

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.

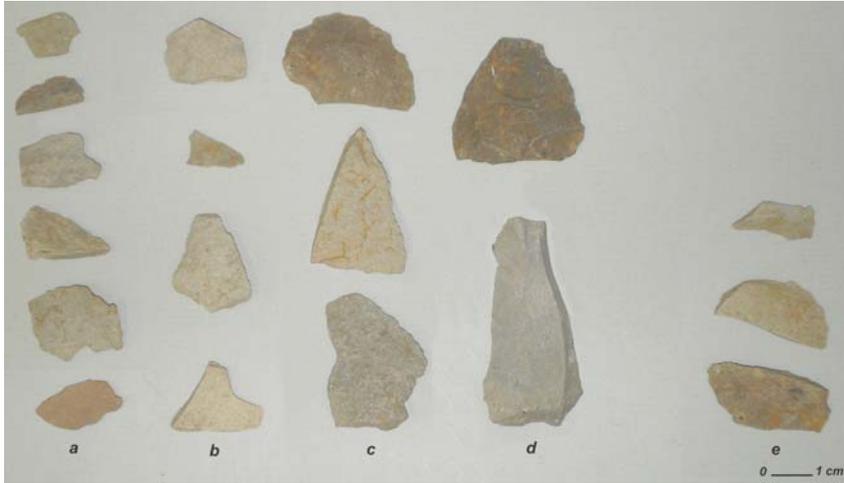


Figure 5.7: Basalt flakes from *lo'i* terrace C-8, TU 27: *a-d* Layer I level 5; *e* Layer I level 6.



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.

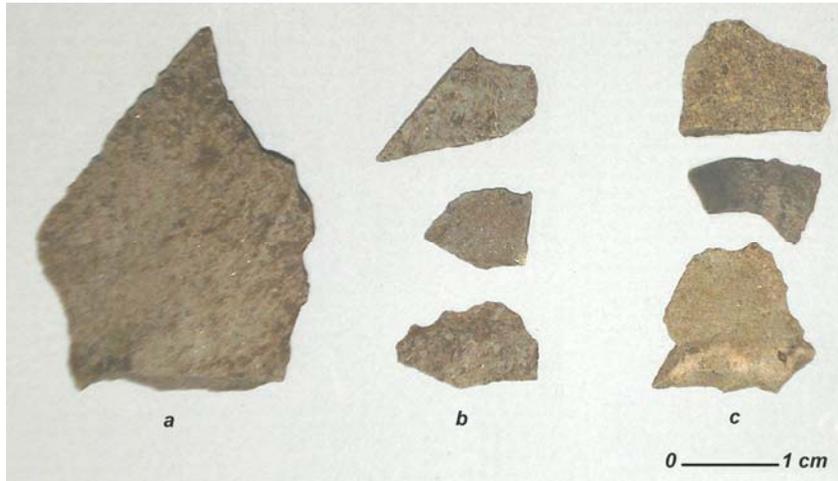


Figure 5.12: Basalt flakes from hearth C-18, Layer I level 1 of TU 22, outside the hearth feature.



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.

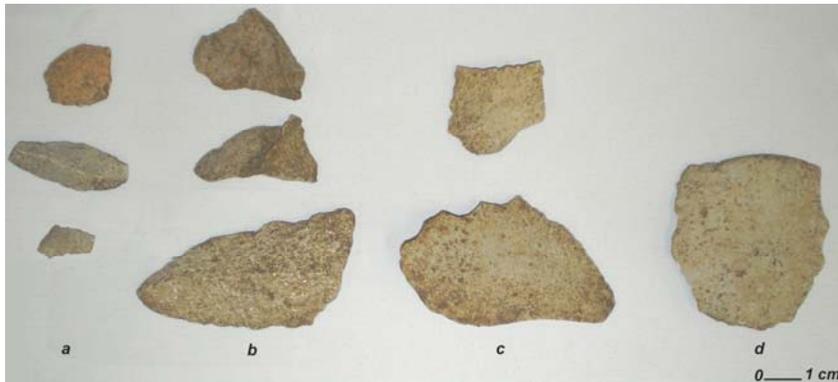


Figure 5.14: Basalt flakes from *lo'i* terrace C-20, TU 23: *a* and *b* Layer I level 2; *c* Layer I level 3; *d* Layer I level 4.



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.

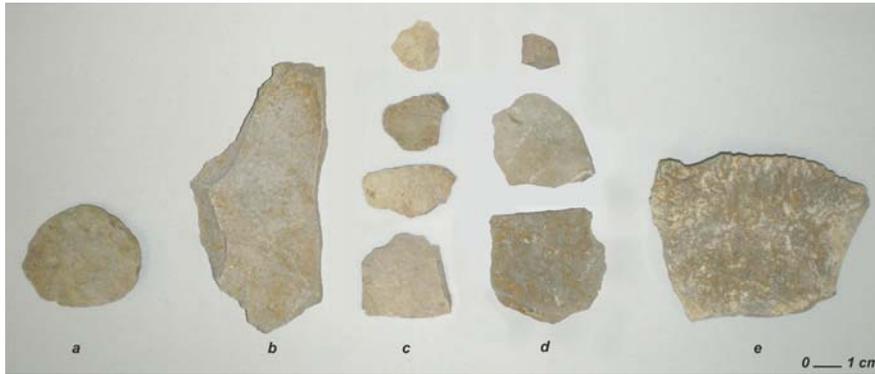


Figure 5.18: Basalt flakes: *a* from *lo'i* terrace M-7, Layer I of TR 10; *b-d* from terrace M-8, Layer I of TR 9; *e* from terrace M-9, Layer I of TR 8.

