E
	E-45	terrace	<i>lo'i</i>	
	E-46	terrace	<i>lo'i</i>	
	E-47	terrace	<i>lo'i</i>	
	E-48	terrace	<i>lo'i</i>	
	E-49	terrace	<i>lo'i</i>	
	E-50	terrace	<i>lo'i</i>	
	E-51	terrace	<i>lo'i</i>	
	E-52	terrace	<i>lo'i</i>	
	E-53	terrace	<i>lo'i</i>	2340920.35N 724642.84E
	E-54	terrace	<i>lo'i</i>	
	E-55	terrace	<i>lo'i</i>	
	E-56	terrace	<i>lo'i</i>	
	E-57	terrace	<i>lo'i</i>	2340914.19E 724676.47E
	E-58	terrace	<i>lo'i</i>	
	E-59	terrace	<i>lo'i</i>	
	E-60	<i>'auwai</i>		2340904.66N 724715.70E
	E-61	terrace	<i>lo'i</i>	
	E-62	terrace	<i>lo'i</i> ; boulder alignment at east end	

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Upper	E-63	terrace	<i>lo'i</i>	
Eliali'i	E-64	terrace	<i>lo'i</i>	
(cont.)	E-65	terrace	<i>lo'i</i>	
	E-66	terrace	<i>lo'i</i>	
	E-67	terrace	<i>lo'i</i>	
	E-68	terrace	<i>lo'i</i>	
	E-69	terrace	<i>lo'i</i>	
	E-70	terrace	<i>lo'i</i>	2340911.02N 724716.38E
	E-71	terrace	<i>lo'i</i>	
	E-72	terrace	<i>lo'i</i>	
	E-73	terrace	<i>lo'i</i>	
	E-74	terrace	<i>lo'i</i>	
	E-75	terrace	<i>lo'i</i>	
	E-76	terrace	<i>lo'i</i>	
	E-77	terrace	<i>lo'i</i>	
	E-78	terrace	<i>lo'i</i>	2340895.42N 724737.33E
	E-79	terrace	<i>lo'i</i>	
	E-80	terrace	<i>lo'i</i>	
	E-81	terrace	<i>lo'i</i>	
	E-82	terrace	<i>lo'i</i>	
	E-83	terrace	<i>lo'i</i>	
	E-84	terrace	<i>lo'i</i>	
	E-85	terrace	<i>lo'i</i>	
	E-86	terrace	<i>lo'i</i>	
	E-87	terrace	<i>lo'i</i>	
	E-88	terrace	<i>lo'i</i>	
	E-89	terrace	function undetermined	2340901.30N 724767.26E
	E-90	terrace	<i>lo'i</i>	
	E-91	terrace	<i>lo'i</i>	
	E-92	terrace	<i>lo'i</i>	

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Upper	E-93	historic house platform		2340864.31N 724776.78E
Eliali'i	E-94	terrace	<i>lo'i</i>	
(cont.)	E-95	terrace	<i>lo'i</i>	
	E-96	terrace	<i>lo'i</i>	
	E-97	terrace	<i>lo'i</i>	
	E-98	terrace	<i>lo'i</i>	
Halepoki	H-1	terrace	<i>lo'i</i>	2340756.95N 724741.19E
Makai	H-2	terrace	<i>lo'i</i>	2340769.17N 724713.10E
	H-3	terrace	<i>lo'i</i>	
	H-4	terrace	<i>lo'i</i>	
	H-5	<i>'auwai</i>		2340711.94N 724715.52E
	H-6	terrace	<i>lo'i</i>	
	H-7	terrace	<i>lo'i</i>	2340707.49N 724723.73E
	H-8	terrace	<i>lo'i</i>	
	H-9	terrace	<i>lo'i</i>	
	H-10	terrace	<i>lo'i</i>	
	H-11	terrace	<i>lo'i</i>	
	H-12	terrace	<i>lo'i</i>	
	H-13	terrace	<i>lo'i</i>	
	H-14	terrace	<i>lo'i</i>	
	H-15	terrace	<i>lo'i</i>	
	H-16	terrace	<i>lo'i</i>	
	H-17	terrace	<i>lo'i</i>	
	H-18	terrace	<i>lo'i</i>	
	H-19	terrace	<i>lo'i</i>	2340740.13N 724673.96E
	H-20	terrace	<i>lo'i</i>	2340694.83N 724709.05E
	H-21	terrace	<i>lo'i</i>	
	H-22	terrace	<i>lo'i</i>	
	H-23	terrace	<i>lo'i</i>	2340687.96N 724694.17E
	H-24	terrace	<i>lo'i</i>	

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Halepoki	H-25	terrace	<i>lo'i</i>	
Makai (cont.)	H-26	terrace	<i>lo'i</i>	
	H-27	terrace	<i>lo'i</i>	
	H-28	terrace	<i>lo'i</i>	
	H-29	terrace	<i>lo'i</i>	
	H-30	terrace	<i>lo'i</i>	
	H-31	terrace	<i>lo'i</i>	
	H-32	terrace	<i>lo'i</i>	2340705.07N 724636.88E
	H-33	terrace	<i>lo'i</i>	2340668.08N 724708.83E
	H-34	terrace	<i>lo'i</i>	
	H-35	terrace	<i>lo'i</i>	2340648.74N 724702.18E
	H-36	terrace	<i>lo'i</i>	2340645.10N 724691.83E
	H-37	terrace	<i>lo'i</i>	
	H-38	terrace	<i>lo'i</i>	
	H-39	terrace	<i>lo'i</i>	
	H-40	terrace	<i>lo'i</i>	
	H-41	terrace	<i>lo'i</i>	
	H-42	terrace	<i>lo'i</i>	
	H-43	terrace	<i>lo'i</i>	
	H-44	terrace	<i>lo'i</i>	
	H-45	terrace	<i>lo'i</i>	2340693.33N 724645.35E
	H-46	terrace	<i>lo'i</i>	
	H-47	terrace	<i>lo'i</i>	
	H-48	terrace	<i>lo'i</i>	
	H-49	terrace	<i>lo'i</i>	
	H-50	terrace	<i>lo'i</i>	2340644.84N 724658.84E
	H-51	terrace	<i>lo'i</i>	
	H-52	terrace	<i>lo'i</i>	
	H-53	terrace	<i>lo'i</i>	
	H-54	terrace	<i>lo'i</i>	

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Halepoki	H-55	terrace	<i>lo'i</i>	
Makai (cont.)	H-56	terrace	<i>lo'i</i>	
	H-57	terrace	<i>lo'i</i>	2340661.66N 724644.92E
	H-58	terrace	<i>lo'i</i>	
	H-59	terrace	<i>lo'i</i>	
	H-60	terrace	<i>lo'i</i>	
	H-61	terrace	<i>lo'i</i>	
	H-62	terrace	<i>lo'i</i>	
	H-63	terrace	<i>lo'i</i>	2340672.42N 724629.89E
	H-64	wall		2340624.17N 724567.91E
Lahoeka	L-1	terrace	function undetermined	2340621.64N 724743.72E
	L-2	terrace	<i>lo'i</i>	2340627.24N 724743.72E
	L-3	terrace	<i>lo'i</i>	
	L-4	terrace	<i>lo'i</i>	
	L-5	terrace	<i>lo'i</i>	
	L-6	terrace	<i>lo'i</i>	
	L-7	terrace	<i>lo'i</i>	
	L-8	terrace	<i>lo'i</i>	
	L-9	terrace	<i>lo'i</i>	
	L-10	terrace	<i>lo'i</i>	
	L-11	terrace	<i>lo'i</i>	
	L-12	terrace	<i>lo'i</i>	2340641.81N 724762.77E
	L-13	terrace	<i>lo'i</i>	
	L-14	terrace	<i>lo'i</i>	
	L-15	terrace	<i>lo'i</i>	
	L-16	terrace	<i>lo'i</i> with two stone concentrations	
	L-17	terrace	<i>lo'i</i>	2340688.33N 724763.89E
	L-18	terrace	<i>lo'i</i>	
	L-19	terrace	<i>lo'i</i> with two stone mounds, one with grindstone	
	L-20	terrace	<i>lo'i</i>	

Appendix A: List of Features (continued)

Study Area	Feature	Description	Notes	GPS Position
Lahokea (cont.)	L-21	terrace	<i>lo'i</i>	
	L-22	terrace	<i>lo'i</i>	
	L-23	terrace	<i>lo'i</i>	
	L-24	terrace	<i>lo'i</i>	2340728.12N 724795.28E
	L-25	<i>'auwai</i>		2340755.02N 724814.33E
	L-26	terrace	function undetermined	

APPENDIX B: ARTIFACT DATA

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Keiu	K-11	TU 12	I/2	109	<i>hihiwai</i> shell	1	0.2		
	K-11	TU 12	I/2	110	volcanic glass	1	0.1		
Pawa'a	N/A	N/A	surface	118	ceramics	1	86.8	E/A ¹ large serving vessel sherds	ironstone; blue flower transfer print; probably oval platter; 1850-1910
	N/A	N/A	surface	118	ceramics	2	22.8	E/A soup plate sherds	ironstone; blue flower transfer print; 1850-1910
	N/A	N/A	surface	118	ceramics	1	117.9	E/A large bowl base sherd	whiteware/ironstone; undecorated; 1850-1930
	N/A	N/A	surface	118	ceramics	2	25.8	E/A plate sherds	whiteware/ironstone; hand-painted; >1870
	N/A	N/A	surface	118	ceramics	1	11.8	E/A plate cavetto sherd	whiteware/ironstone; undecorated
	N/A	N/A	surface	118	ceramics	2	23.6	E/A large bowl sherds	whiteware/ironstone; possibly two vessels represented
	N/A	N/A	surface	118	glass	2	116.6	beer/soda base and body frags ²	pale green quart size; "428 H" embossed on base
	N/A	N/A	surface	118	glass	3	130.7	alcohol bottle frags	pale blue mold-blown
	N/A	N/A	surface	120	adze blank	1	93.4	chipping on all surfaces and one edge	
	N/A	N/A	surface	120	ceramics	1	58.4	Chinese <i>tz'u</i> rice bowl base sherd	porcelaineous stoneware; hand-painted "three circles and dragonfly" motif; 19 th - early 20 th C.
	N/A	N/A	surface	120	glass	1	615.1	alcohol bottle base, body, and part of neck	light blue; two-piece mold-blown; "A.B.G.M. CO. 82" embossed on base; manufactured by Adolphus Bush Glass Manufacturing Company 1886-1920

** Layer/level

¹ English/American

² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Pawa'a (cont.)	N/A	N/A	surface	120	metal	1	207.5	lock hardware	
	N/A	N/A	surface	123	ceramics	1	244	E/A ¹ soup plate sherd	1873-1891
	N/A	N/A	surface	123	glass	1	78.3	whole medicine bottle	11.9 cm tall; 3.8 wide base; 2.4 diameter lip
	N/A	N/A	surface	124	metal	1	100.9	brass doorknob	engraved
	P-8	N/A	surface	119	ceramics	2	178	Chinese <i>tz'u</i> rice bowl base and body sherds	porcelaineous stoneware; hand-painted; "double happiness" motif; mid 19 th -20 th C.
	P-8	N/A	surface	119	ceramics	2	145.7	Chinese <i>Min Gei</i> base sherds	wide mouth food or soy sauce jar; brown glaze on inside; base unglazed; sherds mend; mid 19 th -20 th C.
	P-8	N/A	surface	119	ceramics	4	172.4	E/A soup plate base and cavetto sherds	whiteware/ironstone; undecorated; two sherds mend
	P-8	N/A	surface	119	ceramics	1	30.6	E/A bowl base sherd	whiteware/ironstone; undecorated
	P-8	N/A	surface	119	glass	1	106.3	case gin frag ²	clear; manganese decolorized; machine-made; 1910-1920
	P-8	N/A	surface	119	glass	2	376.3	alcohol base and body frags	amber to brown turn-molded snap base with nipple; 1870-1910
	P-8	N/A	surface	119	glass	1	166.8	large tumbler base frag	clear
	P-12	N/A	surface	122	ceramics	2	175.8	E/A bowl sherds	white ironstone hotelware; undecorated; >1880
	P-12	N/A	surface	122	glass	1	546.8	wine/champagne base and body frag	light olive green; kick-up/push-up; late 19 th -early 20 th C.
	P-12	N/A	surface	122	glass	1	348.9	wine/champagne base and body frag	medium olive green; turn-molded; kick-up/push-up; late 19 th -early 20 th C.
	P-12	N/A	surface	122	glass	1	87.1	base and body frag	blue-green; machine-made; stippling and "1481-W" embossed on base; 1950s-1960s

** Layer/level

¹ English/American

² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Pawa'a (cont.)	P-12	N/A	surface	122	glass	1	109.1	base and body frag ²	clear; machine-made; stippling and maker's mark on base; Maywood Glass Co., Compton, CA; 1958 one perforated; one with snap
	P-12	N/A	surface	122	leather strips	2	5.1	rein parts	
	P-12	N/A	surface	122	metal	3	310.5	cinch buckle for horse harness	graduated rings; late 19 th -20 th C.
	P-12	N/A	surface	122	metal	1	49.7	iron buckle	
	P-12	N/A	surface	122	metal	1	22.5	buckle for rein	part of cache; >1893
	P-12	N/A	surface	122	metal	1	339.1	large iron spike	
	P-12	N/A	surface	122	metal	1	121.5	large iron bolt	
	P-12	N/A	surface	122	metal	1	5.3	wire nail	
Ku'eie Central	P-15	N/A	surface	121	hammer-stone	1	364	waterworn cobble with crushing wear on one surface	
	C-2	TU 25	I/1	189	adze blank	1	13.2	one polished surface	
	C-2	TU 25	I/1	189	adze frag	1	0.7	one polished surface	
	C-2	TU 25	I/1	189	adze frag	1	2.0	one polished surface	
	C-2	TU 25	I/1	189	adze frag	1	10.5	one polished surface	
	C-2	TU 25	I/1	189	adze frag	1	13.6	one polished surface	
	C-2	TU 25	I/4	201	adze frag	1	50.6	two polished surfaces	
	C-2	TU 25	surface	188	basalt core	1	179.0		
	C-2	TU 25	I/1	189	basalt flakes	32	184.5	two with chipping, one with polish	
	C-2	TU 25	I/2	198	basalt flakes	3	8.8		
	C-2	TU 25	I/4	201	basalt flake	1	4.6		
	C-2	TU 25	surface	188	basalt flakes	2	198.8		

** Layer/level
² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I) ^{**}	Bag	Material	Count	Weight (g)	Description	Notes
Ku'e Central (cont.)	C-2	TU 25	I/1	189	ceramics	1	2.7	E/A ¹ undecorated	
	C-2	TU 25	surface	188	ceramics	1	2.2	E/A saucer frag ² , base with royal crest	maker's mark on base
	C-2	TU 25	I/1	189	glass	3	1.6	window glass frags, light blue	
	C-2	TU 25	I/1	189	glass	1	2.4	window frag, clear	
	C-2	TU 25	I/1	189	glass	11	31.7	olive green frags	
	C-2	TU 25	surface	188	glass	3	11.4	olive green frags	
	C-2	TU 25	I/1	189	volcanic glass	2	1.2		
	C-2	TU 25	I/2	198	volcanic glass	1	tr.		
	C-6	TU 26	I/2	193	adze blank	1	456.5		
	C-6	TU 26	I/1	192	adze frag	1	10.8	one polished surface	
	C-6	TU 26	I/2	193	awl	1	9.9	flaking on all surfaces	
	C-6	TU 26	I/1	190	basalt flake	1	1.5		
	C-6	TU 26	I/1	192	basalt flakes	17	176.3	one with a utilized edge	
	C-6	TU 26	I/2	193	basalt flakes	43	538.1	two with chipping, three with polish	
	C-6	TU 26	I/2	195	basalt flakes	8	58.8		
	C-6	TU 26	I/3	196	basalt flakes	2	2.0		
	C-6	TU 26	II/1	204	basalt flakes	4	50.9		
	C-6	TU 26	I/2	193	bone	1	0.1		
	C-6	TU 26	I/2	193	chert	1	4.0		

^{**} Layer/level

¹ English/American

² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I) ^{**}	Bag	Material	Count	Weight (g)	Description	Notes
Ku'eie Central (cont.)	C-6	TU 26	I/2	195	chisel frag ²	1	1.9	circular cross-section; all surfaces polished	
	C-6	TU 26	I/1	190	glass	4	5.8	window glass frags	
	C-6	TU 26	I/1	191	glass	4	42.6	window glass frags	
	C-6	TU 26	I/1	192	glass	1	6.1	green frag	
	C-6	TU 26	I/1	192	glass	5	4.6	window glass frags	
	C-6	TU 26	I/2	193	glass	1	0.6	aqua frag	
	C-6	TU 26	I/2	193	glass	2	0.9	clear frags	
	C-6	TU 26	I/2	193	glass	4	1.8	medium green frags	
	C-6	TU 26	I/2	193	glass	3	8.5	window glass frags	
	C-6	TU 26	I/2	193	metal	1	1.2	bullet casing frag	
	C-6	TU 26	I/1	192	volcanic glass	1	0.5		
	C-6	TU 26	I/2	193	volcanic glass	2	0.3		
	C-6	TU 26	I/2	193	whetstone	1	674.7		
	C-8	TU 27	I/4	285	adze frag	1	14.0	one polished surface	
	C-8	TU 27	I/5	288	basalt flakes	15	46.3	one with chipping	
	C-8	TU 27	I/6	290	basalt flakes	3	5.3		
	C-8	TU 27	I/5	288	modified basalt	1	47.0	one ground surface	
	C-8	TU 27	I/4	286	volcanic glass	1	0.1		
	C-8	TU 27	I/5	339	volcanic glass	5	0.6		
	C-8	TU 27	II/1	294	volcanic glass	1	1.8		

^{**} Layer/level

² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I) ^{**}	Bag	Material	Count	Weight (g)	Description	Notes
Ku'eie Central (cont.)	C-8	TR 38	I	373	abrader frag ²	1	4.1	one ground surface	
	C-8	TR 38	I	370	basalt flakes	48	345.4	one with chipping	
	C-8	TR 38	I	372	volcanic glass	2	1.4		
	C-9	TR 16	I	283	adze frag	1	13.2		
	C-9	TR 16	I	283	awl	1	75.8	made from a broken adze; one polished surface; other surfaces flaked	
	C-9	TR 16	I	283	basalt flakes	33	315.4	two with polish	
	C-9	TR 16	I	283	pounder frag	1	148.6	one ground surface	
	C-9	TR 16	I	283	volcanic glass	1	0.9		
	C-9	TR 37	I	335	adze frag	1	70.7		
	C-9	TR 37	I	335	basalt flakes	79	469.5	one with chipping, one with polish	
	C-9	TR 37	surface	334	basalt flake	1	5.4		
	C-9	TR 37	I	335	chert	1	2.9	non-Hawaiian origin	
	C-9	TR 37	I	335	volcanic glass	6	2.2		
	C-18	TU 22	I/1	247	basalt flakes	6	9.3		
	C-18	TU 22	I/1	249	basalt flake	1	1.0		