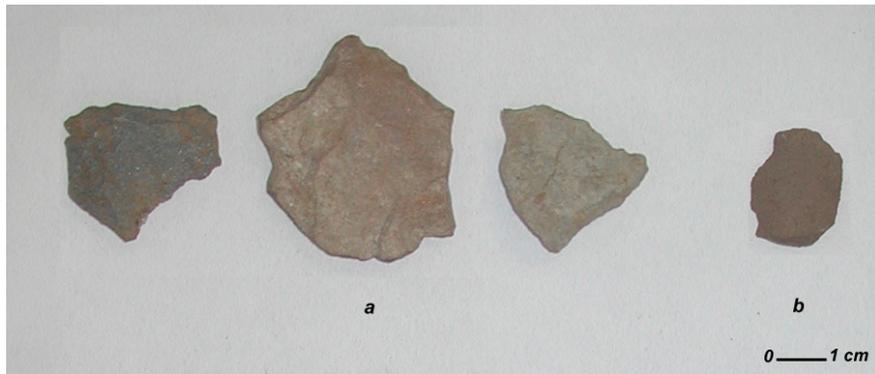


Figure 5.19: Basalt flakes: *a* from *lo'i* terrace M-10, Layer I level 3 of TU 11; *b* from *lo'i* terrace M-13, Layer I level 1 of TU 10.

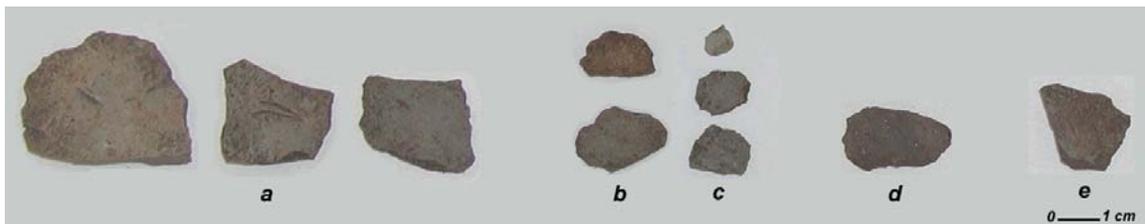


Figure 5.20: Basalt flakes from historic house platform M-17, TU 7: *a* Layer I level 1; *b* and *c* Layer I level 2; *d* Layer I level 5; *e* Layer II level 1.



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.

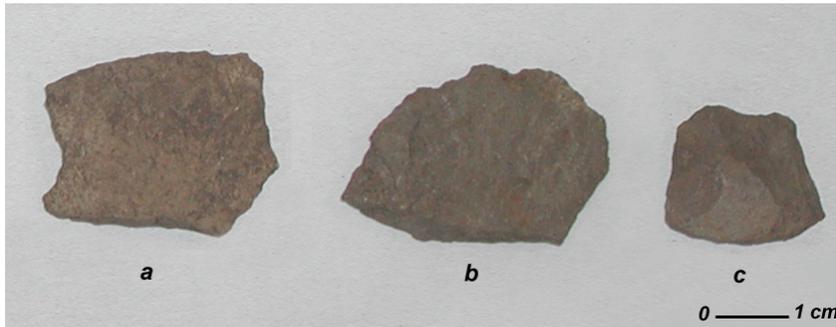


Figure 5.22: Basalt flakes: *a* from *lo'i* terrace E-33, Layer I level 2 of TU 2; *b* from *lo'i* terrace E-48, Layer I level 5 of TU 1; *c* from *lo'i* terrace E-48, Layer I level 6 of TU 1.

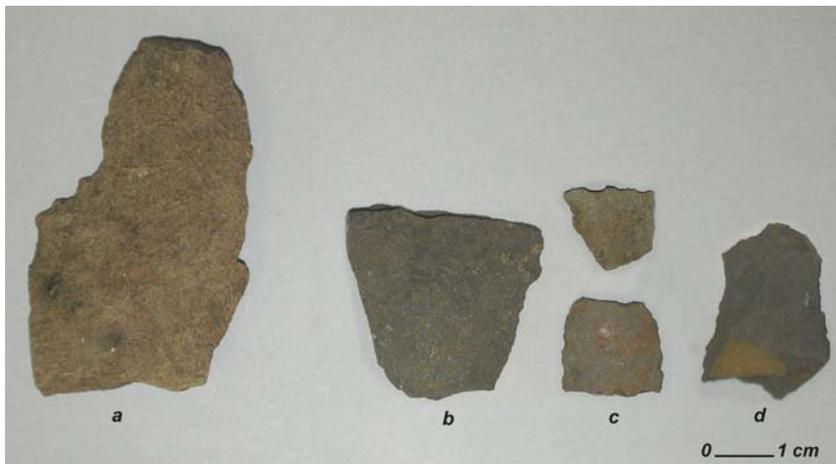


Figure 5.23: Basalt flakes: *a* from *lo'i* terrace H-23, TR 29 surface; *b-d* from *lo'i* terrace H-57, TR 30 Layer I.

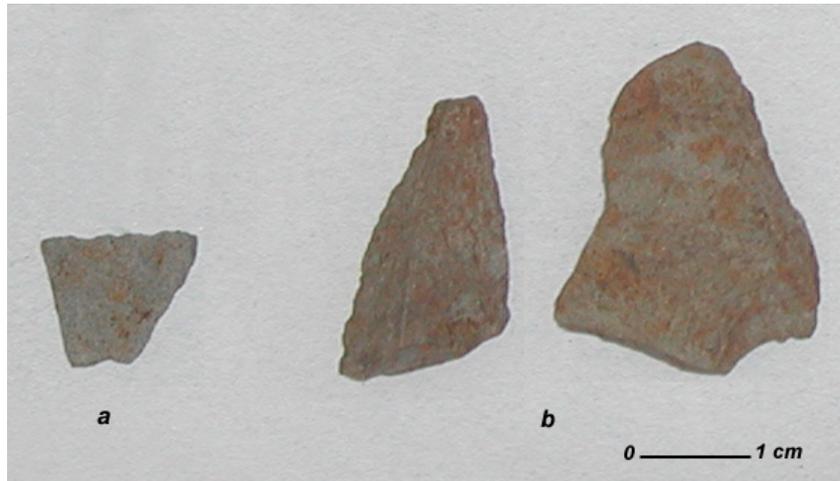


Figure 5.24: Basalt flakes from *lo'i* terrace L-24, TU 16: *a* from Layer I level 4; *b* from Layer I level 6.



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

from Halepoki, three from Lahokea, and six from Palaloha. 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 | |
| | | | 46.1 | 6.5 | 3.5 | chipping on 2 edges |
| | | | 20.8 | 6.0 | 2.8 | |
| | | | 5.7 | 3.0 | 2.6 | |
| | | | 9.7 | 3.0 | 2.7 | |
| | row <i>b</i> , left to right | | 1.2 | 2.2 | 1.9 | polish on 1 surface |
| | | | 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 | |
| | | | 6.4 | 4.8 | 2.1 | chipping on 2 edges |
| | | | 10.5 | 3.5 | 3.3 | |
| | row <i>d</i> , left to right | | 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 | 1 utilized edge |
| | | | 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 | | | |
| | | | 10.6 | 3.5 | 3.1 | | | |
| | | | 1.5 | 2.2 | 2.1 | | | |
| | | | 3.6 | 2.3 | 2.7 | | | |
| | | | 0.4 | 1.8 | 1.4 | | | |
| | | row <i>c</i> , left to right | 0.4 | 1.8 | 0.7 | | | |
| | | | 1.0 | 1.9 | 1.0 | | | |
| | | | 0.6 | 1.3 | 1.0 | | | |
| | | | 0.3 | 1.2 | 0.9 | | | |
| | | | Figure 5.5 | 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 | | | | | |
| 4.9 | | 2.9 | 2.0 | | | | | |
| row <i>d</i> , left to right | 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 | | |
| | | | 11.8 | 3.5 | 2.8 | | |
| | | row <i>e</i> , left to right | 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 | | |
| | column <i>b</i> bottom to top | | 0.5 | 1.5 | 0.9 | | |
| | | | 1.2 | 2.1 | 1.9 | | |
| | | | 2.4 | 2.4 | 1.8 | | |
| | | | 0.3 | 1.5 | 0.8 | | |
| | | | 1.5 | 1.9 | 1.5 | | |
| | column <i>c</i> bottom to top | | 4.8 | 3.0 | 2.1 | | |
| | | | 4.8 | 3.5 | 2.2 | | |
| | | | 6.1 | 3.1 | 2.3 | chipping on 1 edge | |
| | column <i>d</i> bottom to top | | 12.6 | 5.0 | 2.3 | | |
| | | | 7.5 | 3.5 | 3.3 | | |
| | | | 3.1 | 2.9 | 1.6 | | |
| | column <i>e</i> bottom to top | | 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 | |
| | | | | | 18.3 | 5.2 | 2.3 | |
| | | | | row <i>b</i> , left to right | 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 | |
| | | | | row <i>c</i> , left to right | 6.2 | 3.3 | 2.4 | |
| | | | | | 7.4 | 3.5 | 2.0 | |
| | | | | | 7.9 | 3.6 | 2.5 | |
| | | | | | 6.6 | 4.1 | 1.3 | |
| | | | | | 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 | |
| | | | | row <i>d</i> , left to right | 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 | |
| | | | | | 2.0 | 2.7 | 1.3 | |
| | | | | | 1.4 | 2.4 | 1.6 | |
| | | | 1.3 | 4.2 | 1.5 | | | |
| | | row <i>e</i> , left to right | 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 | | | |

Table 5.1: Basalt Flake Data (continued)

| Area | Photo | Weight (g) | Length (cm) | Width (cm) | Notes | | |
|-------------------|---------------------------------|---------------------------------|---------------------------------|------------|-------|---------------------|--|
| Ku'ele (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 | | |
| | | | 42.2 | 5.6 | 5.5 | | |
| | | row <i>b</i> , left to right | 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 | | |
| | | | 4.6 | 3.6 | 2.3 | | |
| | | | 4.0 | 4.0 | 2.5 | | |
| | | | row <i>c</i> , left to right | 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 | chipping on 1 edge |
| | | 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'eie (cont.) | Figure 5.10 (cont.) | row <i>f</i> , left to | 2.6 | 3.7 | 1.2 | |
| | | right | 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 | 50.1 | 5.4 | 4.4 | chipping on 1 edge |
| | | right | 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'eie (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> , bottom to top | 0.3 | 1.5 | 0.9 | |
| | | 0.3 | 1.2 | 0.9 | |
| | | 1.0 | 1.7 | 1.5 | |
| | column <i>c</i> , bottom to top | 0.5 | 1.9 | 0.9 | |
| | | 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 | |
| | column <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> bottom to top | 0.5 | 1.7 | 0.8 | |
| | | 2.1 | 3.3 | 1.3 | |
| | | 1.1 | 2.1 | 1.5 | |
| | column <i>b</i> bottom to top | 20.9 | 6.0 | 3.2 | |
| | 6.2 | 3.1 | 2.0 | | |
| | 4.7 | 3.0 | 2.2 | | |
| column <i>c</i> bottom to top | 20.0 | 6.0 | 3.6 | | |
| | 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 | | |
| | | | 12.3 | 4.1 | 4.0 | | |
| | column <i>d</i> , bottom to top | | 8.1 | 4.0 | 3.4 | | |
| | | | 0.8 | 1.6 | 1.1 | | |
| | <i>e</i> | | 65.3 | 7.5 | 5.6 | chipping on 1 edge | |
| | | | | | | | |
| Figure 5.19 | <i>a</i> left to right | | 4.2 | 3.2 | 2.7 | | |
| | | | 12.3 | 4.5 | 3.6 | | |
| | <i>b</i> | | 4.6 | 3.0 | 2.5 | | |
| | | | 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 | chipping on 1 edge | |
| | | | 5.3 | 2.5 | 2.3 | | |
| | <i>b</i> bottom | | 3.1 | 3.0 | 2.4 | | |
| | | | 6.3 | 3.6 | 2.3 | | |
| | | | 3.7 | 3.0 | 1.6 | | |
| | <i>c</i> bottom to top | | 2.8 | 2.2 | 1.9 | | |
| | | | 1.6 | 2.3 | 1.7 | | |
| | <i>d</i> | | 0.5 | 1.5 | 1.1 | polish on 1 surface | |
| | | | 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 | | |
| Elialii | 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 | |
| Palalooa | 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 | |
| | | <i>c</i> | | 0.5 | 1.4 | 0.8 | |
| | | | | 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.