^{**} Layer/level
² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Ku'eie West (cont.)	C-18	N/A	surface	155	basalt flakes	12	273.8	two with chipping	
	C-20	N/A	surface	156	basalt flakes	3	279.5		
	C-21	TU 23	I/2	254	abrader	1	67.0	one ground surface	
	C-21	TU 23	I/1	251	basalt flakes	3	77.9		
	C-21	TU 23	I/2	254	basalt flakes	6	35.5		
	C-21	TU 23	I/3	255	basalt flakes	2	25.2		
	C-21	TU 23	I/4	259	basalt flake	1	17.0		
	C-30	TR 3	7 cmbs	163	basalt core	1	91.3		
	C-30	TR 3	7 cmbs	163	basalt flakes	2	15.7		
	C-30	TR 3	9 cmbs	164	basalt flake	1	14.9		
	C-34	TR 2	12 cmbs	159	volcanic glass	1	5.0		
	N/A	N/A	surface	158	adze blank	1	246.9		south of C-24
	N/A	N/A	surface	157	basalt core	1	199.6		between C-18 and C-19
Makea Lowland	M-2	TU 6	I/3	44	basalt flakes	6	45.6		
	M-6	TR 11	I	272	basalt flakes	9	179.0	one with chipping, one with a utilized edge	
	M-7	N/A	surface	181	adze blank	1	240.0		
	M-7	TR 10	I	179	basalt flake	1	17.1	one utilized edge	
	M-8	TR 9	I	267	adze blank	1	58.9		

** Layer/level

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Makea Lowland (cont.)	M-8	TR 9	I	267	basalt flakes	8	93.1		
	M-9	TR 8	I	177	basalt flake	1	65.3	one chipped edge	
	M-10	TU 11	I/3	102	basalt flakes	3	20.7		
	M-10	TU 11	I/2	89	volcanic glass	1	0.1		
	M-13	TU 10	I/1	87	basalt flake	1	4.3		
	M-13	TU 10	I/2	91	volcanic glass	2	0.5		
	M-13	TU 10	I/3	95	volcanic glass	3	0.8		
Makea Slope	M-17	TU 7	surface	64	ceramics	3	39.9	E/A ¹ plate sherds	white ironstone whiteware; undecorated; small plate; common 1840-1910
	M-17	TU 7	surface	64	ceramics	4	126.1	E/A open vegetable dish sherds	ironstone/whiteware; hand-painted; thick bodied; no footring; possibly oval; 1870-1930
	M-17	TU 7	surface	64	ceramics	1	12.5	E/A bowl	ironstone/whiteware; undecorated; 1850-1930
	M-17	TU 7	surface	64	glass	1	348.1	alcohol bottle base frag ²	olive amber; two piece mold-blown; Edward H. Everett Glass Company; 1883-1904
	M-17	TU 7	surface	64	glass	1	360.9	alcohol bottle base frag	olive green; mold-blown; turn-molded with nipple; common 1870-1917

** Layer/level

¹ English/American

² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Makea Slope (cont.)	M-17	TU 7	surface	64	glass	2	46.4	lamp globe frags ²	molded grape leaf pattern; selenium decolorized 1916-1930; 2 frags mend
	M-17	TU 7	surface	64	glass	1	27.1	alcohol bottle neck frag	pale green mold-blown square bead over sloping ring
	M-17	TU 7	surface	64	glass	1	8.1	wine/champagne bottle base frag	green kick-up/push-up; probably machine-made
	M-17	TU 7	surface	64	glass	1	59	wine/champagne bottle base frag	light olive green push-up; probably machine-made
	M-17	TU 7	surface	64	glass	7	111.1	lamp globe frags	clear, undecorated, lip ground from wear
	M-17	TU 7	surface	64	glass	3	7.1	non-diagnostic frags	clear
	M-17	TU 7	surface	64	metal	1	330.8	horse bit	
	M-17	TU 7	surface	64	rubber strips	2	36.5		
	M-17	TU 7	surface	64	slate	8	35.4	five plain; two engraved; one corner engraved	fine polish, probably chalkboard with wood frame
	M-17	TU 7	I/1	62	basalt flakes	3	24.3	one with possible retouch	chipping on one edge
	M-17	TU 7	I/1	62	buttons	3	1.5	porcelain	sew through; 4-hole; 2 whole; 1 frag; >1850
	M-17	TU 7	I/1	62	ceramics	3	50.6	E/A ¹ nappy sherds	yellowware; 1830-1930
	M-17	TU 7	I/1	62	ceramics	75	268.5	E/A bowl sherds	plain whiteware; at least 3 small bowls and one plate represented; late 19 th -early 20 th C.
	M-17	TU 7	I/1	62	ceramics	5	37.1	E/A plate sherds	hand-painted rim band and stencil motif; >1870
	M-17	TU 7	I/1	62	ceramics	1	6.3	E/A bowl sherd	hand-painted >1870

** Layer/level

² fragment

¹ English/American

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I) ^{**}	Bag	Material	Count	Weight (g)	Description	Notes
Makea Slope (cont.)	M-17	TU 7	I/1	62	ceramics	1	6.3	E/A ¹ plate sherd	hand-painted >1870
	M-17	TU 7	I/1	62	ceramics	3	27.7	E/A plate sherds	common before 1880
	M-17	TU 7	I/1	62	glass	4	451.3	case gin frags ²	mold-blown
	M-17	TU 7	I/1	62	glass	2	19.5	base frags	blue-green relief molded; oval base
	M-17	TU 7	I/1	62	glass	5	4.5	lamp chimney frags	clear; thin
	M-17	TU 7	I/1	62	glass	1	10.1	medicine bottle frag	clear; mold-blown; chamfered corner; square lip
	M-17	TU 7	I/1	62	glass	27	108.1	lamp globe frags	molded grape leaf pattern; 3 frags mend "DIETZ No 0.TUBULAR NEW YORK" embossed on body; selenium decolorized 1916-1930
	M-17	TU 7	I/1	62	glass	23	60.5	window glass frags	light blue-green
	M-17	TU 7	I/1	62	glass	4	10.7	alcohol bottle frags	dark olive green mold-blown
	M-17	TU 7	I/1	62	glass	15	183.3	base and body frags	medium olive green with push-up base
	M-17	TU 7	I/1	62	glass	1	12.5	wine/champagne bottle frag	dark olive green
	M-17	TU 7	I/1	62	glass	42	124.1	non-diagnostic frags	clear
	M-17	TU 7	I/1	62	glass	2	9.1	medicine bottle frags	clear; flat panel; machine-made
	M-17	TU 7	I/1	62	glass	1	1	beer/whiskey bottle frag	amber
	M-17	TU 7	I/1	62	glass	3	9.2	non-diagnostic frags	2 cornflower blue; 1 cobalt blue
	M-17	TU 7	I/1	62	glass	3	38.8	wine/champagne bottle frags	light green; 1 mold-blown single band lip frag; at least 2 bottles represented
	M-17	TU 7	I/1	62	glass	29	448	quart-size beverage bottle frags	19 light green; 10 light blue-green; at least 5 bottles represented
	M-17	TU 7	I/1	62	metal	5	142.8	iron	probably large nails, bolts, or machinery parts

^{**} Layer/level

¹ English/American

² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
	M-17	TU 7	I/1	62	rubber strip	1	1		
	M-17	TU 7	I/1	62	unidentified	1	0.2	bone or shell frag ²	
	M-17	TU 7	I/1	62	<i>hihiwai</i> shell	14	0.7		
	M-17	TU 7	I/1 or I/2	61	slate	1	14.9	edge frag	
	M-17	TU 7	I/2	67	adze chip	1	0.5	polish on one surface	
	M-17	TU 7	I/2	67	basalt flakes	4	14.3		
	M-17	TU 7	I/2	67	ceramics	5	1.16	E/A ¹ plate sherds	one with hand-painted rim and stencil motif; 1870-1930
	M-17	TU 7	I/2	67	glass	3	8.9	non-diagnostic	2 olive green; 1 light green
	M-17	TU 7	I/2	67	metal	1	2.6	lead, reshaped	
	M-17	TU 7	I/2	67	metal	1	75.2	iron	probably large nail, bolt or machinery part
	M-17	TU 7	I/2	67	red stone	1	2.9	unidentified	
	M-17	TU 7	I/2	67	slate	1	0.2		
	M-17	TU 7	I/2	67	<i>hihiwai</i> shell	4	0.1		
	M-17	TU 7	I/3	70	basalt flake	1	1.7		
	M-17	TU 7	I/3	70	glass	1	1	clear frag	
	M-17	TU 7	I/3	73	ceramics	1	0.4	non-diagnostic	plain whiteware
	M-17	TU 7	II/1	78	basalt flake	1	3.5		

** Layer/level

² fragment

¹ English/American

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Makea Slope (cont.)	M-17	N/A	I/1 or I/2	85	adze	1	42.8	three polished surfaces, chipped edge	
	M-17	N/A	I/1 or I/2	85	ceramics	2	3.3	E/A ¹ nappy sherds	yellowware; 1830-1930
	M-17	N/A	surface	48	ceramics	2	132.2	E/A large serving vessel rim/cavetto sherds	whiteware; cut sponge stamped with hand-painted line; >1870
	M-17	N/A	surface	48	ceramics	4	160.8	E/A plate base/cavetto sherds	whiteware; cut sponge stamped with hand-painted line; >1870
	M-17	N/A	surface	48	ceramics	1	27.1	E/A plate rim sherd	whiteware; hand-painted; >1870
	M-17	N/A	surface	48	ceramics	3	21.8	E/A cup rim/body sherds	whiteware; blue flower transfer print; 1820-1870; sherds do not mend
	M-17	N/A	surface	48	ceramics	3	60.4	E/A small bowl base and body sherds	ironstone; undecorated; >1880; earlier than bag 122 ironstone
	M-17	N/A	surface	48	ceramics	2	12.8	E/A plate base and body sherds	whiteware; undecorated
	M-17	N/A	surface	48	ceramics	1	149.3	doorknob	yellowware stoneware; Rockingham glaze
	M-17	N/A	surface	48	glass	1	547	alcohol bottle base/body frag ²	medium olive green quart size; "II" embossed on base France >1870 or U.S. >late 1800s
	M-17	N/A	surface	48	glass	1	258.3	alcohol bottle base/body frag	dark olive green; turn-molded; 1870-1910
	M-17	N/A	surface	48	glass	1	273.5	alcohol bottle base/body frag	medium olive green quart size; kick-up/push-up
	M-17	N/A	surface	48	glass	1	282	beer or soda bottle base/body frag	aqua mold-blown; "A.B.G.M. CO. E22" embossed on base; manufactured by Adolphus Bush Glass Manufacturing Company; 1886-1920

** Layer/level

¹ English/American

² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Makea Slope (cont.)	M-17	N/A	surface	48	glass	1	198.5	alcohol bottle base frag	dark olive green mold-blown with pontil; <1865
	M-17	N/A	surface	48	glass	1	151.3	beer or soda bottle base/body frag ²	pale green; possibly mold-blown; "R1" embossed on base; 1850-1910
	M-17	N/A	surface	48	glass	1	204.4	case gin base/body frag	clear manganese decolorized; snap case; mold-blown; 1880-1920
	M-17	N/A	surface	48	glass	2	65.2	medicine bottle base and body frags	clear; mold-blown; chamfered corner; square lip
	M-17	N/A	surface	48	glass	2	8.8	medicine bottle frags	clear; manganese decolorized
	M-17	N/A	surface	48	glass	1	0.9	non-diagnostic frag	clear with delicate embossed pattern
	M-17	N/A	surface	48	glass	1	13.7	non-diagnostic frag	clear; manganese decolorized
	M-17	N/A	surface	48	glass	2	166	wine/champagne bottle base and neck frags	pale green mold-blown; kick-up/push-up
	M-17	N/A	surface	48	glass	3	95.5	possible lamp frags	clear with yellowish tint; embossed leaf pattern
	M-17	N/A	surface	48	glass	5	6.3	window glass frags	light blue-green
	M-17	N/A	surface	48	glass	2	3.2	lamp chimney frags	clear; thin
	M-17	N/A	surface	48	glass	2	8.5	alcohol bottle frags	medium olive green
	M-17	N/A	surface	48	glass	1	7.2	alcohol bottle frag	pale green
	M-17	N/A	surface	48	glass	4	100.7	non-diagnostic frags	clear; one with chamfered corners
	M-17	N/A	surface	48	metal	1	152.9	barstock	spring or machinery part; riveted
	M-17	N/A	surface	48	rubber strips	3	46.1		
	M-17	N/A	surface	48	slate	2	9.9	one engraved	
	M-17	N/A	surface	93	ceramics	1	38.9	E/A ¹ cup sherd	heavy ironstone; blue transfer print; 1850-1930
	M-22	TR 17	I	214	basalt flake	1	15.8		
	M-31	TU 24	I/4	175	basalt flake	1	5.2	one utilized edge	

** Layer/level

² fragment

¹ English/American

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Kukuinui	KU-13	N/A	surface	216	ceramics	1	355.9	E/A large bowl frag	undecorated
Upper Eliali'i	E-1	TU 5	I/3	31	volcanic glass	1	0.2		
	N/A	N/A	surface	84	chopping tool	1	356.8	chipping on at least one surface and one edge	
	E-33	TU 2	I/2	5	basalt flake	1	6.9		
	E-48	TU 1	I/5	13	basalt flake	1	6.4		
	E-48	TU 1	I/6	15	basalt flake	1	2.7		
	E-48	TU 1	I/2	2	plastic	1	0.1		
	E-48	TU 1	II/1	11	plastic	1	0.2		
	E-78	TR 26	I	309	shell	1	0.1		
	E-78	TR 26	I	306	volcanic glass	2	0.4		
	E-78	TR 26	under wall	308	volcanic glass	1	0.6		
	E-93	N/A	surface	21	ceramics	3	528.8	E/A ¹ soup plate sherds	white ironstone; undecorated; "ROYAL PATENT; IRONSTONE; GEORGE JONES & SONS" and royal arms crest on base; 1873-1891; three sherds mend
	E-93	N/A	surface	21	ceramics	1	44.8	E/A saucer sherd	blue tinted ironstone; undecorated; "ROY" on base
	E-93	N/A	surface	21	ceramics	1	115.9	Chinese <i>tz'u</i> rice/soup bowl base/body/rim sherd	porcelaineous stoneware; hand-painted three circles and dragonfly motif; 19 th to early 20 th C.
	E-93	N/A	surface	21	ceramics	1	49.1	Japanese medium rice bowl base/body sherd	porcelain; blue transfer print flower blossoms motif; 1870 to early 20 th C.

** Layer/level

¹ English/American

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Upper Elialii (cont.)	E-93	N/A	surface	21	ceramics	2	325.7	E/A ¹ large bowl base/body sherds	thick bodied; large mixing or serving bowl; two sherds mend blue tinted ironstone; undecorated; “INA; HNSON BROS; ENGLAND” and royal arms crest on base; manufactured by Johnson Bros.; 1883-1913.
	E-93	N/A	surface	21	ceramics	1	45.9	E/A saucer sherd	
	E-93	N/A	surface	21	slate	1	15.8		
Halepoki Makai	H-5	N/A	surface	325	ceramics	3	445.2	modern	
	H-20	TR 28	I	313	volcanic glass	1	tr.		
	H-23	TR 29	surface	228	basalt flake	1	25.3		
	H-45	TR 31	I	319	hammerstone	1	501.7	river cobble with battered end	
	H-50	N/A	surface	326	ceramics	2	9.3	Chinese <i>tz'u</i> sherds	porcelaineous stoneware; hand-painted; two sherds mend undecorated hand-painted undecorated
	H-50	N/A	surface	326	ceramics	3	22.5	E/A saucer sherds	
	H-50	N/A	surface	326	ceramics	3	79.0	E/A large bowl sherds	
	H-50	N/A	surface	326	ceramics	17	379.2	E/A large bowl sherds	
	H-50	N/A	within wall	327	glass	1	19.2	medium green frag ²	
	H-50	N/A	within wall	327	glass	1	33.2	light green base frag	
	H-52	N/A	surface	229	ceramics	1	25.7	E/A saucer sherd	
	H-57	TR 30	0-5 cmbs	231	basalt flake	1	1.2	one with polish	

** Layer/level

¹ English/American

² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I) ^{**}	Bag	Material	Count	Weight (g)	Description	Notes
Halepoki Makai (cont.)	H-57	TR 30	15 cmbs	232	basalt flake	1	15.4		
	H-57	TR 30	21 cmbs	236	basalt flake	1	1.1		
	H-57	TR 30	28 cmbs	241	basalt flake	1	3.5		
	H-57	TR 30	28 cmbs	239	volcanic glass	1	0.6		
Halepoki Central	N/A	TR 32	under wall	322	volcanic glass	1	0.3		
Lahokea	L-1	N/A	surface	149	glass	1	181.6	olive green black alcohol bottle base	within N wall; mid – late 19 th C.
	L-2	TU 18	I/1	142	glass	1	0.3	non-diagnostic frag ²	clear
	L-2	TU 18	I/2	143	button	1	0.3	porcelain	sew-through; 3-hole; >1850
	L-2	TU 18	I/3	147	glass	2	6.2	non-diagnostic frag	medium olive green
	L-24	TU 16	I/4	136	basalt flake	1	0.5		
	L-24	TU 16	I/4	137	volcanic glass	1	0.4		
	L-24	TU 16	I/6	140	basalt flakes	2	7.9		
	L-24	TU 16	I/6	141	basalt cutting tool	1	17	waterworn cobble frag, one chipped edge	
	L-25	TU 17	face	133	<i>hihiwai</i> shell	3	0.3		

^{**} Layer/level

² fragment

Appendix B: Artifact Data (continued)

Study Area	Feature	Unit	Depth (L/I)**	Bag	Material	Count	Weight (g)	Description	Notes
Palalao	N/A	TU 28	I/1	368	basalt flakes	2	3.4		
	N/A	TU 28	I/2	364	basalt flake	1	11.3		
	N/A	TU 28	I/2	366	basalt flakes	3	4.4		
	N/A	TU 28	I/2	363	volcanic glass	2	0.7		

** Layer/level

APPENDIX C: GEOCHEMICAL ANALYSIS OF BASALT ARTIFACTS

Geochemical analysis was carried out for 383 of the 417 basalt artifacts. Of the 417 basalt artifacts collected, 33 were too small for analysis and one was returned to the landowner before it could be examined. The analysis was conducted by Peter Mills, Steve Lundblad, Arian Drake-Raue, and Jacob Smith at the University of Hawai'i at Hilo. A non-destructive energy dispersive x-ray fluorescence (EDXRF) instrument was used to determine the elemental abundances in each artifact. A total of 17 elements were examined: Mg, Al, SiO₂, K₂O, CaO, TiO₂, V, MnO, Fe, Ni, Cu, Zn, Rb, Sr, Y, Zr, and Nb.