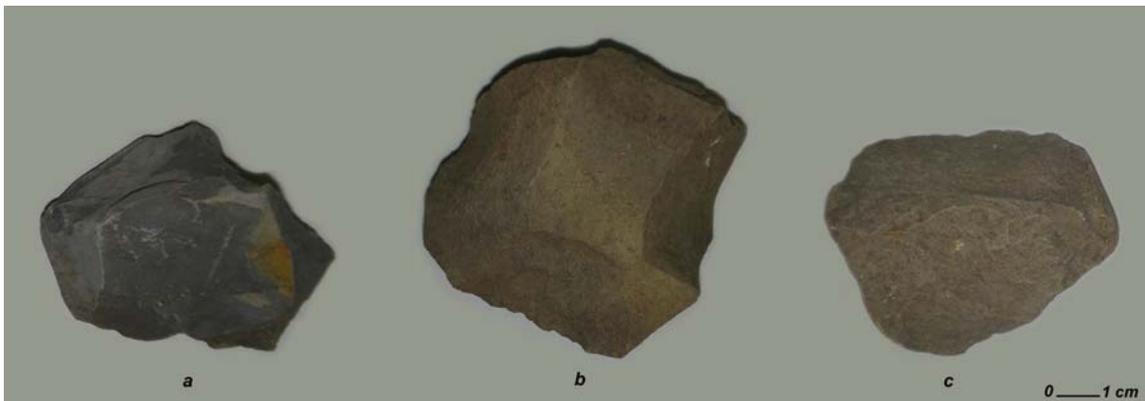


Figure 5.26: Basalt cores from Ku‘ele: *a* from platform C-2, surface of TU 25; *b* from surface collection between hearth C-18 and *lo‘i* terrace C-19; *c* from *lo‘i* terrace C-30 Layer I of TR 3.

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.

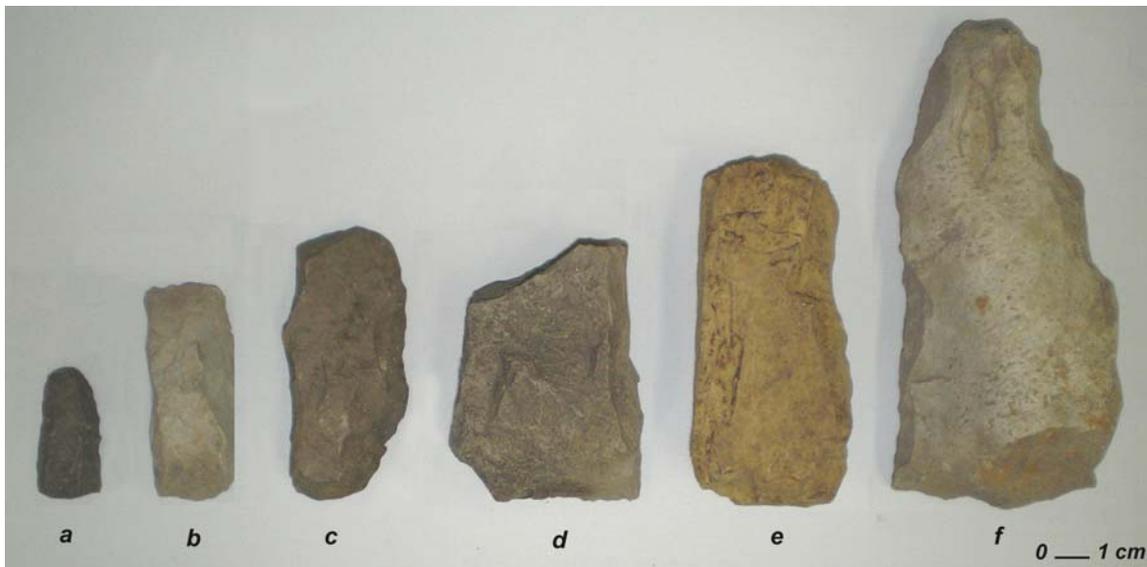


Figure 5.28: Adze blanks: *a* from platform C-2, Layer I level 1 of TU 25; *b* from *lo'i* terrace M-8 surface collection; *c* from Pawa'a surface collection, not associated with a particular feature; *d* from *lo'i* terrace M-7 surface collection; *e* from Ku'ele surface collection, southwest of *lo'i*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

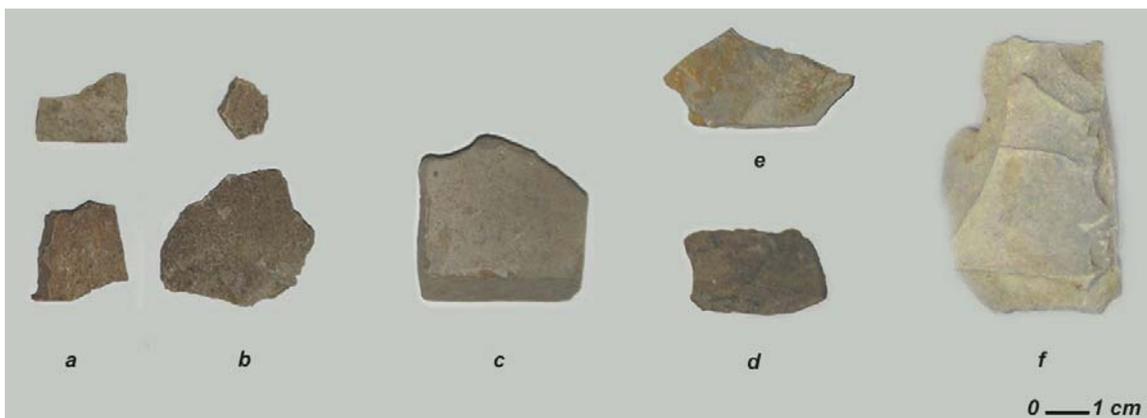


Figure 5.29: Adze fragments from Ku‘ele: *a* and *b* from platform C-2, Layer I level 1 of TU 25; *c* from platform C-2, Layer I level 4 of TU 25; *d* from terrace C-6, Layer I level 1 of TU 26; *e* from terrace C-8, Layer I level 4 of TU 27; *f* from terrace C-9, Layer I of TR 37.