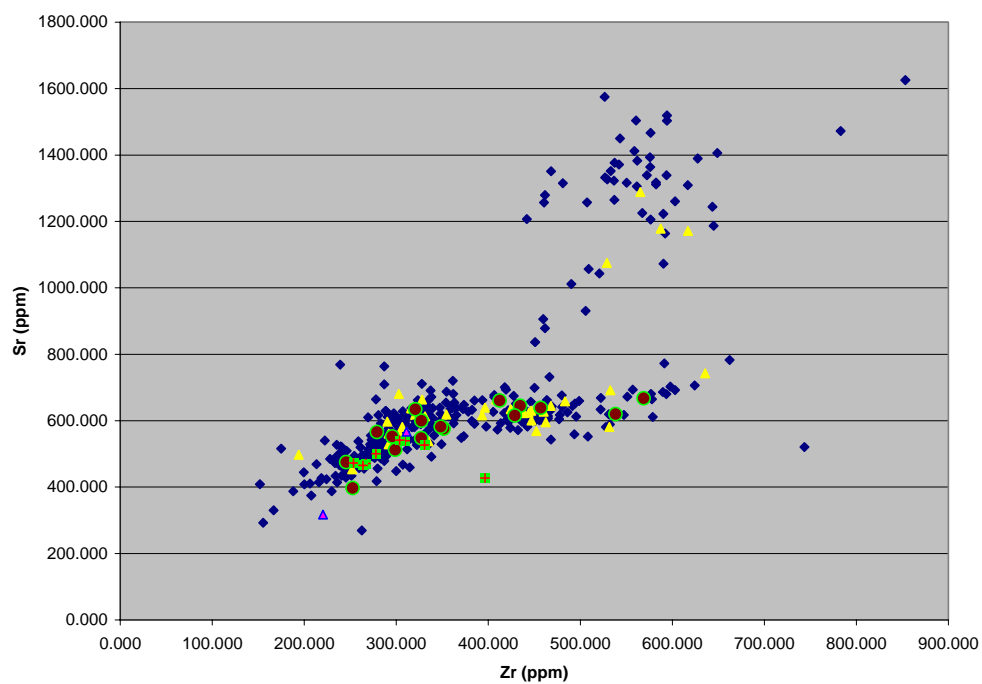
Sample 335-2, from terrace C-9 in Ku'e'e exhibited a fresh break, and this was useful for determining potential error due to surface weathering. Elemental abundances were almost the same for the weathered and unweathered surfaces, suggesting that weathering was not a source of error in this assemblage.

The following scatter plots show the abundances of Zr to Sr and Rb to Sr, first grouped according to macroscopic characteristics and then by land division. Raw data is presented at the end of this appendix. Artifacts were first grouped according to macroscopic characteristics, including unpolished material, polished material, cobbles with cortex, a distinct red basalt, and atypical pieces. It is assumed that the cobbles with cortex were collected from local Wailau sources. The cobbles with cortex occur throughout most of the range of values in each plot, suggesting that most of the Wailau material was procured locally. The samples of red basalt generally fell in the mid-range of the plots, with moderate to somewhat low levels of Zr, Sr, and Rb. The two samples that were macroscopically atypical appeared chemically indistinct from the rest of the assemblage, although one piece, from terrace C-8 in Ku'e'e, was somewhat low in Sr and Rb.

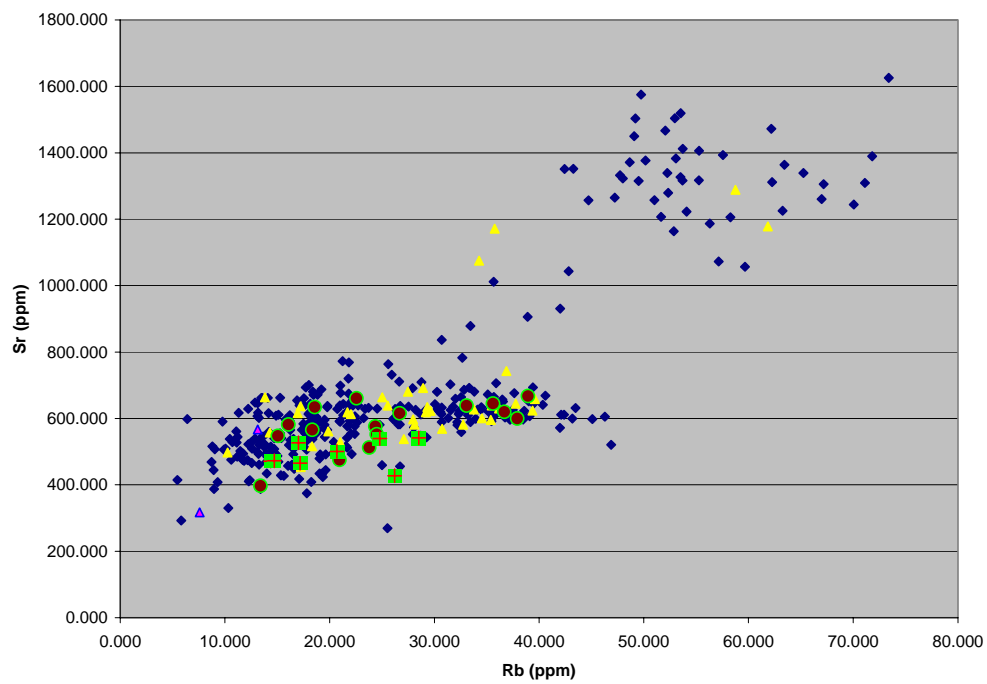
Outliers on the high and low ends of the plots are most likely imported materials. These were all unpolished basalt flakes and most were from Ku'e'e, although these two categories dominated the assemblage, with 320 of the 383 samples (83.6%) consisting of unpolished flakes, and 320 of the 383 samples (83.6%) collected from Ku'e'e. The most obvious outlier was sample 283-3, from terrace C-9 in Ku'e'e. This sample was high in Zr, Sr, and Rb. A rerun of the sample produced similar results. Sample 335-44, also from terrace C-9, was high in Zr and somewhat high in Sr. Sample 283-10, also from terrace C-9, was low in Zr, high in Sr, and somewhat high in Sb. Sample 193-30 from terrace C-6 in Ku'e'e, was low in Zr, Sr, and Rb. Sample 267-9, from terrace M-8 in Makea, was low in Sr and somewhat low in Zr and Sb.

Taken together, these data suggest that two distinct volcanic series were utilized as raw material for stone tools in Wailau. The two sources were likely found locally within the valley, and one of them exhibits a substantial range of variation in Zr between the various flows. Some of the material was probably not from these two flows. This material may have been imported to Wailau from other parts of Moloka'i or elsewhere. Analysis of other basalt sources on Moloka'i might help to determine the provenance of the outlying samples.

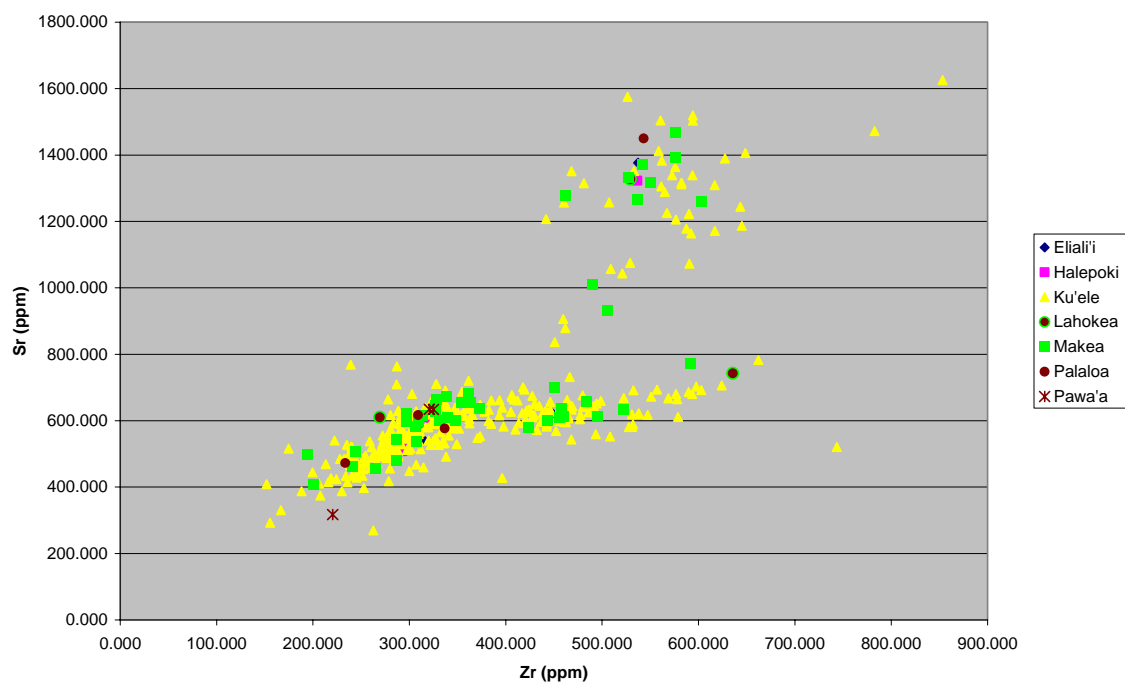
Zr to Sr, by Macroscopic Characteristics



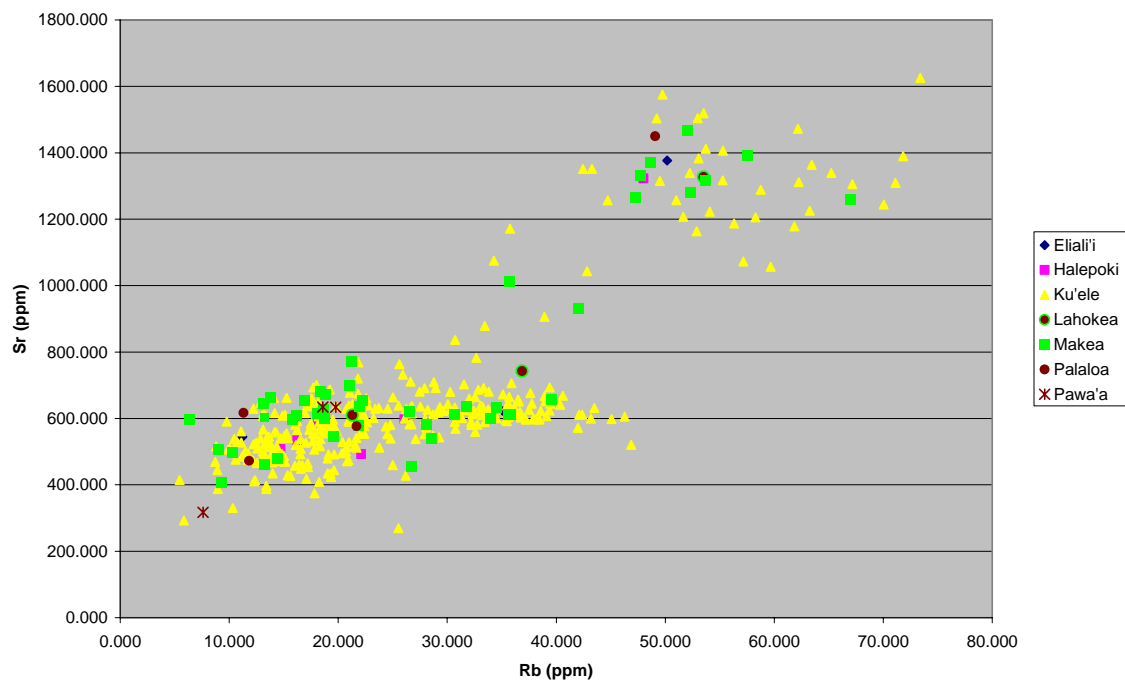
Rb to Sr, by Macroscopic Characteristics



Zr to Sr, by Land Division



Rb to Sr, by Land Division



Geochemical Analysis: Raw Data

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
005-1	314.338	544.357	11.212	0.812	16.524	46.489	0.803	8.781	5.639	693.441	1108.090	7.598	41.372	16.334	127.642	44.764	22.158
013-1	537.261	1376.360	50.171	0.812	18.068	55.456	1.981	6.782	3.413	324.870	1099.190	4.656	26.269	17.404	159.691	58.119	68.066
015-1	448.742	621.908	35.132	0.812	13.851	50.333	1.308	6.096	4.319	508.983	1247.110	9.574	35.569	30.602	153.450	47.275	43.000
044-1	292.932	507.804	14.707	0.812	17.324	48.924	0.693	8.046	4.275	522.976	1362.670	8.560	42.243	36.900	168.452	46.348	18.011
044-2	309.580	590.405	18.176	0.812	17.253	50.839	0.826	9.505	4.716	599.257	1051.240	7.587	41.426	10.977	131.975	38.883	25.518
044-3	536.621	1322.380	48.005	0.812	18.194	56.027	1.817	5.312	3.203	367.908	1253.190	6.722	32.952	15.304	134.466	54.366	69.923
044-4	292.171	534.886	16.264	1.344	13.377	44.272	0.604	8.028	4.110	545.639	1204.510	10.203	43.246	37.830	148.944	39.846	21.904
044-5	320.916	597.500	26.081	2.445	13.547	47.904	0.923	8.289	4.259	481.514	1175.860	10.314	39.526	17.797	138.746	39.212	29.658
044-6	274.641	492.793	22.118	2.034	13.957	46.951	0.675	7.693	3.653	477.787	1239.610	11.331	41.553	113.407	153.382	35.979	22.305
062-1	240.696	434.050	13.992	3.044	15.037	51.211	0.594	7.492	3.046	450.218	1471.280	11.876	33.341	34.441	151.524	34.793	14.024
062-2	242.156	460.948	16.421	2.700	14.763	49.979	0.592	7.841	3.112	444.213	1509.130	12.051	27.739	29.695	168.293	35.700	15.920
062-3	378.075	627.312	30.274	1.280	15.764	51.651	0.870	7.414	4.196	557.146	1246.990	10.899	33.600	57.666	163.994	46.475	34.189
067-1	370.663	548.146	28.701	0.812	15.705	50.478	0.973	6.673	4.709	597.550	1177.260	11.487	40.115	64.059	154.212	47.235	27.542
067-2	251.431	434.206	19.031	2.103	11.819	42.221	0.722	6.831	3.425	460.975	1526.050	12.444	47.334	54.522	266.426	38.097	16.893
067-3	441.817	1206.610	51.649	0.812	17.279	52.720	1.647	5.513	3.044	289.491	2194.200	8.771	24.794	13.620	181.108	49.431	62.685
067-4	293.808	565.069	18.840	1.186	14.497	49.203	0.674	9.507	3.714	487.627	1172.580	9.461	45.851	32.551	179.481	40.664	22.197
070-1	480.156	641.402	40.355	0.812	15.816	52.473	1.371	6.573	3.558	454.937	1394.210	9.540	26.929	15.614	132.189	56.328	43.543
078-1	248.191	459.254	16.708	1.468	13.363	44.483	0.603	8.161	3.147	407.228	1352.550	10.069	40.368	56.826	144.894	36.193	18.190
085-1	351.651	575.956	24.375	0.812	13.911	46.401	0.876	8.312	4.591	571.436	1463.700	9.388	40.131	22.200	184.040	45.178	27.913
087-1	240.356	521.538	13.824	1.773	13.671	45.955	0.614	10.841	4.097	507.722	958.683	6.870	53.867	31.949	104.830	32.150	13.829
102-1	576.451	1205.410	58.280	0.812	19.280	59.926	2.324	6.798	3.315	343.788	1362.370	4.660	58.869	25.312	136.113	55.324	75.816
102-2	266.945	471.634	14.374	1.116	12.650	45.174	0.777	5.810	3.675	575.025	938.240	10.784	51.501	53.141	135.245	32.602	18.986
102-3	347.381	639.301	17.130	0.812	17.811	51.861	0.863	9.623	5.430	735.313	831.286	6.860	41.229	25.739	121.154	45.699	30.404
120-1	451.084	599.564	43.176	1.317	14.482	52.756	1.243	5.756	4.064	456.202	1582.430	11.220	26.111	27.710	145.787	47.020	39.747
121-1	275.634	495.291	20.329	0.812	11.801	42.055	0.693	7.412	3.727	500.693	2617.740	11.933	23.877	42.032	147.451	44.355	23.373
136-1	288.855	492.845	14.859	1.373	14.950	46.305	0.642	7.763	4.016	533.429	1340.690	9.786	40.838	29.342	134.411	40.495	20.749
140-1	567.260	1225.310	63.259	0.812	18.821	57.481	2.673	6.729	3.960	406.459	1033.350	2.944	59.438	14.089	137.733	54.964	78.275
140-2	326.618	590.346	21.009	1.500	14.155	46.353	0.946	9.195	4.930	595.619	988.534	8.028	48.787	21.099	124.813	40.353	27.840
141-1	462.493	623.749	32.432	0.812	13.682	47.445	1.054	5.484	3.459	536.391	1365.330	9.725	18.207	48.347	135.163	46.825	41.462