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 poulder 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 poulder 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* poulder 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.

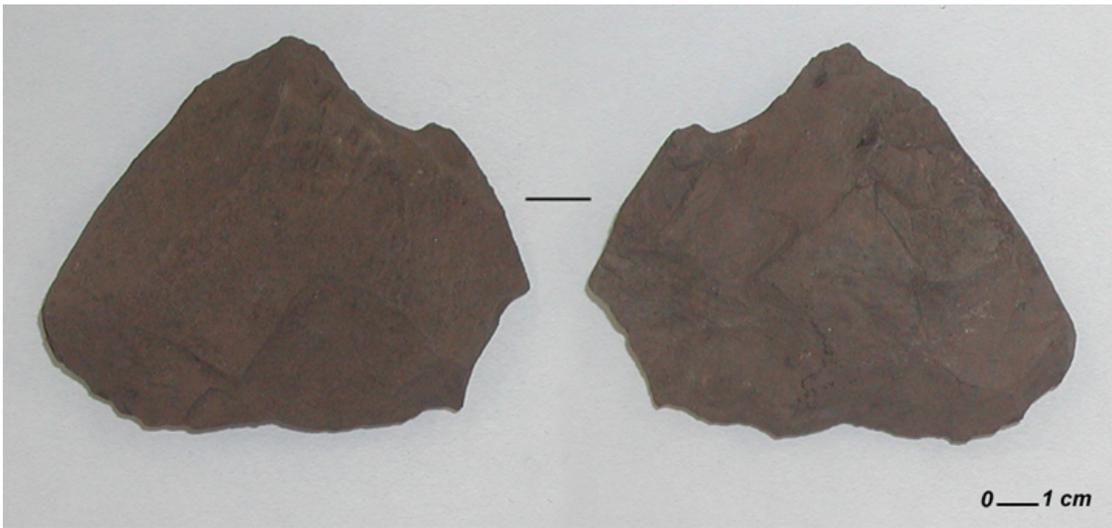


Figure 5.36: Basalt chopping tool from Lower Eliali'i surface survey, front and back.

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.

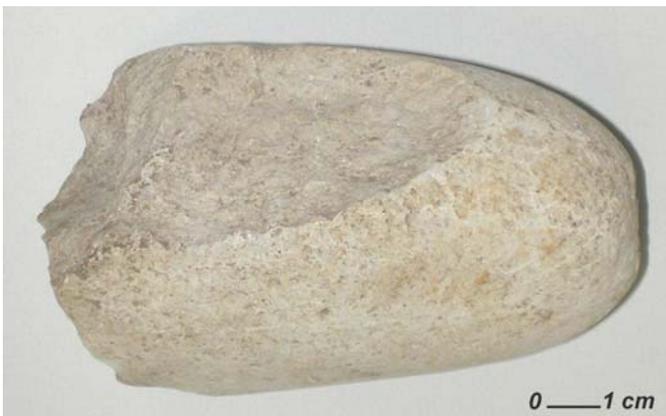


Figure 5.38: Hammerstone found within Layer I of TR 31, terrace H-45. The end on the right exhibits battering.

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.

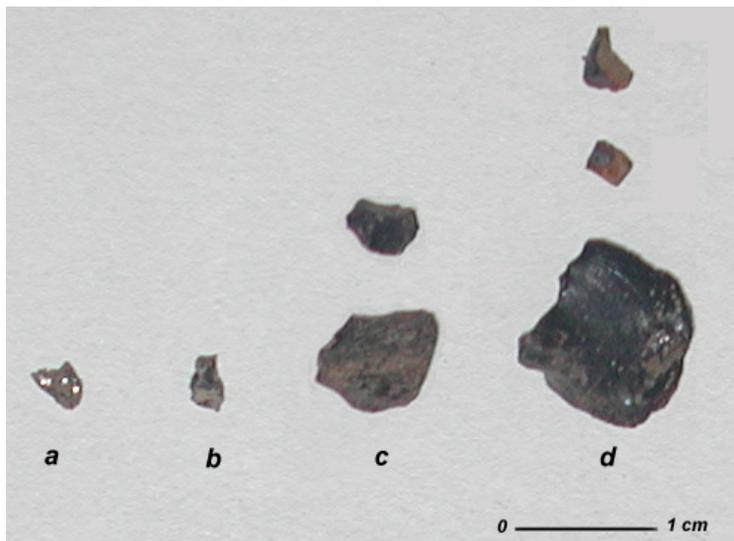


Figure 5.40: Volcanic glass: *a* from Layer I level 2 of terrace K-11; *b* from Layer I level 2 of terrace M-11; *c* from Layer I level 2 of terrace M-10; *d* from Layer I level 3 of terrace M-10.

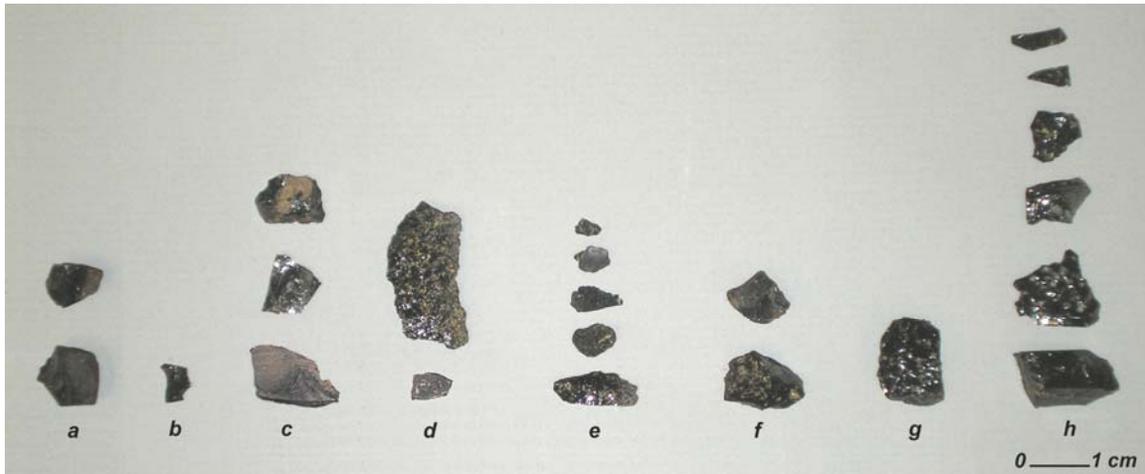


Figure 5.41: Volcanic glass from Ku‘ele: *a* from Layer I level 1 of terrace C-2; *b* from Layer I level 2 of terrace C-2; *c* bottom from Layer I level 1 of terrace C-6; *c* center and top from Layer I level 2 of terrace C-6; *d* bottom from Layer I level 4 of terrace C-8; *d* top from Layer II level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