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
155-1	362.357	604.467	18.738	0.812	15.879	48.918	0.875	6.539	4.157	535.688	1388.880	10.698	41.757	39.436	163.717	43.383	29.269
155-10	286.866	709.257	28.766	0.812	18.012	52.598	1.052	9.842	4.121	560.134	1321.800	6.899	39.636	22.020	120.259	39.971	25.547
155-11	460.570	1256.560	44.716	0.812	18.028	54.157	1.655	6.198	3.551	351.711	2297.310	7.396	23.599	22.882	147.405	50.490	63.872
155-12	590.486	1072.390	57.162	0.812	14.068	44.205	2.148	5.002	2.391	262.127	2303.740	3.234	35.893	15.223	139.401	51.319	66.628
155-2	349.194	529.001	20.385	0.812	12.645	45.757	0.771	7.280	4.142	539.597	1592.380	11.146	28.831	50.152	153.938	47.740	27.422
155-3	616.816	1308.810	71.122	0.812	18.197	56.414	2.190	5.602	2.777	282.686	2076.450	6.666	17.607	26.147	144.093	54.306	88.193
155-4	330.754	606.348	22.414	0.812	17.333	50.317	0.880	8.053	4.728	638.602	1779.730	10.305	35.357	41.742	147.311	41.056	26.947
155-5	280.571	616.766	18.422	0.812	16.234	49.420	0.848	9.266	4.010	507.668	1592.510	7.983	39.293	25.625	129.007	35.400	23.015
155-6	261.040	520.123	16.118	0.812	15.314	47.602	0.677	8.248	3.614	414.327	2522.820	10.635	26.122	48.157	160.783	34.949	22.067
155-7	582.358	1316.970	55.270	0.812	17.974	56.548	1.936	4.514	2.896	273.620	2044.930	9.172	9.881	23.774	154.548	52.612	71.842
155-8	532.100	588.989	33.443	0.812	15.518	52.788	1.338	5.663	4.255	486.315	1557.700	11.388	34.273	26.057	150.327	57.535	46.008
155-9	464.935	606.995	39.098	0.987	14.910	51.340	1.245	5.568	4.345	488.398	1434.350	10.237	34.734	22.421	146.810	46.722	41.668
156-1	338.201	491.422	19.622	0.812	10.167	35.089	0.865	6.361	4.729	584.142	1568.770	10.309	37.165	29.241	152.881	34.435	27.604
156-2	644.800	1186.830	56.309	0.812	18.365	55.449	1.979	3.250	2.659	278.691	2333.500	9.691	33.549	21.153	159.086	52.667	76.298
156-3	314.669	459.364	25.010	0.812	11.628	39.551	0.836	5.602	4.278	571.729	2606.870	14.124	36.637	57.255	166.333	32.076	21.706
157-1	432.276	572.044	41.993	0.812	12.998	42.523	1.333	5.145	4.249	527.642	1783.210	11.232	35.063	28.123	160.742	48.721	40.849
158-1	331.333	613.467	22.029	0.812	14.899	47.198	0.923	8.287	4.168	544.698	1509.930	8.755	53.290	50.728	170.515	42.666	23.979
163-1	531.040	619.348	30.591	0.812	16.193	53.686	1.382	4.298	4.856	497.305	1644.320	11.716	33.273	28.164	188.613	48.743	51.066
163-2	336.452	531.375	17.758	0.812	15.557	45.913	0.939	7.922	5.866	670.876	1057.820	7.524	43.181	46.694	191.079	45.593	23.380
163-3	462.427	595.768	35.394	0.812	16.567	46.385	1.477	4.343	6.038	654.872	1747.140	8.234	66.443	30.834	242.501	38.403	40.589
164-1	297.613	512.157	21.685	0.812	12.651	43.773	0.748	7.571	4.244	516.059	1173.460	10.150	51.598	44.367	147.911	37.979	18.857
170-18	239.801	522.739	12.247	1.477	15.929	47.963	0.529	10.218	3.506	406.203	1480.880	7.955	43.376	33.532	148.481	43.156	17.015
175-1	578.753	611.266	42.112	0.812	16.668	47.910	1.359	3.678	4.497	558.952	1968.830	13.703	9.992	19.131	163.685	47.479	53.851
177-1	337.273	690.833	27.915	1.379	15.692	51.850	1.082	8.795	4.196	581.221	969.734	7.090	24.863	27.931	151.033	42.568	27.989
179-1	427.650	674.920	21.825	0.812	18.750	53.502	1.070	6.491	5.747	776.490	972.083	7.227	28.200	29.850	121.590	50.256	40.459
181-1	616.979	1171.720	35.769	0.812	19.886	46.916	1.646	7.871	6.960	855.696	874.288	2.900	6.185	26.791	167.615	60.593	62.620
188-1	295.851	552.462	24.500	2.463	13.999	47.225	0.791	8.274	3.500	433.908	1383.330	10.018	38.616	25.049	146.202	40.305	25.186
188-2	279.015	565.692	18.349	0.812	14.764	46.554	0.717	8.594	3.465	463.510	1312.720	9.720	45.934	32.747	148.021	39.609	29.909

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
188-3	301.086	516.357	18.334	2.140	14.041	45.462	0.725	6.535	3.311	507.315	1419.020	10.115	48.131	71.099	151.282	42.983	23.355
189-1	316.316	637.641	26.741	2.049	15.375	50.354	0.867	8.412	3.772	528.124	1219.560	9.036	38.032	42.158	169.311	42.029	28.877
189-10	303.567	541.568	21.665	1.913	14.329	46.721	0.715	7.197	3.364	454.733	1495.730	12.313	37.192	20.507	176.010	40.151	23.720
189-11	507.254	1257.170	51.012	0.812	16.336	46.756	1.499	5.313	2.830	255.689	2205.410	7.974	14.411	16.541	150.704	50.480	62.705
189-12	224.177	424.205	19.346	0.812	13.773	33.779	0.569	5.634	2.828	405.995	1679.310	13.327	38.322	39.769	182.083	33.769	14.371
189-13	237.452	499.431	13.096	0.812	14.169	37.300	0.536	7.008	3.214	408.359	1435.370	11.592	27.443	66.055	168.731	38.879	18.721
189-15	436.584	596.615	38.133	0.812	13.834	46.037	1.113	6.653	3.830	472.298	1645.910	10.560	23.517	33.688	155.768	54.150	37.192
189-16	290.444	589.221	30.698	0.812	14.409	43.851	0.873	7.788	3.546	467.640	1184.160	10.562	25.827	35.017	176.684	46.713	27.829
189-17	265.015	493.118	13.206	0.812	14.561	44.705	0.615	7.950	3.501	448.504	1530.490	10.800	37.842	57.415	266.742	38.986	19.825
189-18	300.479	554.336	22.029	2.355	15.395	49.405	0.721	7.548	3.548	476.172	1530.070	12.644	32.574	20.235	201.582	41.482	27.698
189-19	288.543	629.782	24.536	1.447	15.527	47.022	0.654	8.957	3.618	466.479	1265.990	10.337	33.414	36.617	182.943	38.303	26.162
189-2	531.410	581.376	32.758	0.812	12.733	48.258	1.187	7.192	3.979	462.960	1299.250	10.547	20.005	30.012	150.235	60.906	51.635
189-20	527.738	581.101	24.783	0.812	14.707	44.120	0.964	6.125	4.156	500.791	1656.080	12.029	40.104	62.163	195.198	63.250	49.151
189-21	206.230	410.384	12.288	2.678	13.964	46.855	0.563	8.131	2.938	390.090	1439.120	10.703	42.619	41.679	188.333	31.378	14.803
189-22	538.352	619.591	36.688	0.812	14.432	49.775	1.248	7.145	4.042	488.993	1652.030	10.338	14.949	31.450	215.507	63.859	50.417
189-23	296.382	612.203	28.717	0.812	14.218	43.899	0.901	8.819	4.169	594.595	1225.580	8.227	28.846	36.148	153.319	42.460	21.686
189-24	234.041	433.454	19.297	1.937	14.030	44.910	0.529	7.473	3.044	432.907	1506.590	11.916	43.304	56.141	212.103	33.513	14.219
189-25	334.996	537.659	27.096	0.812	14.403	43.086	0.881	6.737	3.816	508.906	1295.320	12.166	36.135	69.741	219.996	42.472	30.596
189-26	592.162	1163.480	52.877	0.812	14.847	38.576	1.447	4.749	2.797	298.022	2379.660	9.477	17.078	25.223	200.740	54.909	66.176
189-27	243.227	479.222	19.038	0.812	14.252	43.220	0.559	7.527	3.245	411.037	1438.190	11.426	27.082	38.316	167.872	36.175	15.514
189-28	452.196	568.810	30.745	0.812	15.153	43.152	1.040	6.020	3.734	467.405	1402.130	14.835	35.532	17.503	170.591	52.681	42.090
189-29	199.528	444.407	8.920	0.812	14.744	37.640	0.464	8.744	3.033	379.591	1551.920	11.267	63.353	54.515	247.309	30.648	12.879
189-3	252.035	453.702	17.234	2.174	13.775	45.797	0.633	7.144	3.195	430.666	1375.360	11.465	37.726	26.758	176.013	41.623	13.602
189-30	257.005	470.925	20.815	2.061	14.838	46.588	0.550	7.055	3.129	424.982	1411.230	12.582	38.400	44.453	159.161	34.819	14.627
189-31	320.672	618.800	29.203	0.812	15.434	41.768	0.944	7.426	3.633	453.725	1361.790	10.462	44.570	42.631	215.094	44.145	28.194
189-32	291.829	560.971	19.874	0.812	14.916	44.793	0.717	8.304	3.755	503.872	1235.780	9.513	51.081	25.440	171.369	34.766	26.295
189-33	382.353	632.612	30.706	3.011	13.190	48.069	1.394	6.285	3.436	399.547	1287.160	10.906	10.072	77.043	330.824	45.006	34.921
189-35	263.193	496.366	14.289	2.899	10.981	40.955	0.580	8.357	3.328	481.380	1492.360	10.268	52.020	25.558	141.785	36.103	21.019
189-37	151.908	408.565	18.254	0.812	14.079	36.632	0.571	7.169	2.629	338.650	1577.270	9.085	52.720	37.674	171.434	24.164	8.817

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
189-39	213.266	468.996	8.721	2.693	12.239	40.830	0.446	7.710	2.873	362.488	1370.910	12.191	25.605	35.936	154.173	33.162	12.509
189-4	218.524	427.181	15.622	2.038	13.700	44.694	0.527	8.130	2.600	369.754	1330.520	10.432	46.337	25.002	148.456	34.652	14.066
189-5	290.183	597.212	27.971	0.812	13.627	46.449	0.939	8.453	3.457	444.018	1176.720	8.454	40.245	37.085	144.549	43.111	25.667
189-6	311.699	513.859	20.782	2.808	14.149	49.227	0.750	7.290	3.317	448.435	1418.180	11.081	50.992	45.109	181.317	41.825	22.982
189-7	298.898	512.336	23.784	2.937	14.110	47.903	0.718	7.460	3.592	449.570	1547.770	10.813	47.333	43.859	162.167	39.090	24.984
189-8	520.829	1043.130	42.837	0.812	17.096	47.760	1.406	5.696	2.985	310.528	1999.540	9.573	7.971	16.147	152.141	51.638	58.862
189-9	291.787	576.799	22.391	0.812	16.242	41.717	0.696	7.524	3.827	464.237	1358.970	12.008	38.033	45.946	198.077	41.613	26.947
190-1	590.205	1222.720	54.093	0.812	17.282	50.371	1.804	5.091	3.528	356.634	942.733	6.746	42.035	13.155	129.923	82.719	69.233
192-1	240.040	469.571	15.109	0.812	14.246	47.207	0.528	7.649	2.648	388.840	1197.580	10.683	50.237	47.933	281.502	37.105	7.527
192-10	232.293	484.853	14.059	0.812	16.502	47.866	0.626	8.878	3.489	446.464	1524.330	8.034	62.262	12.026	197.748	40.029	16.834
192-11	446.304	656.737	36.500	0.812	17.534	53.170	1.210	6.751	4.937	597.919	1376.920	8.522	42.297	30.823	175.887	47.305	40.367
192-12	454.117	605.252	46.278	0.812	15.564	48.708	1.320	6.324	3.724	442.783	1491.110	9.500	30.924	25.654	157.891	54.236	45.486
192-14	238.374	465.872	12.563	0.812	11.166	32.963	0.661	7.699	3.514	501.124	1277.450	4.999	17.151	78.789	244.933	35.871	18.336
192-15	508.291	552.238	27.942	0.812	15.902	45.010	1.065	5.754	4.026	490.755	1128.140	7.223	48.358	37.867	195.384	60.499	49.868
192-16	207.671	374.510	17.825	0.812	8.662	25.005	0.807	6.436	3.232	483.954	810.467	2.684	17.633	38.023	170.610	26.255	18.294
192-18	327.330	599.826	37.916	2.009	17.024	51.012	0.842	8.112	4.261	484.177	1222.660	9.659	33.059	25.783	187.757	42.719	31.829
192-2	446.897	600.522	34.546	0.812	14.858	49.624	1.079	6.958	4.134	440.277	1484.510	9.869	34.425	31.243	198.751	52.191	37.184
192-3	304.355	606.634	18.234	0.812	17.038	51.145	0.762	10.232	4.504	551.740	1122.810	6.558	35.651	55.744	367.499	43.544	27.250
192-4	303.619	541.470	28.512	2.587	15.600	53.612	0.740	6.773	2.845	414.100	1100.950	13.315	29.379	83.940	200.670	39.095	16.560
192-5	340.970	555.482	18.722	0.812	15.819	48.843	0.835	8.486	4.288	577.315	1290.380	8.514	41.999	30.484	164.370	45.051	23.713
192-6	396.334	639.378	35.475	0.812	16.509	47.349	1.009	6.890	4.309	474.099	1357.230	8.437	37.159	32.156	176.930	49.610	37.066
192-7	316.510	637.031	17.215	0.812	16.765	50.279	0.807	9.650	4.813	602.529	1028.620	6.615	41.260	33.199	196.278	41.163	29.322
192-8	275.182	516.196	21.550	1.417	17.219	47.650	0.569	7.771	3.948	512.245	1387.700	13.466	32.276	51.515	185.189	42.444	19.857
192-9	440.805	626.995	34.462	0.812	16.228	48.311	1.163	7.071	4.318	505.127	1452.210	8.593	28.614	30.245	229.974	53.926	38.466
193-1	419.303	693.495	17.718	0.812	14.305	40.929	1.275	7.414	6.546	832.488	804.785	4.641	29.089	14.887	124.333	40.496	37.176
193-10	643.529	1244.010	70.046	0.812	20.183	60.706	3.186	7.690	5.281	514.882	676.779	0.579	71.463	23.348	140.265	55.004	86.085
193-11	469.048	642.726	30.069	0.812	16.681	53.808	1.311	6.023	4.965	598.517	1467.680	8.212	47.236	25.702	146.664	44.202	42.820
193-12	269.394	505.947	9.903	1.674	16.194	47.856	0.576	8.564	3.573	522.043	1206.280	9.855	45.833	37.524	167.143	36.335	19.026

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
193-13	382.174	599.063	26.096	0.812	14.457	48.066	1.011	6.455	5.428	620.390	923.395	9.417	54.153	90.217	159.489	39.197	31.197
193-14	304.474	590.681	9.766	0.948	16.151	47.571	0.655	7.368	4.417	675.044	668.606	10.529	40.822	34.935	185.182	33.819	26.744
193-15	479.808	676.280	37.634	0.812	16.822	54.206	1.441	5.976	4.545	594.606	1092.400	9.187	21.078	28.878	152.177	48.849	47.021
193-16	348.387	581.602	16.056	0.812	15.301	49.191	0.841	8.421	4.856	649.310	1088.630	8.136	46.699	45.897	155.243	46.365	31.652
193-17	528.989	1074.950	34.281	0.812	18.898	51.881	1.735	9.923	6.460	743.010	846.749	2.190	45.972	18.129	169.125	55.337	53.011
193-18	280.789	573.178	18.388	1.442	15.998	49.807	0.780	8.603	3.781	514.902	1021.390	7.358	47.755	20.455	135.062	34.885	19.825
193-19	393.392	615.992	16.951	0.812	16.202	52.062	1.081	8.269	5.290	709.546	908.018	7.932	39.084	10.096	111.323	49.208	37.028
193-2	288.346	508.968	12.582	1.823	16.528	51.183	0.644	9.231	4.407	507.267	1426.440	7.893	41.458	35.580	183.369	33.638	20.372
193-20	246.071	509.442	10.052	1.716	15.324	45.615	0.590	9.341	4.384	543.051	1146.130	9.217	42.635	45.724	139.209	35.056	18.262
193-21	326.646	590.127	18.274	0.812	16.383	50.651	0.898	9.773	5.000	672.146	1014.830	6.517	42.002	22.562	124.778	38.164	29.395
193-22	547.320	617.473	32.378	0.812	14.756	51.608	1.304	7.545	4.346	544.351	1179.410	8.914	31.373	20.890	160.438	67.861	48.244
193-23	335.063	661.849	14.096	0.812	16.174	46.853	0.936	8.811	5.883	718.724	749.209	6.807	33.279	30.911	140.870	36.912	31.638
193-24	281.408	538.058	16.541	0.812	15.778	45.066	0.767	9.071	4.825	529.675	1148.160	6.209	33.634	23.355	149.109	42.429	21.434
193-25	319.717	580.052	32.212	2.580	14.647	50.834	0.884	8.212	3.841	497.034	1205.750	8.638	47.607	30.447	206.529	40.165	29.846
193-26	409.913	572.992	28.066	0.812	13.172	48.360	1.141	6.411	4.066	605.845	1385.060	8.604	28.662	20.946	130.992	44.943	41.603
193-27	364.294	639.207	20.981	0.812	17.697	50.260	1.109	8.596	6.076	759.691	819.835	6.767	41.415	17.849	133.413	34.384	33.528
193-29	339.091	588.226	22.639	0.812	15.625	46.928	0.697	7.475	5.140	663.176	998.772	7.466	36.985	21.919	180.323	38.581	22.468
193-3	417.263	622.970	38.581	0.812	14.298	48.754	1.073	7.605	3.912	426.756	1374.720	8.906	25.909	30.019	178.639	51.090	37.058
193-30	155.432	292.781	5.841	0.855	9.039	19.693	0.845	6.597	3.120	424.313	852.612	1.304	-1.984	57.170	181.884	17.462	11.732
193-31	338.371	607.325	13.102	0.812	14.882	43.809	0.912	8.317	5.251	670.400	935.390	7.170	27.030	26.112	140.574	41.729	25.828
193-32	373.592	647.898	12.886	0.812	16.938	47.481	1.076	8.011	5.952	807.262	822.528	7.429	32.658	33.090	127.843	41.496	36.088
193-33	309.561	539.275	24.803	2.946	14.995	49.095	0.854	6.531	3.997	652.696	929.713	13.664	28.400	87.381	160.216	26.799	21.794
193-34	455.554	601.228	31.343	0.812	15.284	49.735	1.204	6.344	4.472	510.572	1413.210	10.895	41.285	19.479	138.527	48.259	40.475
193-35	354.678	687.267	19.208	0.812	17.438	49.204	1.021	10.158	6.096	693.104	921.696	5.938	16.778	24.095	129.466	45.743	32.218
193-36	457.106	639.017	33.073	0.812	15.832	53.748	1.213	6.257	4.040	477.547	1379.380	8.903	29.990	26.623	143.837	52.389	43.936
193-37	594.168	1503.400	49.207	0.812	21.305	62.102	2.839	7.882	5.833	644.762	494.583	1.171	20.116	20.150	147.146	60.893	73.579
193-38	434.722	644.511	35.610	0.812	15.605	52.840	1.106	7.475	4.007	492.931	1413.720	7.837	28.107	27.642	156.500	54.512	36.372
193-39	493.417	558.943	32.567	0.812	14.286	51.621	1.112	6.069	3.392	429.270	1302.420	9.406	20.988	40.453	170.130	55.476	43.412

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
193-4	442.536	582.148	26.713	0.812	14.171	46.139	1.251	5.994	3.983	563.070	1267.880	7.423	32.978	44.520	123.277	42.998	37.047
193-41	283.525	485.801	14.614	0.812	10.671	29.298	0.872	7.744	4.915	608.969	1075.410	4.727	50.684	36.080	146.874	31.970	17.413
193-42	438.526	622.994	29.640	0.812	14.948	51.967	1.137	6.953	3.916	521.259	1289.430	10.215	29.433	32.841	137.619	49.194	41.399
193-43	565.063	1288.120	58.759	0.812	18.507	56.401	2.803	7.672	3.335	417.856	749.779	2.397	37.841	15.730	141.343	53.126	76.472
193-44	304.140	557.900	14.294	0.812	18.610	46.604	0.845	7.395	6.063	710.874	941.158	6.728	46.909	20.277	130.096	34.803	27.329
193-45	491.330	644.434	39.461	0.812	19.415	46.458	1.130	5.191	4.843	754.182	1117.500	9.959	8.889	17.742	169.775	50.945	47.307
193-46	336.318	632.290	23.718	0.812	19.242	44.005	0.922	5.226	5.803	709.542	1061.310	8.775	58.326	26.795	169.745	30.303	30.829
193-5	354.368	618.788	21.710	0.812	15.605	48.982	0.831	9.005	4.942	649.829	956.643	6.735	46.153	29.451	130.212	46.242	29.215
193-6	424.375	634.506	29.326	0.812	13.678	47.844	0.880	6.997	3.797	542.472	1242.570	10.411	38.338	42.174	172.131	49.200	40.903
193-7	269.742	513.955	13.760	0.812	15.981	46.602	0.724	9.185	4.615	584.958	1122.330	5.954	58.544	21.631	135.606	37.350	15.117
193-8	272.022	491.390	19.105	1.493	14.414	48.704	0.610	7.819	3.346	481.656	1194.510	11.846	28.852	50.705	165.376	36.241	23.575
193-9	357.105	612.987	17.971	0.812	18.603	51.228	1.036	7.862	5.953	746.249	891.374	7.455	48.615	24.304	125.210	34.399	29.472
195-1	316.257	638.660	25.543	0.812	14.682	47.658	0.795	8.350	3.709	488.773	965.856	7.980	26.792	51.632	208.905	43.971	23.371
195-2	421.587	631.238	43.492	0.812	13.033	49.127	1.289	7.675	3.663	426.082	1365.260	8.675	17.533	28.999	149.476	51.574	39.195
195-3	334.469	616.299	14.177	0.812	16.354	47.598	0.813	8.619	5.082	634.962	783.147	7.479	39.127	32.322	124.291	36.860	26.779
195-4	258.934	537.815	18.371	1.949	15.886	48.699	0.646	8.113	3.747	492.626	1270.570	10.638	45.162	66.392	150.656	35.441	18.254
195-5	460.208	596.924	38.479	0.812	14.202	52.243	1.314	7.679	4.095	454.633	1590.500	8.501	42.339	17.156	180.308	51.492	46.672
195-6	291.869	528.748	21.002	1.830	14.109	48.227	0.726	8.145	3.729	465.240	1474.810	10.046	56.909	17.576	189.973	37.777	24.321
195-7	273.766	506.283	17.811	0.812	15.471	48.742	0.744	8.149	3.877	454.779	1350.920	9.765	48.512	20.588	249.787	32.875	20.711
195-8	428.009	609.931	33.211	0.812	15.211	52.264	1.238	6.984	4.074	549.246	1246.210	8.666	29.895	18.256	140.324	50.544	39.114
195-9	311.207	567.159	13.123	0.812	17.744	45.201	0.629	9.207	4.817	569.570	1118.560	6.158	14.892	45.444	281.335	44.322	17.848
196-1	235.262	527.261	11.117	0.812	15.255	45.061	0.543	11.023	3.561	525.720	931.344	6.353	72.602	44.932	134.998	33.865	20.465
196-2	166.757	330.307	10.338	0.812	4.702	8.072	0.874	4.878	3.661	486.323	419.837	-0.481	-6.994	45.837	151.786	20.269	11.386
198-2	283.127	591.680	20.946	1.456	14.143	45.352	0.676	8.460	3.292	436.996	1170.870	8.870	33.666	56.785	142.136	40.160	22.532
198-3	477.576	617.625	35.494	1.374	14.158	53.001	1.126	6.871	3.470	440.906	1315.460	10.845	19.031	32.182	169.359	53.667	42.171
201-1	341.792	580.655	19.502	0.812	15.909	51.225	0.795	8.054	3.886	481.805	1261.790	10.641	34.098	49.109	153.660	49.211	29.434
201-2	245.587	475.145	20.948	1.633	15.585	44.624	0.557	7.981	3.219	439.900	1620.610	11.057	40.810	80.059	172.723	39.211	14.797
204-1	228.062	484.611	11.181	1.677	14.763	46.610	0.535	8.795	3.047	410.112	1363.520	9.836	45.728	25.636	172.299	34.343	14.713

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
204-2	358.811	635.984	27.539	0.812	13.637	40.702	0.833	6.172	4.269	752.113	908.174	12.920	-5.289	49.514	144.680	34.473	30.209
204-3	301.659	571.502	19.436	1.109	16.490	47.551	0.763	8.181	4.487	551.217	1086.040	8.506	49.825	31.672	128.703	31.704	24.350
204-4	405.295	626.746	29.211	0.812	14.230	44.141	0.899	6.452	4.713	679.509	1071.520	9.809	28.045	69.890	171.784	38.124	34.350
214-1	455.267	611.504	42.392	0.812	13.468	50.921	1.237	6.924	3.939	445.418	1389.200	9.737	28.698	27.787	145.899	51.077	41.888
228-1	229.861	387.307	13.408	3.324	15.072	47.224	0.455	8.384	2.782	410.074	1312.070	10.553	63.681	95.347	158.963	32.812	9.978
231-1	428.854	615.454	26.679	0.812	13.022	49.872	1.110	6.698	3.901	519.635	1082.510	8.047	42.231	25.808	152.010	47.226	36.656
232-1	298.811	591.780	35.456	0.812	14.982	45.443	0.919	8.499	4.018	521.307	1171.850	9.344	36.295	29.846	143.525	43.010	27.350
236-1	238.723	475.243	11.693	1.282	14.438	47.444	0.518	8.183	3.324	436.222	1397.410	11.732	44.389	38.569	155.516	34.110	19.184
241-1	307.133	467.919	13.929	2.203	12.668	45.154	0.505	6.459	3.406	435.536	1544.880	12.049	36.820	18.310	175.967	44.823	23.891
247-1	323.551	596.296	19.520	0.812	16.106	47.608	0.787	7.912	4.271	532.077	1365.210	12.528	26.948	28.983	160.893	40.960	26.475
247-6	277.918	664.346	32.556	3.767	12.295	46.582	0.952	8.484	3.828	501.068	1091.370	9.790	43.415	24.223	130.758	40.898	20.666
249-1	296.359	554.990	17.671	2.308	10.368	42.408	0.804	8.974	4.132	547.501	1301.580	10.868	56.151	27.853	134.032	42.537	24.578
251-1	587.404	1178.100	61.844	0.812	15.580	48.031	2.155	6.040	3.202	331.829	2988.640	5.443	32.141	25.846	150.043	54.765	83.192
251-2	459.641	906.015	38.907	0.812	15.904	46.495	1.259	6.094	4.658	530.018	2261.180	12.827	26.927	28.768	151.531	47.426	46.731
254-1	561.764	1382.830	53.061	0.812	15.970	49.039	1.634	4.522	2.819	282.566	2360.020	7.543	8.564	19.745	220.741	52.372	72.277
254-2	593.786	1338.660	52.248	0.812	17.452	51.156	1.751	4.959	3.190	290.241	3125.360	9.263	17.610	22.346	157.839	52.005	82.299
254-3	396.298	427.439	26.197	1.676	10.961	40.445	0.801	5.648	4.301	559.064	1159.170	18.853	30.766	35.932	158.216	31.788	32.600
254-4	468.292	1351.140	42.451	0.812	16.814	50.343	1.800	6.449	4.120	468.253	3081.480	6.633	41.008	34.802	160.845	49.233	60.967
254-5	413.553	592.282	21.913	0.812	14.826	39.492	0.853	5.258	4.813	610.626	2165.130	14.283	10.203	46.234	143.720	44.495	38.021
254-6	444.303	598.107	45.080	0.812	13.768	44.989	1.159	5.620	4.186	550.768	2176.010	13.999	8.349	27.827	145.120	52.197	40.198
254-7	246.353	444.479	19.611	2.454	10.436	40.348	0.995	7.902	2.509	366.926	3603.310	13.360	19.170	37.684	133.893	41.129	15.250
255-1	278.652	417.843	17.085	1.509	13.331	46.080	0.645	6.915	4.007	492.265	1825.080	13.237	37.032	43.179	159.417	37.414	21.075
255-2	299.941	448.251	16.597	1.631	11.787	43.442	0.659	6.908	3.700	471.737	2039.820	12.721	29.186	29.205	150.770	39.755	22.982
259-1	235.818	414.033	12.374	1.374	15.355	50.261	0.575	8.083	3.484	458.334	1905.750	10.920	61.753	67.775	167.310	35.234	9.770
267-1	662.170	782.753	32.671	0.812	17.369	54.751	1.671	6.884	5.943	760.509	802.970	5.748	7.606	17.670	137.269	70.315	59.561
267-2	334.682	641.934	21.819	0.812	15.556	48.004	1.038	9.660	5.922	748.647	886.999	5.386	39.333	19.865	132.933	39.525	30.863
267-3	275.677	520.742	13.266	0.812	14.829	43.055	0.755	9.402	4.882	587.625	1026.170	5.525	43.218	29.703	130.455	37.900	18.028
267-4	308.946	565.872	19.781	0.812	15.974	47.647	0.902	7.928	4.745	606.540	1002.510	9.313	52.131	41.984	140.695	37.001	26.994

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
267-5	278.227	538.209	10.468	0.812	14.320	41.541	0.557	8.165	4.270	582.127	1011.600	7.882	39.051	31.682	154.556	31.472	20.111
267-6	422.889	625.962	28.221	0.812	14.694	45.495	1.279	7.266	4.381	485.942	1329.000	6.961	21.881	11.672	121.428	47.035	36.664
267-7	454.142	626.577	34.124	0.812	15.697	54.840	1.177	7.080	4.330	517.463	1522.210	8.296	32.172	15.080	135.854	42.834	40.885
267-8	597.791	702.416	31.536	0.812	17.826	55.069	1.434	6.934	5.732	665.409	848.409	6.362	18.794	24.482	124.742	64.073	52.572
267-9	262.681	269.639	25.527	1.751	16.989	51.749	1.030	6.642	4.076	444.109	1367.250	9.217	74.731	35.599	188.870	33.769	11.402
272-1	442.902	625.751	37.504	0.812	13.938	46.666	1.297	6.158	4.277	521.855	1356.830	8.237	27.188	31.528	137.973	46.567	37.980
272-2	467.989	644.438	37.765	0.812	14.306	50.163	1.266	6.232	4.173	569.762	1163.610	9.790	18.252	41.714	139.236	48.041	42.563
272-3	417.889	700.841	18.019	0.812	16.624	49.055	1.003	9.779	6.075	710.528	997.956	4.852	23.880	17.076	136.706	56.674	39.240
272-4	468.525	633.502	36.132	0.812	14.932	49.690	1.394	7.089	4.696	526.949	1557.850	6.530	42.263	25.361	167.045	49.941	43.343
272-5	347.735	584.235	17.485	0.812	16.087	49.973	0.873	8.660	5.654	674.155	1020.570	6.968	34.377	44.293	128.255	43.638	28.024
272-6	344.793	576.848	17.622	0.812	13.778	45.374	0.943	8.883	5.052	578.471	1221.780	7.468	36.045	59.392	151.855	44.931	28.595
272-7	408.376	663.709	25.030	0.812	16.802	50.839	0.953	7.311	5.545	639.039	1086.780	8.033	36.416	80.000	154.223	41.194	32.317
272-8	302.694	680.702	27.469	1.674	14.381	50.983	1.000	9.046	3.641	477.145	1203.580	8.202	35.506	39.237	126.666	42.415	25.961
272-9	317.038	580.110	18.671	0.812	16.459	47.038	0.643	8.314	4.838	593.364	1085.270	7.931	21.316	31.802	151.496	40.008	18.486
283-1	627.476	1389.600	71.811	0.812	20.390	56.222	3.006	8.334	4.722	550.723	809.608	1.333	37.213	36.197	158.514	55.483	80.457
283-10	526.364	1574.620	49.747	0.812	19.110	54.912	2.396	11.143	6.936	723.762	785.855	0.880	6.336	14.669	193.346	79.268	73.936
283-11	450.887	836.705	30.712	0.812	17.505	47.670	1.345	8.581	7.714	845.644	877.739	10.240	11.978	7.793	139.122	49.580	44.119
283-12	269.653	501.714	11.478	0.812	14.793	45.371	0.720	8.957	4.883	578.562	1102.700	6.887	40.200	37.226	121.718	39.198	16.287
283-13	397.737	582.324	26.545	0.812	15.076	51.982	1.086	6.426	5.053	685.036	1038.860	10.526	38.902	32.110	220.921	40.830	28.886
283-14	309.763	565.749	17.350	0.812	15.585	47.713	0.638	8.341	4.779	581.192	1216.510	7.955	40.704	31.824	148.951	41.353	19.672
283-15	560.517	1503.480	52.972	0.812	18.285	56.389	2.576	7.523	3.139	405.437	710.987	2.545	38.882	28.465	143.631	55.160	71.758
283-16	332.441	565.339	16.235	0.812	17.464	52.550	0.925	8.809	5.999	691.673	1099.900	6.943	42.849	38.970	142.501	43.683	25.355
283-17	362.237	592.072	16.211	0.812	15.294	46.749	1.064	9.250	5.902	645.570	1056.970	6.641	50.586	68.632	150.524	44.266	29.235
283-2	406.465	670.913	18.457	0.812	16.128	47.840	1.094	8.023	6.583	818.452	704.237	5.245	39.341	33.774	117.272	43.907	31.676
283-20	365.413	617.483	13.177	0.812	16.543	49.383	0.789	8.619	6.777	788.392	1046.730	5.330	44.185	25.500	288.845	37.577	24.822
283-22	406.449	677.097	21.044	0.812	18.260	51.991	1.198	9.275	6.950	832.397	869.348	5.205	27.173	11.187	131.658	51.399	33.666
283-23	494.171	651.674	39.009	0.812	15.505	50.656	1.411	5.867	4.834	528.231	1282.100	8.489	41.345	24.840	150.883	47.386	41.679
283-24	498.734	659.501	32.024	0.812	17.301	54.578	1.416	6.464	5.104	561.348	1276.850	7.927	39.455	20.310	208.831	49.102	46.005

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
283-25	486.018	625.305	31.574	0.812	16.133	55.950	1.249	6.231	4.381	538.175	1611.310	9.352	41.145	19.803	165.493	47.837	44.017
283-26	252.540	487.437	15.025	0.812	15.675	45.935	0.678	9.286	4.024	471.910	1194.640	6.716	47.063	33.957	148.230	35.267	13.481
283-27	384.976	660.631	17.559	0.812	15.618	44.976	1.032	7.381	6.362	719.346	765.733	6.964	41.122	14.899	145.192	47.486	39.403
283-28	174.812	515.597	8.812	1.491	15.893	51.509	0.774	10.532	2.889	386.987	1190.420	4.679	118.627	44.408	164.836	32.266	6.000
283-29	462.659	634.360	33.257	0.812	14.158	44.418	1.346	5.248	4.573	529.100	1146.500	8.773	32.369	9.037	143.278	43.782	47.568
283-3	853.148	1625.490	73.390	0.812	20.140	56.794	3.255	9.636	5.990	720.992	319.755	-0.500	-39.158	42.957	136.445	92.001	91.053
283-3 rerun	782.790	1472.250	62.177	0.812	21.353	61.993	3.689	7.753	6.578	691.794	260.833	-0.314	-21.959	18.581	125.714	72.137	92.255
283-30	300.351	551.847	17.844	0.812	16.699	44.986	0.763	9.041	5.648	681.726	869.402	5.523	19.807	31.750	179.854	42.106	20.662
283-31	322.308	527.033	12.463	0.812	14.634	41.208	0.759	7.903	5.401	672.966	914.357	6.081	35.423	26.553	116.534	34.303	27.406
283-32	188.140	387.580	8.956	0.812	7.632	19.542	0.638	6.741	3.352	497.909	631.876	3.501	32.426	45.752	170.627	26.031	10.272
283-33	259.642	457.378	16.033	1.676	13.721	45.061	0.758	8.129	4.054	455.197	1138.100	10.212	40.879	16.951	167.439	33.077	19.916
283-34	568.829	667.470	38.941	0.812	17.256	56.638	1.511	5.792	5.127	550.121	1330.080	8.699	21.774	23.654	168.618	58.419	51.732
283-35	327.119	547.630	15.070	0.812	16.930	47.951	0.679	7.695	4.978	663.067	1213.660	7.813	39.271	46.962	149.804	44.641	21.240
283-36	239.151	769.078	21.846	0.812	16.500	46.564	0.972	11.358	5.275	592.406	850.548	4.402	14.432	25.361	123.398	38.590	20.605
283-4	365.327	639.465	22.229	0.812	15.284	47.442	0.887	7.549	5.050	681.702	818.050	6.783	57.172	23.230	105.092	34.832	27.160
283-5	301.666	608.608	14.895	0.812	16.211	44.867	0.818	10.488	5.617	690.278	995.492	4.675	48.291	22.876	153.732	40.722	27.083
283-6	522.317	668.737	40.608	0.812	16.424	54.453	1.497	5.634	4.902	564.274	1253.780	10.703	30.986	18.694	147.678	48.764	45.974
283-7	460.083	627.458	33.763	0.812	14.790	50.881	1.321	6.711	4.369	487.807	1245.820	7.546	46.987	2.002	168.207	49.432	41.651
283-8	550.992	671.960	35.114	0.812	17.824	52.778	1.639	5.978	6.115	748.361	807.094	8.227	24.615	31.467	153.178	55.892	49.776
283-9	348.137	620.810	21.691	0.812	16.136	48.090	1.043	8.906	6.278	746.833	922.218	6.255	40.796	17.368	127.226	35.326	33.128
288-1	330.669	526.748	17.023	2.322	14.979	46.974	0.963	5.451	5.511	732.950	671.523	8.939	64.928	68.546	174.242	24.788	23.697
288-10	288.663	629.152	12.217	0.812	17.445	51.126	0.661	10.879	5.154	670.761	1025.140	6.179	35.570	45.461	118.886	42.703	22.299
288-11	412.339	660.542	22.574	0.812	17.869	54.918	0.997	8.661	5.748	725.696	935.109	8.176	25.750	19.485	129.225	50.959	34.525
288-12	297.840	545.495	13.658	2.004	16.276	48.999	0.550	8.643	4.782	579.954	1127.820	9.155	38.225	27.078	135.929	41.299	24.184
288-13	335.067	601.195	23.244	1.869	15.678	51.468	0.990	7.708	4.198	620.707	1223.340	8.110	43.917	25.115	141.439	37.776	32.675
288-14	265.413	495.207	13.949	0.812	15.617	50.813	0.622	8.737	3.722	553.020	1329.280	9.529	45.437	46.893	138.287	36.523	15.962
288-15	440.826	612.995	32.328	0.812	14.105	50.708	1.215	6.931	4.238	523.477	1509.210	8.465	27.358	18.786	153.823	51.334	40.844