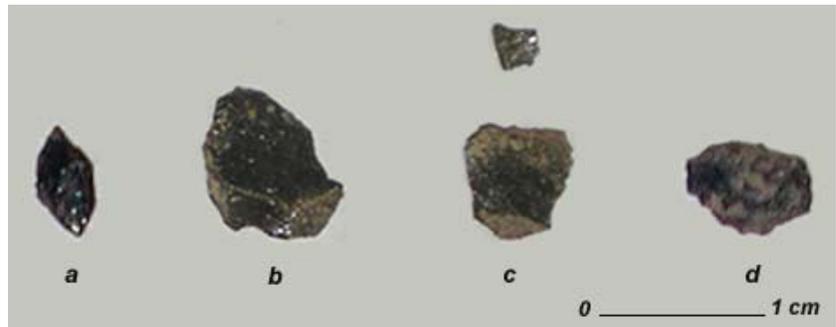


Figure 5.43: Volcanic glass: *a* from Layer I level 3 of terrace E-1; *b* and *c* from Layer 1 of terrace E-78; *d* from Layer I level 4 of terrace L-34.

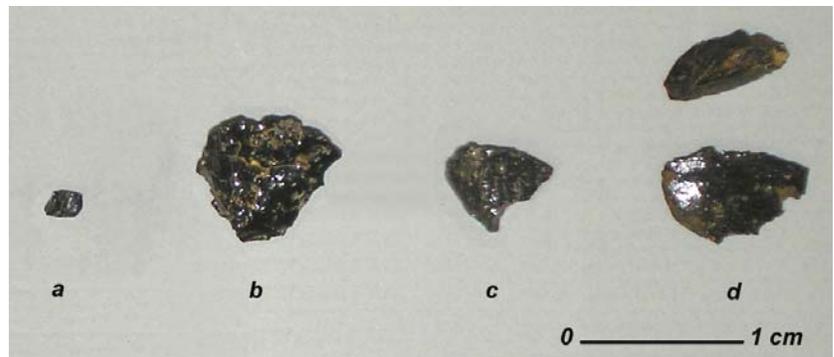


Figure 5.44: Volcanic glass: *a* from Layer I of terrace H-20; *b* from Layer I of terrace H-57; *c* from Layer I of TR 32 (terrace with no number, Halepoki Central); *d* from Layer I level 2 of TU 38 (hearth feature with no number, Palalao).

Table 5.2: Volcanic Glass Data

| Photo | Weight (g) | Length (cm) | Width (cm) | Notes |
|------------------|------------------|-------------|------------|------------------------------------|
| Figure 5.40 | <i>a</i> | tr. | 0.3 | 0.3 |
| | <i>b</i> | tr. | 0.4 | 0.2 |
| | <i>c</i> bottom | 0.2 | 0.9 | 0.6 |
| | <i>d</i> top | tr. | 0.5 | 0.4 |
| | <i>d</i> bottom | 0.6 | 1.1 | 1.0 possible edge damage |
| | <i>d</i> center | tr. | 0.3 | 0.2 |
| | <i>d</i> top | tr. | 0.3 | 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 porcelaineous 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 porcelaineous 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

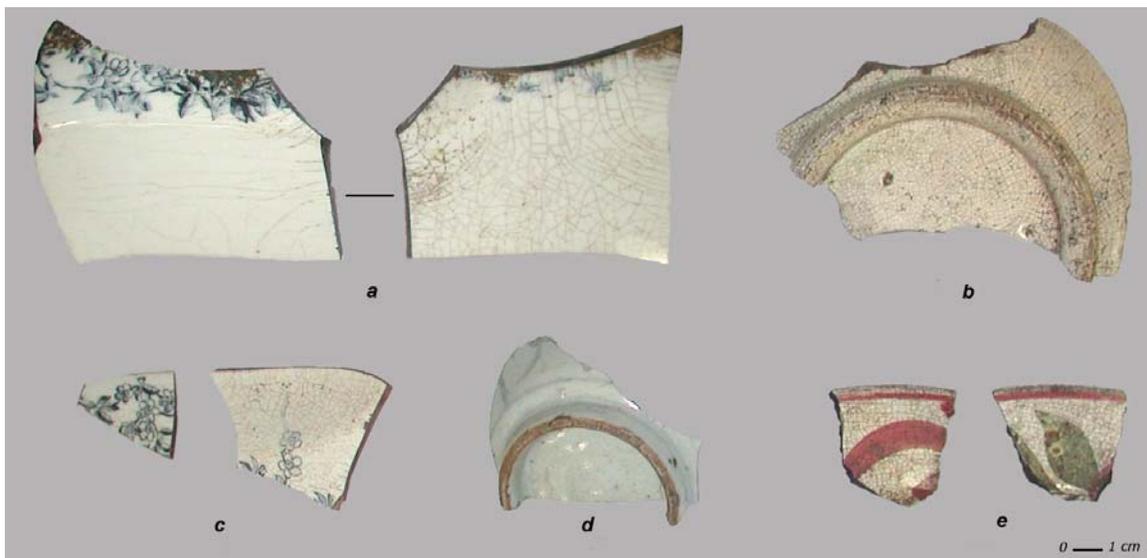


Figure 5.46: Selected ceramics from Pawa'a, not associated with a feature: *a* English or American serving vessel, front and back; *b* English or American large bowl; *c* English or American soup plate; *d* Chinese *tz'u* rice bowl; *e* English or American plate.



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.

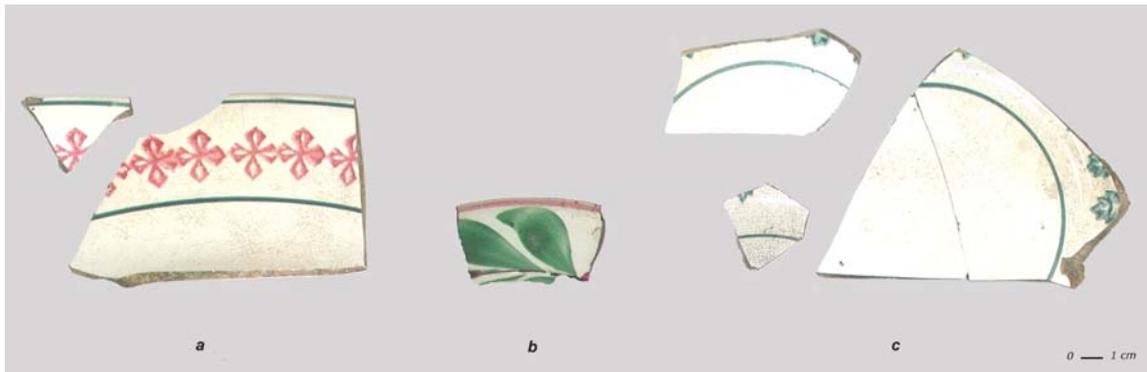


Figure 5.49: Selected ceramics from historic house platform M-17, surface collection: *a* vegetable dish with cut sponge stamping and hand-painted rim band; *b* hand-painted plate; *c* plate with cut sponge stamping and hand-painted line.

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.

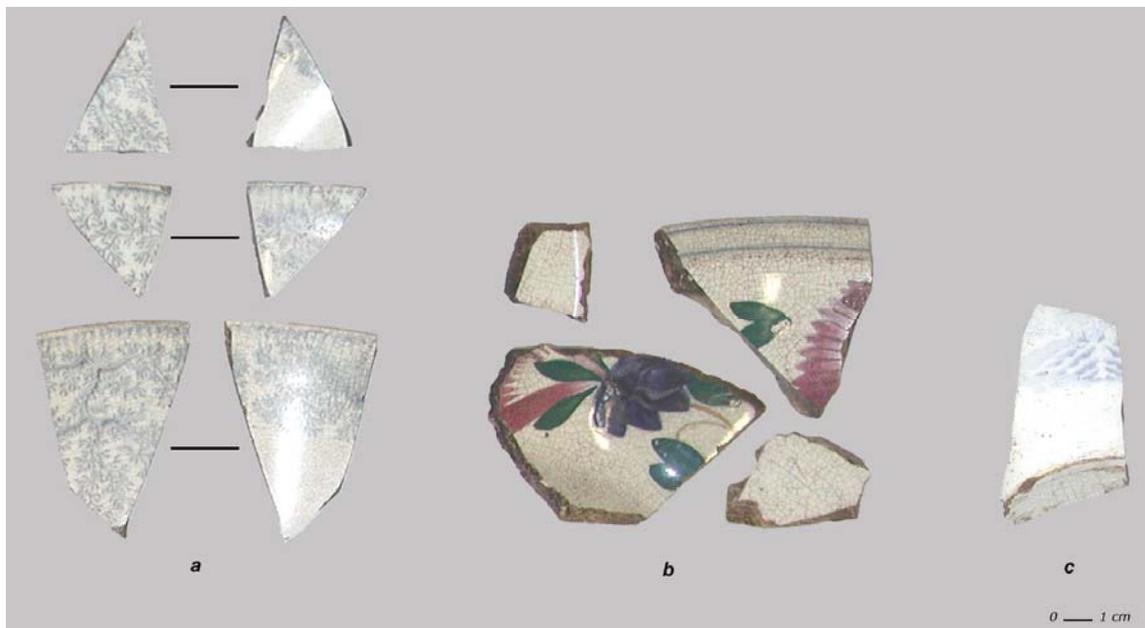


Figure 5.50: Selected ceramics from historic house platform M-17, surface collection: *a* cup with blue flower transfer print (front and back shown); *b* hand-painted vegetable dish; *c* cup with blue transfer print.

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.

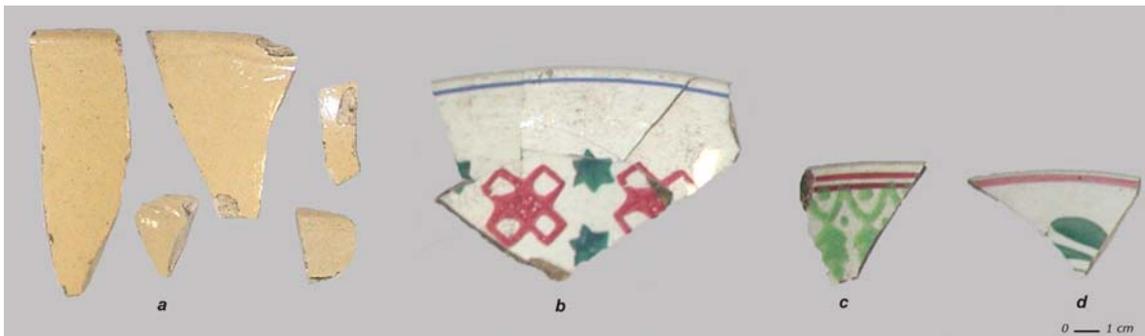


Figure 5.51: Selected ceramics from historic house platform M-17 excavations: *a* nappy with scalloped edge; *b* cut stencil plate with hand-painted rim band (five of six sherds shown); *c* hand-painted bowl; *d* hand-painted plate.

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

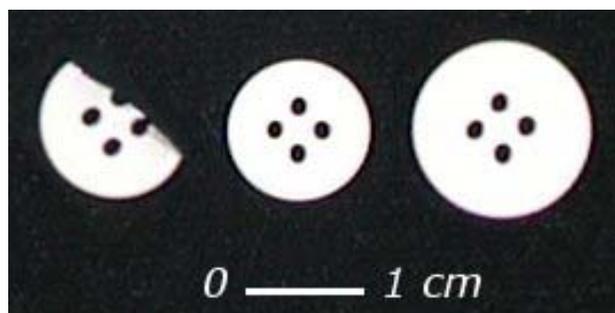


Figure 5.52: Porcelain buttons from historic house platform M-17.