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
288-16	287.032	763.149	25.613	0.812	16.113	47.681	0.788	8.941	4.002	651.453	719.598	8.087	13.503	59.774	143.726	43.531	19.103
288-2	236.717	475.467	10.598	1.378	15.396	48.976	0.520	8.771	3.985	570.964	1220.700	8.463	50.936	27.244	144.901	41.145	17.184
288-3	594.074	1518.870	53.517	0.812	17.711	55.512	2.326	8.699	5.117	593.237	591.944	1.773	1.940	22.006	115.619	64.569	79.003
288-4	328.969	644.030	18.142	0.812	16.306	49.877	0.865	10.068	5.558	710.569	882.427	5.330	41.307	23.426	116.043	42.391	29.521
288-7	648.768	1405.850	55.292	0.812	18.932	57.274	3.053	9.767	6.033	598.006	478.459	-0.565	-17.894	17.708	100.268	69.151	78.813
288-8	222.452	540.113	14.712	2.346	16.087	48.555	0.606	11.629	4.028	530.496	903.788	6.586	58.499	59.449	108.403	32.316	23.521
290-1	261.276	489.405	14.112	1.123	15.237	48.993	0.673	8.904	3.386	518.681	1356.260	8.385	45.302	26.318	165.804	39.754	15.913
290-2	271.610	528.550	10.725	0.812	15.567	46.208	0.568	9.914	4.704	612.413	1176.180	7.041	29.652	40.092	138.350	44.017	16.806
319-1	532.534	691.566	28.928	0.812	18.980	52.085	1.492	7.153	6.485	716.382	966.354	5.452	43.733	51.090	143.743	57.889	48.023
334-1	576.676	680.721	33.811	0.812	15.032	51.235	1.595	6.911	5.654	683.827	1107.700	4.435	31.583	27.557	131.642	63.423	57.826
335-1	443.944	623.792	39.379	0.812	15.231	53.369	1.301	7.082	4.280	512.449	1369.670	10.203	17.546	26.195	138.539	54.177	40.720
335-10	327.816	710.928	26.645	1.416	17.178	49.830	0.964	7.852	4.638	586.467	1014.740	9.092	27.568	17.889	151.211	35.784	33.062
335-11	593.399	680.255	30.262	0.812	16.280	53.224	1.658	8.415	5.963	717.942	1028.420	4.618	12.429	12.948	121.705	65.613	57.008
335-12	245.154	428.710	15.350	2.074	10.524	36.720	0.446	6.206	3.269	544.775	1079.640	16.256	28.475	41.933	158.521	32.032	21.926
335-13	273.115	542.633	13.475	1.231	15.280	47.260	0.756	8.873	3.796	485.452	1266.650	8.391	52.722	47.565	150.026	36.128	22.048
335-14	324.998	539.803	12.875	0.812	14.857	45.673	0.801	8.560	5.567	680.954	1042.140	7.323	35.574	24.953	144.406	46.450	24.013
335-15	464.912	613.601	36.617	0.812	15.217	50.969	1.227	4.739	4.226	563.071	1292.640	11.494	39.319	23.734	161.234	41.572	44.424
335-16	429.730	615.419	26.762	0.812	16.419	51.488	1.343	7.564	5.615	695.795	795.166	6.647	29.177	11.301	119.557	45.672	40.199
335-17	272.353	555.377	15.274	1.899	13.120	44.461	0.862	11.268	4.201	465.046	1331.700	6.415	38.990	33.199	129.400	43.192	22.819
335-18	556.998	693.348	39.406	0.812	17.475	56.209	1.894	6.915	6.549	791.309	845.469	5.674	33.944	16.078	134.286	63.820	54.151
335-19	276.424	487.760	14.020	0.812	15.259	47.334	0.678	7.678	4.297	604.903	1019.560	10.252	52.552	33.427	143.690	33.808	18.973
335-2 unweathered surface	272.552	497.694	14.275	1.635	13.913	47.367	0.547	8.340	3.530	518.266	1249.200	12.012	16.335	50.944	155.516	41.557	18.431
335-2 weathered surface	254.516	494.207	11.748	0.812	15.690	47.817	0.637	9.170	4.198	589.629	1100.280	8.560	36.571	33.852	125.449	36.382	18.097
335-20	361.417	720.275	21.806	0.812	16.062	46.328	1.065	8.297	5.276	644.336	844.246	7.223	31.674	53.134	171.692	39.434	32.589
335-21	288.735	561.095	11.088	0.812	16.127	45.491	0.686	8.456	4.528	559.391	1068.150	7.430	39.151	33.550	186.643	40.323	20.490

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
335-22	285.829	508.483	16.550	0.812	14.964	45.593	0.697	8.403	4.821	620.208	1015.950	7.141	38.058	18.342	154.140	43.819	24.307
335-23	215.946	414.937	5.458	3.123	12.862	44.683	0.446	10.849	3.766	436.767	1457.520	7.458	66.391	56.416	153.440	33.869	13.318
335-24	624.195	706.223	35.893	0.812	17.413	54.073	1.990	7.095	6.807	800.036	907.927	4.539	18.055	26.360	241.080	62.995	61.927
335-25	323.455	661.658	13.589	0.812	16.531	47.829	0.917	9.777	5.445	691.884	794.284	6.530	35.526	25.692	149.074	44.106	32.776
335-26	253.562	472.529	14.709	0.812	13.368	46.950	0.691	6.044	2.923	531.030	762.388	13.527	33.249	64.973	140.475	36.181	16.329
335-27	421.875	596.112	37.229	0.938	16.165	52.758	1.255	6.902	4.221	547.225	1359.340	9.029	27.924	25.587	125.637	44.710	40.767
335-28	283.868	515.027	14.383	0.812	17.458	50.205	0.627	7.762	4.630	620.501	1121.460	9.218	43.139	30.215	179.628	38.691	16.727
335-29	558.693	1411.690	53.711	0.812	17.023	53.783	2.451	7.763	4.259	514.380	710.275	2.722	30.189	13.390	160.463	59.456	70.890
335-3	264.000	465.518	17.190	1.408	15.557	52.784	0.802	6.655	3.464	505.284	936.055	11.555	45.017	65.828	142.801	35.832	18.146
335-30	572.445	1338.900	65.239	0.812	18.261	57.294	2.926	10.164	4.431	460.498	661.309	0.275	52.351	22.924	180.612	60.770	80.288
335-31	481.059	1315.400	49.505	0.812	17.269	53.424	2.165	9.548	4.207	487.888	836.501	2.339	38.733	19.101	150.262	55.876	69.384
335-32	476.990	604.805	35.588	0.812	14.577	49.624	1.369	4.968	4.335	556.907	1051.470	13.137	38.041	41.172	142.644	45.544	42.334
335-33	279.812	456.143	16.617	1.613	13.609	44.238	0.782	7.063	3.821	559.235	1115.730	10.764	41.417	31.327	150.080	34.243	19.383
335-34	276.610	492.044	16.522	0.812	15.436	46.572	0.777	8.768	4.983	589.982	1404.840	8.226	43.614	32.157	166.820	45.304	18.895
335-35	461.723	878.490	33.447	0.812	16.763	49.421	1.335	6.151	4.772	612.093	701.078	8.504	40.299	19.191	169.406	48.220	44.616
335-37	320.017	540.757	15.389	0.812	16.995	49.335	0.971	8.582	5.774	684.456	986.738	5.784	37.663	41.676	168.393	46.706	23.563
335-38	602.898	692.360	33.329	0.812	15.804	51.230	1.997	7.320	6.442	759.852	895.056	5.008	26.103	17.919	124.030	63.649	60.500
335-39	577.925	665.081	35.690	0.812	16.810	53.933	1.670	7.971	5.783	692.386	1019.240	6.139	32.172	18.343	161.169	63.069	53.339
335-4	307.167	628.160	26.255	0.812	16.909	51.416	0.948	8.567	4.527	544.283	1005.170	7.368	53.090	29.325	141.211	40.710	26.043
335-40	385.065	590.944	19.082	0.812	15.124	45.195	1.155	7.796	6.365	769.405	924.920	6.263	36.631	32.807	147.533	47.099	29.610
335-42	360.589	637.534	19.786	0.812	16.342	46.696	1.203	8.748	7.029	799.834	932.988	6.077	39.028	19.743	132.402	35.815	34.194
335-43	339.659	638.338	17.573	0.812	17.865	49.338	1.028	8.701	5.968	709.650	899.193	6.279	31.127	10.943	143.455	39.303	30.753
335-44	743.550	520.920	46.879	0.812	12.425	62.280	2.600	4.655	6.889	750.148	529.932	3.960	10.677	28.680	199.035	87.288	69.770
335-45	290.793	611.335	15.120	0.812	16.541	46.920	0.779	10.640	5.660	695.121	983.421	5.373	28.122	29.589	121.330	43.247	25.612
335-46	327.057	628.393	20.740	0.812	15.065	46.866	0.909	9.737	5.096	623.378	886.227	7.192	35.988	15.007	127.295	43.365	30.919
335-47	323.481	628.847	23.387	0.812	16.972	48.639	0.861	10.066	5.040	642.439	894.034	6.993	46.261	28.590	154.730	41.591	27.870
335-49	325.253	640.693	18.281	0.812	17.162	50.180	0.930	9.817	5.180	652.157	1008.250	6.574	32.566	18.051	138.429	42.410	33.465
335-5	252.751	396.969	13.410	2.215	12.590	49.797	0.675	7.858	3.842	476.439	1461.270	8.923	56.743	121.033	162.532	42.962	14.944

Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
335-50	575.878	1363.660	63.429	0.812	18.203	56.244	3.529	9.424	5.285	570.236	427.021	-0.576	19.971	17.494	117.597	61.413	78.341
335-51	561.367	1305.380	67.171	0.812	18.329	58.001	3.312	9.024	3.206	338.902	507.068	0.307	34.004	21.173	240.884	60.298	79.206
335-52	468.091	543.510	29.262	0.812	8.807	24.362	1.420	4.298	3.156	419.394	470.592	0.766	-13.885	52.597	175.316	50.011	39.072
335-53	509.032	1056.690	59.664	0.812	10.042	30.708	2.862	6.814	3.579	419.800	447.287	-0.226	53.220	15.571	133.520	53.620	66.092
335-54	463.554	662.275	15.266	0.812	14.752	43.024	0.879	7.615	6.177	780.321	947.386	7.266	14.080	29.189	145.917	57.465	41.124
335-55	326.860	617.233	18.119	0.812	16.453	47.544	1.016	8.221	6.287	776.211	799.919	6.388	37.332	24.089	136.501	34.601	32.483
335-56	278.042	500.557	20.694	0.812	16.056	47.789	0.874	6.072	3.825	562.187	717.771	12.235	47.465	52.155	138.889	33.928	20.247
335-57	420.184	602.801	36.738	0.812	14.701	48.825	1.170	6.523	4.196	553.345	1047.850	9.036	26.588	24.807	146.382	50.618	40.298
335-58	582.335	1311.390	62.250	0.812	18.282	56.916	3.046	7.986	4.845	579.167	596.504	0.640	29.379	16.319	157.679	57.191	81.382
335-59	533.156	1351.720	43.281	0.812	14.129	43.553	2.453	7.541	4.077	522.078	449.864	0.660	29.748	10.964	148.538	56.727	69.335
335-6	309.677	559.531	14.184	0.812	16.150	49.289	0.682	8.914	4.512	611.122	1150.140	8.756	28.963	53.574	129.857	42.600	22.213
335-60	429.963	650.770	36.550	0.812	14.989	49.916	1.283	6.632	4.262	504.866	1209.520	8.215	28.817	12.902	143.862	49.693	37.513
335-62	319.136	639.405	22.727	0.812	14.056	44.463	1.070	8.672	5.177	605.853	1084.630	5.489	44.069	21.756	125.259	39.254	29.598
335-64	359.758	643.680	21.295	0.812	14.527	44.346	1.196	8.604	6.166	784.088	1139.420	6.719	38.699	32.008	159.500	40.679	31.666
335-65	589.702	686.337	32.850	0.812	15.856	51.224	1.709	6.693	6.485	762.100	1006.730	6.214	28.895	16.243	150.716	63.087	53.812
335-66	235.046	474.391	12.165	0.812	16.113	48.291	0.764	8.550	3.507	440.331	1368.320	6.655	42.652	26.248	168.226	31.393	17.076
335-67	466.378	731.738	25.925	0.812	17.055	50.201	1.567	8.123	6.089	768.468	910.361	4.733	14.157	4.853	122.642	52.710	48.144
335-69	373.406	553.440	22.401	0.812	16.062	48.331	1.035	8.007	6.439	742.067	1292.540	6.451	26.936	136.615	164.871	43.352	27.588
335-7	446.692	630.153	36.183	0.812	15.356	51.060	1.379	6.122	4.861	523.930	1397.240	8.182	41.684	21.308	129.031	42.077	46.145
335-70	280.159	531.890	13.370	0.812	14.960	44.356	0.863	9.605	4.982	650.230	1219.210	6.008	33.378	37.598	127.084	43.440	23.970
335-71	537.877	622.013	33.118	0.812	14.748	50.360	1.443	7.143	4.764	636.978	980.834	6.641	17.550	47.390	131.331	63.575	50.767
335-72	442.586	589.112	32.194	0.812	16.242	48.446	1.313	6.587	5.292	612.992	1747.160	7.634	33.724	17.650	154.256	41.552	41.920
335-74	287.341	530.755	17.681	3.888	15.160	45.737	0.716	7.707	3.292	457.126	952.400	11.444	118.415	62.529	167.444	38.102	23.685
335-75	283.780	526.341	13.515	0.812	14.901	41.965	0.740	8.869	4.491	601.587	1158.570	5.979	42.228	42.124	218.379	44.373	18.962
335-76	393.513	662.108	13.487	0.812	15.320	44.988	1.079	7.559	5.773	692.651	1276.960	7.129	26.284	34.866	119.695	47.755	33.024
335-77	269.459	609.909	21.290	0.812	14.568	46.080	0.874	8.409	4.053	552.627	1045.370	8.248	41.501	22.876	136.486	37.347	25.333
335-8	635.581	742.564	36.878	0.812	16.814	52.536	1.913	6.990	7.017	820.491	861.500	5.486	16.076	20.750	143.123	62.736	60.399
335-80	529.377	1326.450	53.508	0.812	19.099	56.544	2.577	8.899	5.560	648.933	801.401	0.790	71.019	22.750	158.146	58.986	69.634

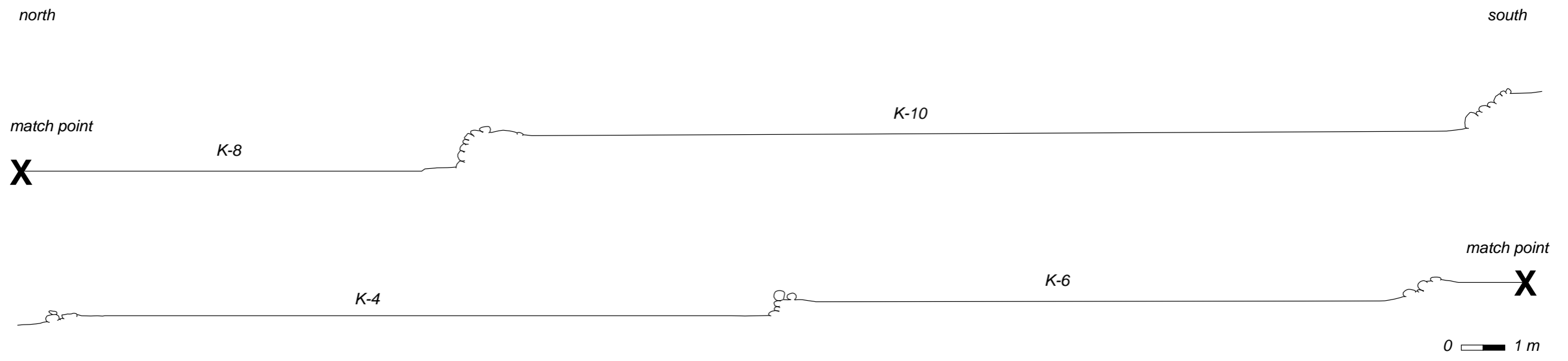
Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
335-9	194.032	497.473	10.255	1.066	14.920	49.422	0.849	9.533	3.570	448.825	1145.160	4.543	113.058	50.537	134.113	28.841	9.683
364-1	306.529	581.655	28.117	1.591	14.943	50.849	0.897	8.240	3.342	456.999	1217.370	11.579	44.879	74.873	147.258	39.836	23.127
366-1	423.904	578.663	21.833	0.812	16.911	50.271	1.078	6.813	5.046	615.919	1067.210	10.494	44.040	29.404	163.872	49.864	32.694
366-2	265.055	455.391	26.730	0.812	11.908	28.965	0.917	3.969	4.071	547.466	1242.160	9.810	39.230	29.977	156.324	58.072	23.978
368-1	307.604	538.116	28.549	2.178	10.443	37.478	0.823	6.666	3.558	470.965	1042.440	10.789	34.816	43.746	152.223	39.928	28.428
370-1	328.052	663.378	13.825	0.812	17.631	48.898	0.888	9.797	6.320	726.362	805.443	5.131	40.580	36.396	150.473	44.414	26.643
370-10	458.366	635.854	31.811	0.812	15.838	54.330	1.271	6.874	4.857	526.974	1519.450	8.456	33.424	37.035	180.308	49.738	41.997
370-11	200.083	408.007	9.302	2.130	16.367	49.090	0.533	10.333	3.619	485.888	1285.560	5.946	95.134	43.199	196.664	29.802	7.524
370-12	363.208	654.302	22.193	0.812	15.947	48.055	1.011	8.649	5.456	669.787	984.988	6.979	31.258	21.270	133.781	40.448	35.091
370-13	495.545	612.360	35.639	0.812	15.703	53.931	1.251	5.430	4.417	512.317	1216.870	11.177	32.839	19.083	162.375	46.316	41.466
370-14	244.062	507.243	9.033	0.812	13.758	43.474	0.569	8.877	3.335	458.680	1021.710	8.725	45.538	36.524	131.252	32.200	18.057
370-15	339.135	609.242	16.204	0.812	16.086	47.209	0.951	8.484	5.720	706.869	809.601	6.174	37.882	27.256	110.282	33.349	29.664
370-16	286.905	478.898	14.467	0.812	13.469	44.518	0.822	8.158	4.424	517.804	1139.950	8.092	56.395	29.544	140.201	37.961	16.329
370-17	241.363	460.878	13.274	1.868	13.353	41.704	0.561	6.381	3.215	639.764	868.118	13.714	31.210	117.889	159.371	31.016	17.767
370-19	459.400	613.013	30.676	0.812	13.542	48.407	1.286	6.267	4.305	527.763	1432.520	6.558	45.408	28.820	151.760	46.150	43.691
370-2	483.436	658.175	39.607	0.812	14.530	49.127	1.390	6.682	4.654	512.125	1307.060	9.091	16.118	25.698	150.605	52.671	44.775
370-20	314.033	616.304	18.083	1.322	15.501	49.652	0.764	8.728	4.309	582.342	919.951	8.813	40.182	26.767	152.745	37.801	23.315
370-21	286.848	544.189	19.538	0.812	16.973	48.752	0.657	8.801	4.841	556.788	987.815	7.960	46.387	32.080	172.476	40.690	21.740
370-22	361.961	680.694	18.409	0.812	18.174	47.490	0.973	8.618	6.638	762.538	969.375	5.587	36.513	36.572	148.451	41.245	34.510
370-23	353.896	654.352	16.896	0.812	16.000	47.737	1.050	9.938	6.848	751.531	853.991	3.828	27.921	15.892	131.679	44.489	32.564
370-24	490.163	1011.680	35.664	0.812	19.539	52.134	1.560	11.207	6.804	695.033	650.972	2.295	26.238	18.373	130.697	59.392	46.790
370-25	461.695	1279.310	52.327	0.812	17.904	54.864	1.651	7.541	3.433	342.576	1400.980	5.324	38.257	18.857	162.774	49.856	62.431
370-26	456.125	610.963	35.826	0.812	15.862	52.625	1.392	6.401	4.976	531.502	1533.460	7.523	52.379	20.742	135.202	41.120	42.361
370-27	450.126	699.086	21.021	0.812	18.180	52.664	1.289	8.217	6.767	825.071	888.711	5.808	44.754	14.225	118.721	43.748	36.712
370-28	331.300	600.605	18.709	0.812	16.484	45.647	0.791	8.767	6.302	725.808	864.701	6.523	29.077	30.900	123.791	39.701	24.680
370-29	550.429	1316.270	53.701	0.812	18.190	55.705	2.267	9.818	4.835	487.754	809.552	1.535	25.160	15.261	165.039	59.289	75.926
370-3	327.074	645.988	13.140	0.812	18.180	50.090	0.822	9.081	5.601	711.133	923.305	6.322	41.942	29.012	140.510	33.070	30.560
370-30	602.973	1260.710	66.989	0.812	17.576	56.271	2.713	6.944	4.235	505.904	654.832	2.349	59.420	25.755	134.099	52.177	83.208

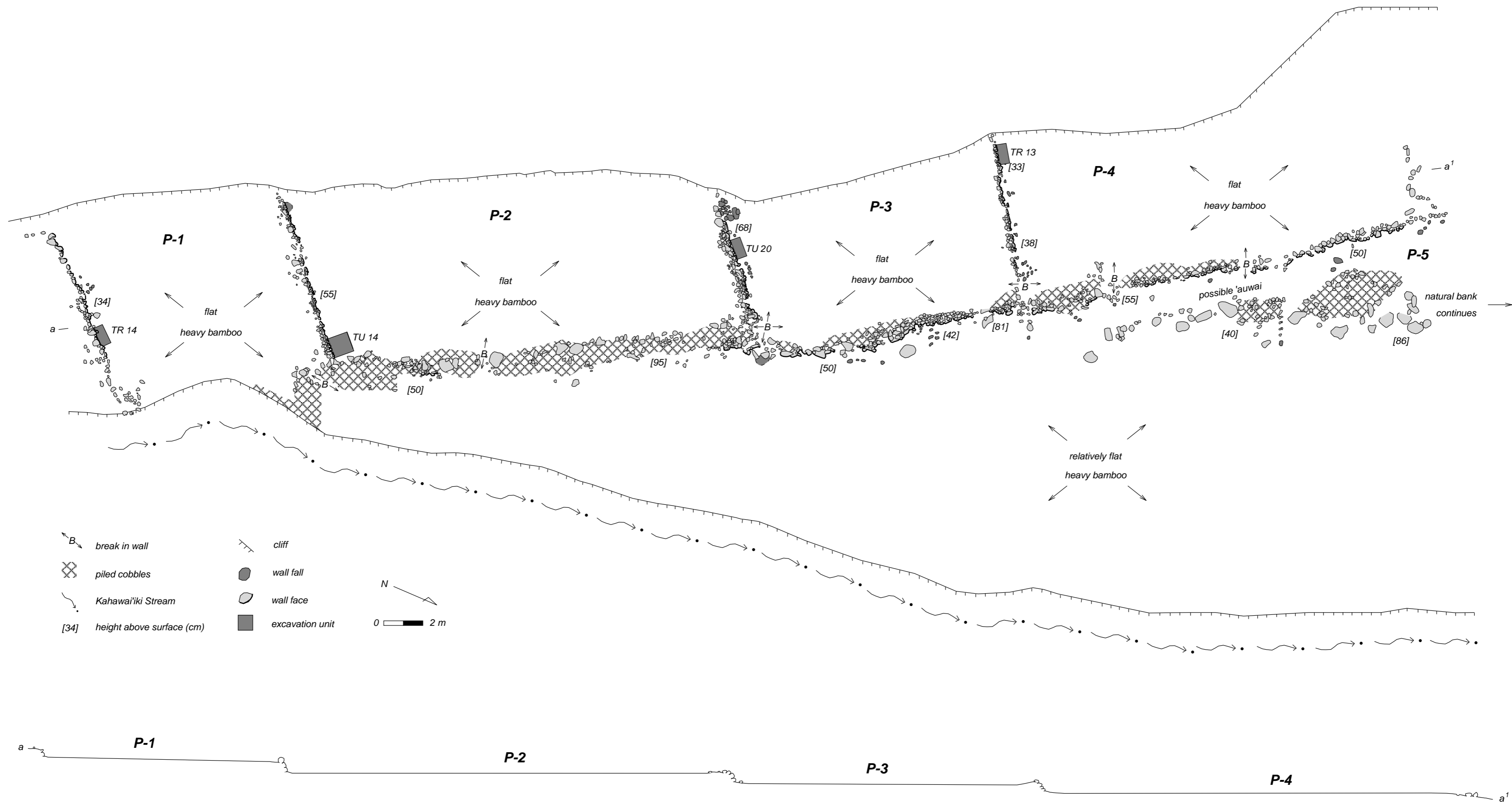
Geochemical Analysis: Raw Data (continued)

Artifact Number.	MgO (%)	Al2O3 (%)	SiO2 (%)	K2O (%)	CaO (%)	TiO2 (%)	V (ppm)	MnO (ppm)	Fe (%)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Rb (ppm)	Sr (ppm)	Y (ppm)	Zr (ppm)	Nb (ppm)
370-31	338.185	671.811	18.839	0.833	17.271	48.050	0.873	9.633	4.869	675.549	878.895	11.801	35.842	35.318	131.789	38.545	30.884
370-32	542.016	1371.200	48.666	0.812	18.129	57.495	1.930	6.850	3.295	402.729	995.538	4.141	30.500	26.898	151.851	57.492	68.199
370-33	505.746	930.651	42.020	0.812	16.227	44.096	1.414	6.262	4.320	614.074	572.781	7.735	-3.342	37.850	124.826	45.959	41.273
370-34	526.998	1332.070	47.733	0.812	16.316	51.577	1.843	6.881	3.316	397.981	1321.170	5.188	26.040	21.341	143.986	57.816	70.270
370-35	537.103	1264.440	47.232	0.812	14.340	47.893	2.058	6.923	3.675	423.685	1211.330	7.705	62.211	15.477	133.878	51.840	71.063
370-36	347.559	601.501	13.243	0.812	16.719	48.178	0.840	9.179	5.170	695.833	995.838	5.940	36.065	23.610	147.256	42.673	29.351
370-37	576.270	1466.470	52.056	0.812	19.264	54.439	2.329	6.849	4.280	484.716	568.153	3.963	23.096	29.149	148.092	57.930	76.884
370-39	591.338	772.296	21.247	0.812	17.661	41.504	1.572	7.772	6.231	699.634	852.128	13.645	20.803	9.913	144.198	69.107	63.258
370-4	443.618	599.327	33.937	0.812	14.094	49.242	1.296	5.694	3.912	515.799	1218.060	9.392	41.732	24.077	133.778	46.031	39.685
370-40	309.293	596.818	15.798	0.812	16.371	45.090	0.746	10.114	4.961	634.251	1139.660	9.841	31.608	28.667	151.617	41.512	24.776
370-41	327.162	627.223	18.620	0.812	16.231	54.398	0.966	9.892	5.446	634.295	1044.960	5.293	39.783	17.533	162.539	39.320	29.045
370-42	372.473	635.353	21.942	0.812	16.547	44.215	1.057	8.415	5.036	608.990	1257.010	8.715	34.587	58.064	160.090	43.173	30.146
370-43	297.332	622.190	26.567	0.812	13.550	43.523	0.963	7.719	4.251	537.261	896.992	8.933	23.800	29.546	161.699	34.901	25.445
370-44	522.030	634.083	34.490	0.812	15.654	51.159	1.537	7.067	4.070	503.077	1944.100	13.989	29.856	5.304	131.892	55.789	47.946
370-45	296.743	598.042	6.406	0.812	15.366	45.364	0.620	10.999	5.603	722.541	962.750	2.547	23.378	40.046	177.470	41.787	20.153
370-46	575.784	1393.340	57.567	0.812	16.770	52.603	1.976	6.510	3.136	316.629	1459.370	6.335	39.161	13.858	155.941	57.244	74.156
370-47	543.125	1449.420	49.082	0.812	17.897	48.886	2.334	8.245	3.498	459.605	842.523	2.212	21.005	8.044	145.481	56.235	62.308
370-5	336.652	576.966	21.676	0.812	13.130	44.563	0.921	7.208	4.670	631.843	1016.400	9.369	51.649	33.566	172.636	36.897	28.701
370-6	309.084	616.679	11.312	0.812	16.749	48.169	0.799	9.907	5.430	650.823	959.280	5.679	40.093	26.181	127.646	41.565	26.874
370-7	233.453	472.454	11.841	0.812	15.355	47.958	0.607	9.863	3.877	481.553	1277.550	7.272	51.608	25.053	136.208	34.795	10.698
370-8	325.066	634.067	19.779	0.812	16.437	48.877	0.896	10.231	5.109	632.381	954.040	6.348	35.860	30.823	126.315	41.388	30.150
370-9	320.706	634.228	18.585	0.812	16.106	49.014	0.874	10.454	5.481	623.628	990.081	4.588	47.517	25.628	134.932	41.681	27.384
373-1	220.474	317.497	7.597	3.985	15.096	44.507	0.446	7.766	3.906	528.190	1019.830	9.760	72.889	96.185	179.058	37.443	10.935

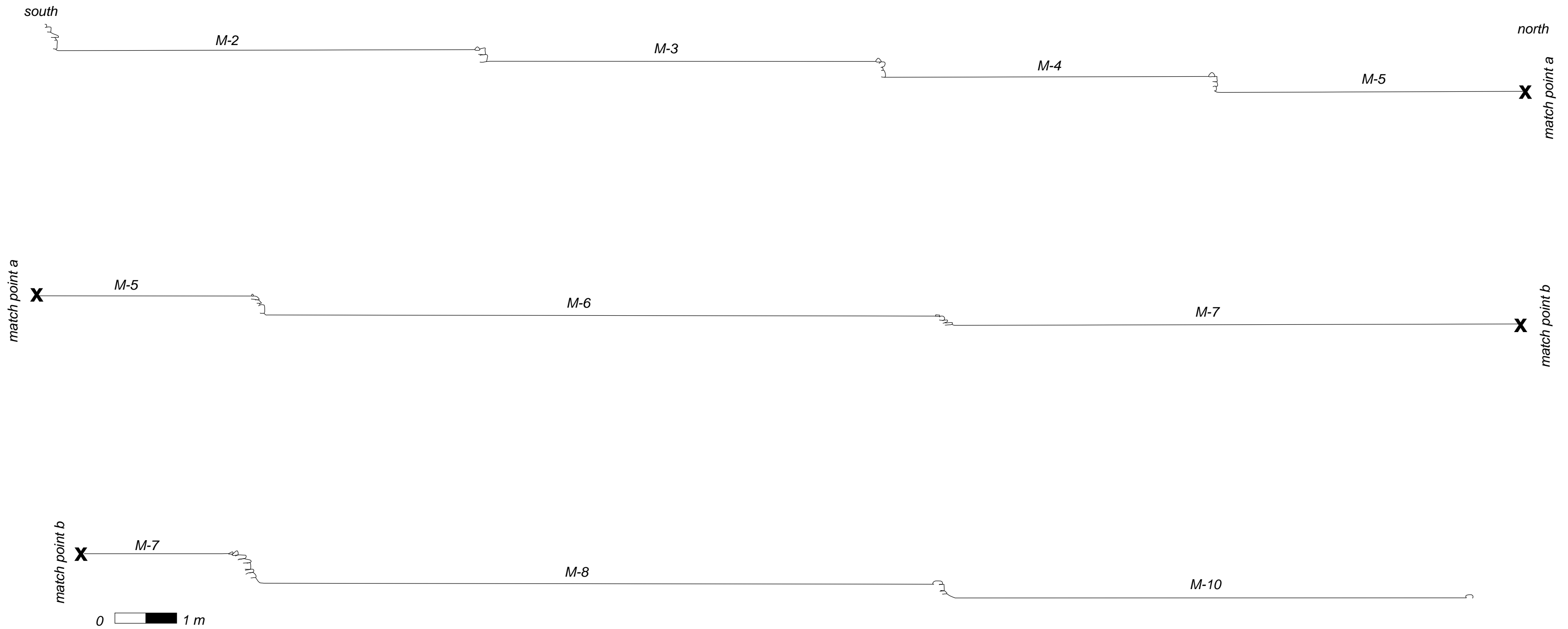
APPENDIX D: OVERSIZE FIGURES



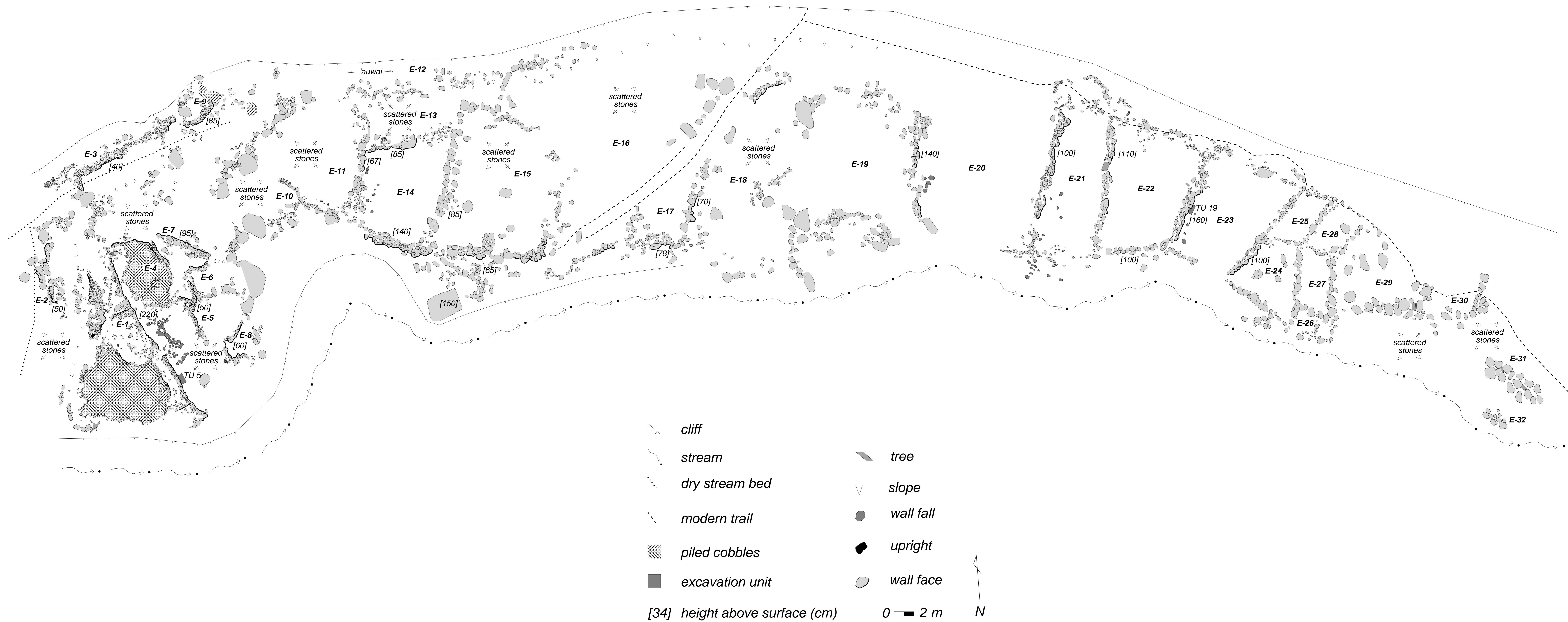
Oversize Figure 1: Cross-section of the Keiu *lo'i* complex.



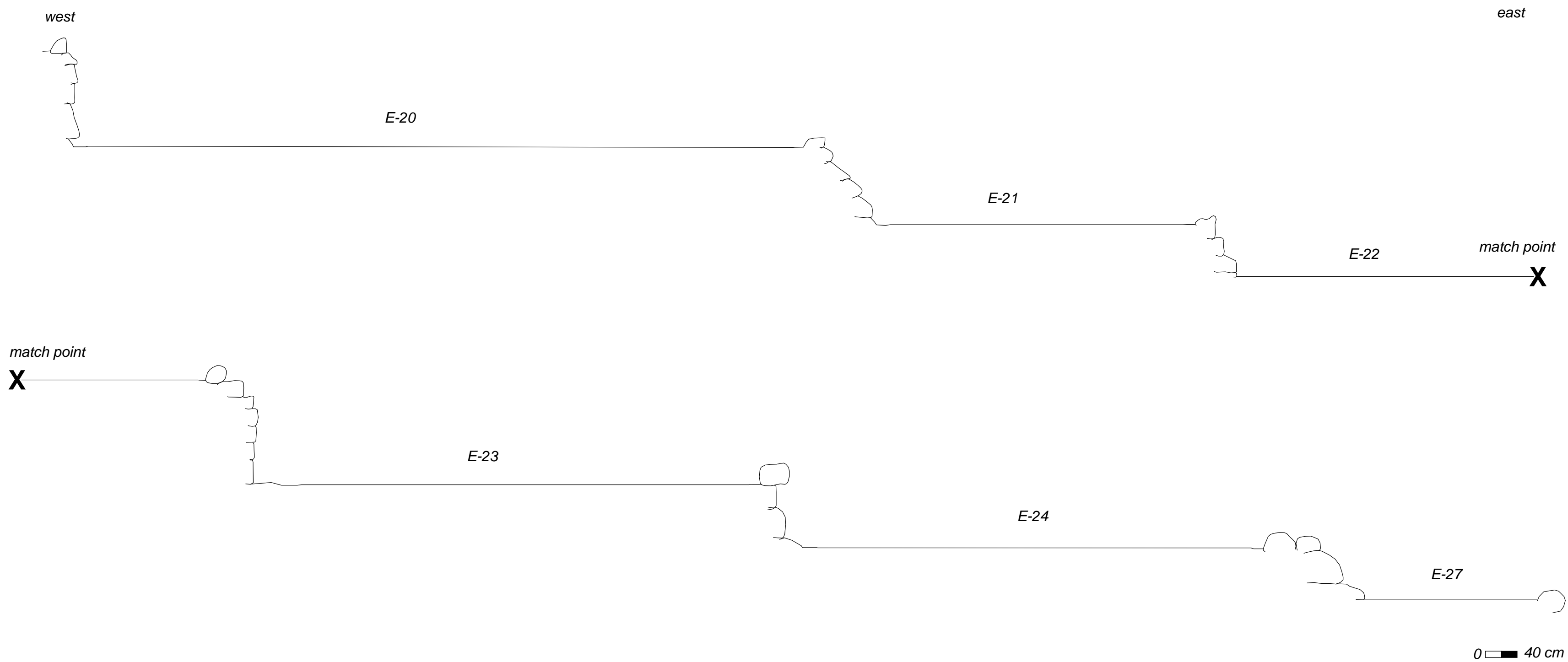
Oversize Figure 2: Pawa'a lo'i complex, plan view and cross-section.



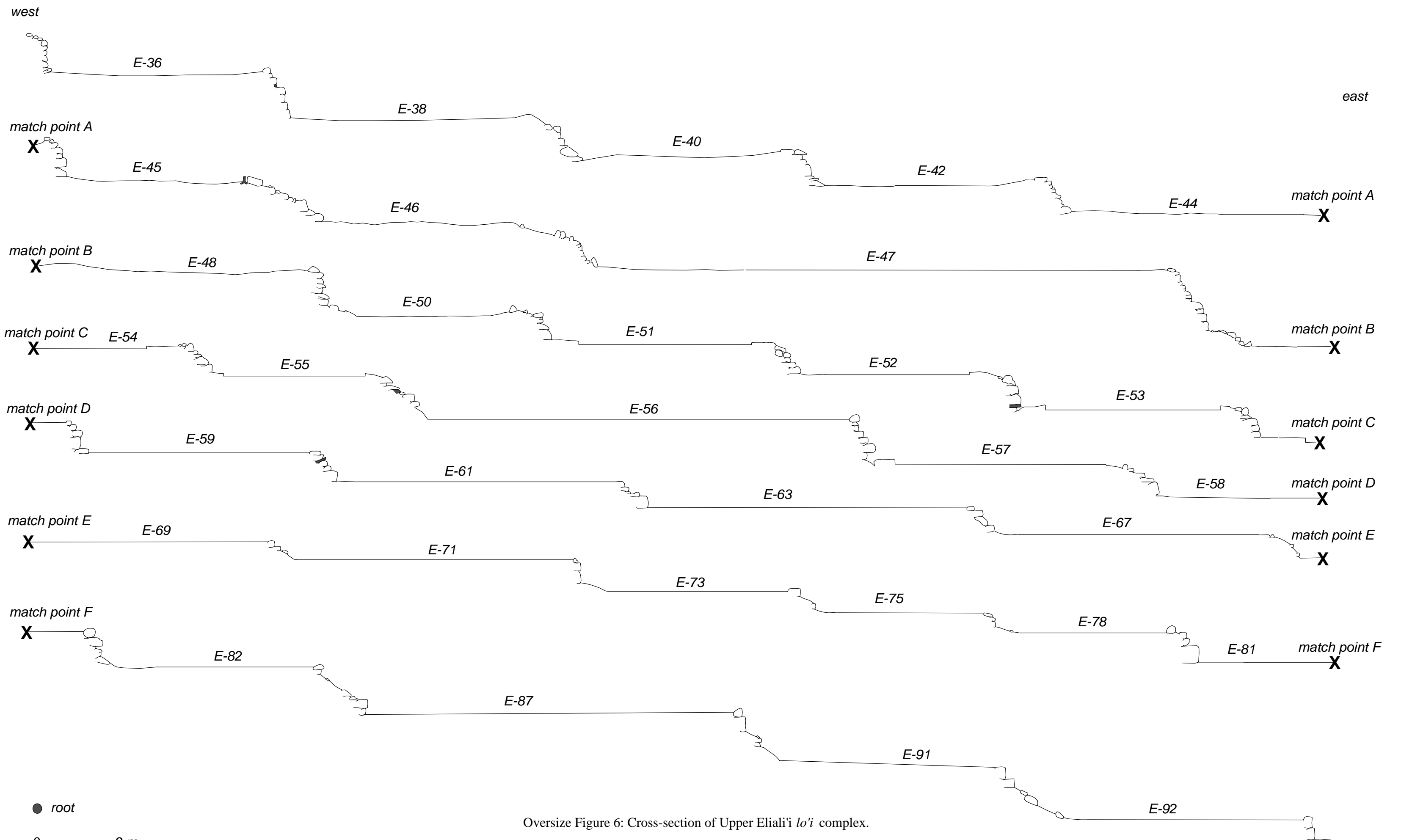
Oversize Figure 3: Cross-section of the Makea and Ku'ele *lo'i* complex.



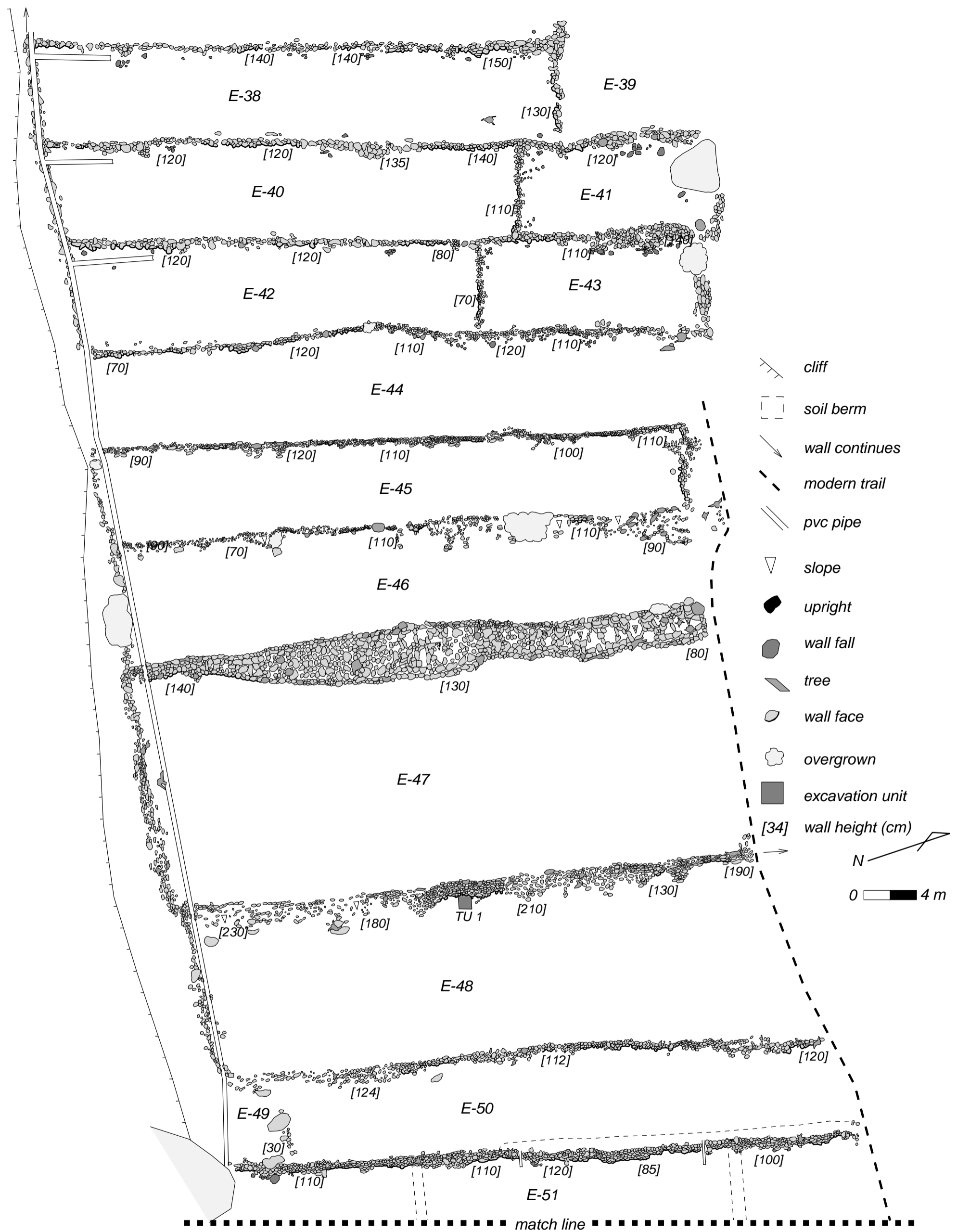
Oversize Figure 4: Lower Eliali'i *lo'i* complex, plan view.



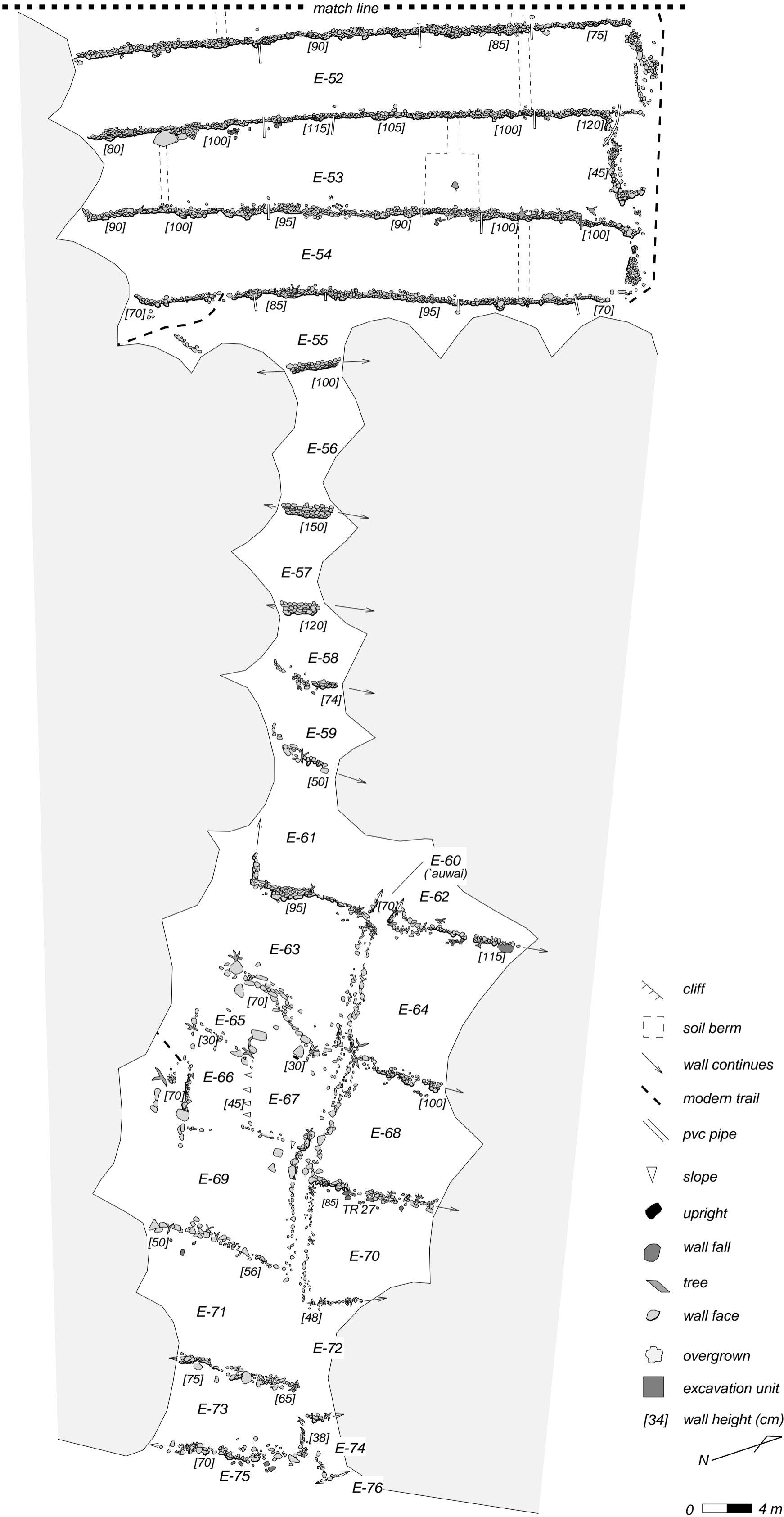
Oversize Figure 5: Cross-section of the Lower Eliali'i lo'i complex.



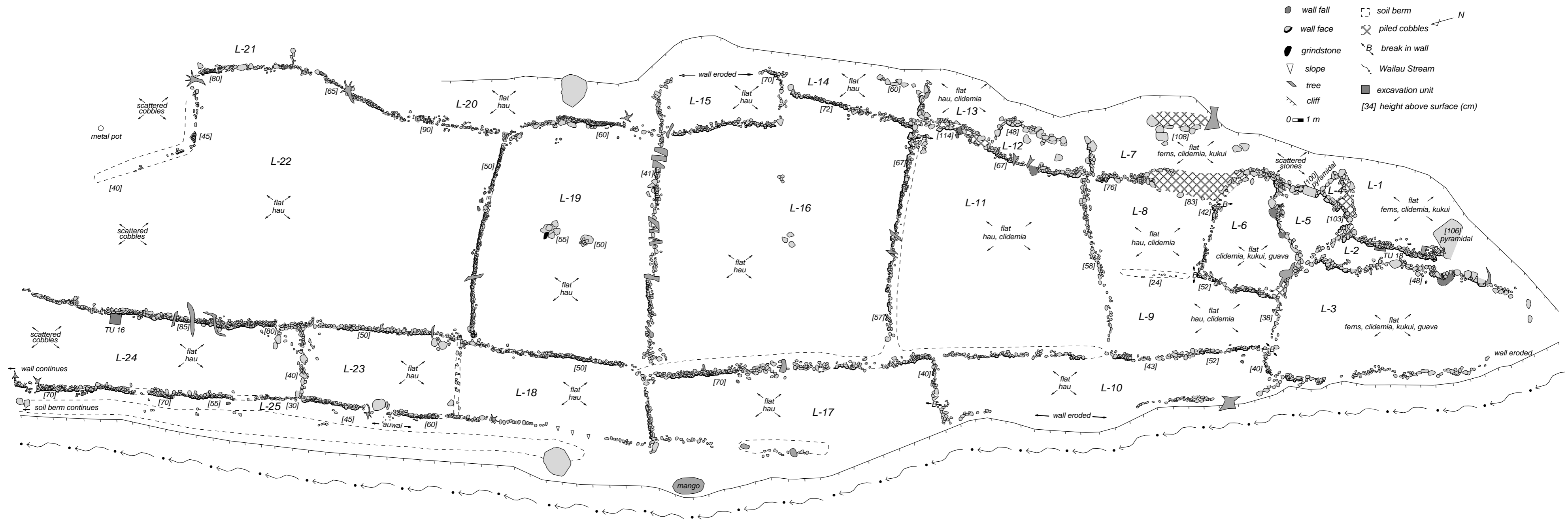
Oversize Figure 6: Cross-section of Upper Eliali'i *lo'i* complex.



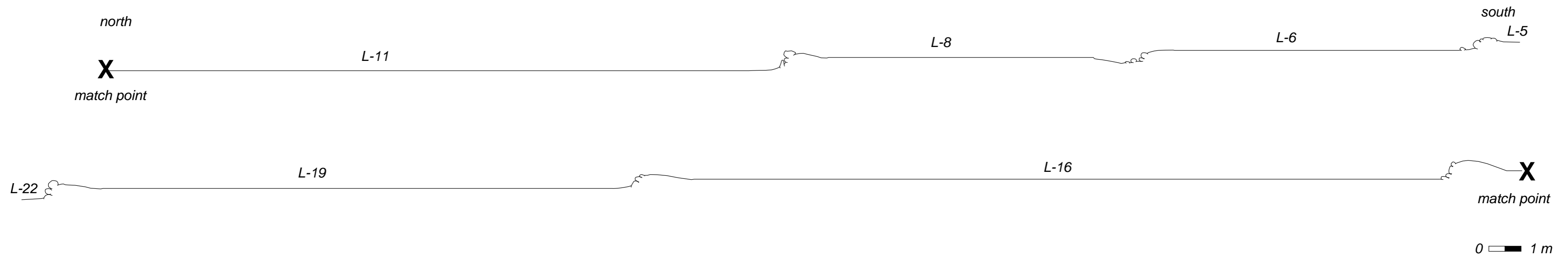
Oversize Figure 7: Upper Eliali'i lo'i complex, plan view.



Oversize Figure 7: Upper Eliali'i lo'i complex, plan view (continued).



Oversize Figure 8: Lahokea *lo'i* complex, plan view.



Oversize Figure 9: Cross-section of the Lahokea *lo'i* complex.