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 porcelaineous stoneware dates from the Nineteenth to the early Twentieth Century. One sherd was part of a Japanese porcelaineous 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

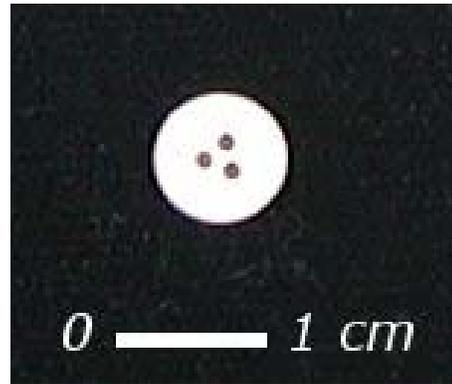


Figure 5.56: Porcelain button from *lo'i* terrace L-2.

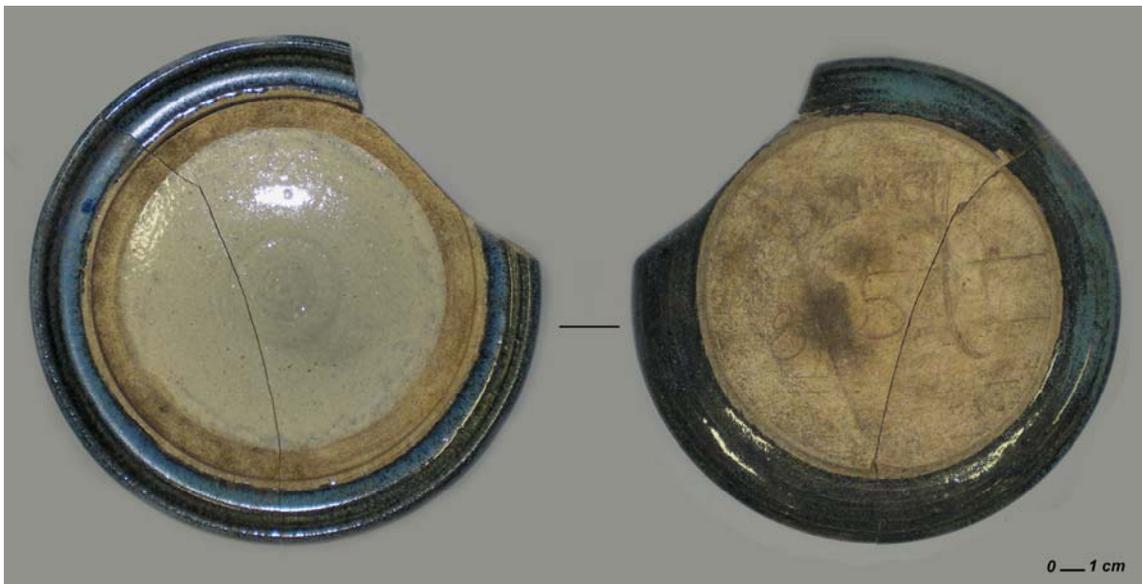


Figure 5.57: Modern plate from 'auwai H-5 (front and back).

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‘ele, 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.

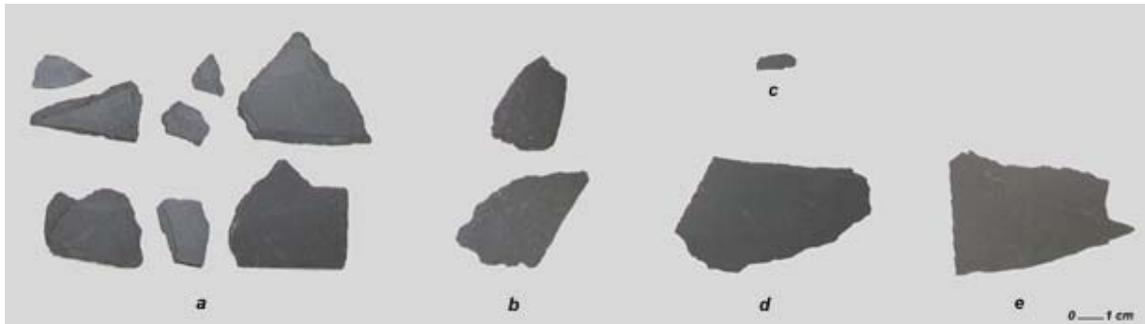


Figure 5.69: Slate fragments: *a* from historic house platform M-17, TU 7 surface; *b* from feature M-17 surface, elsewhere on the platform; *c* from TU 7 Layer I level 2; *d* from TU 7 Layer I level 1 or level 2; *e* from the surface of historic house platform E-93.

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.

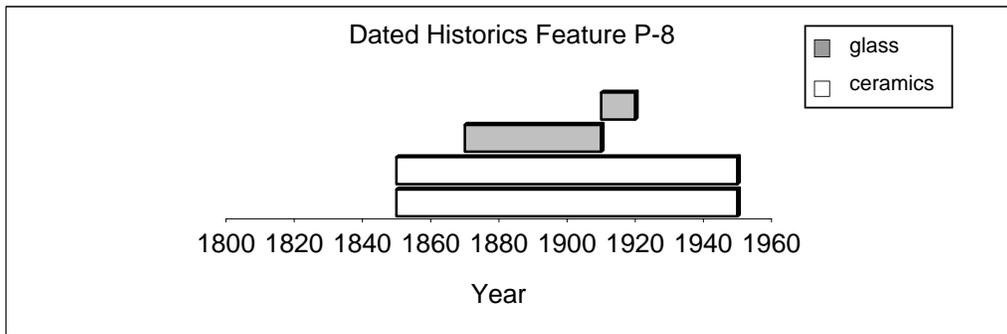


Figure 5.71: Date ranges of diagnostic historic artifacts from house complex P-8.

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.

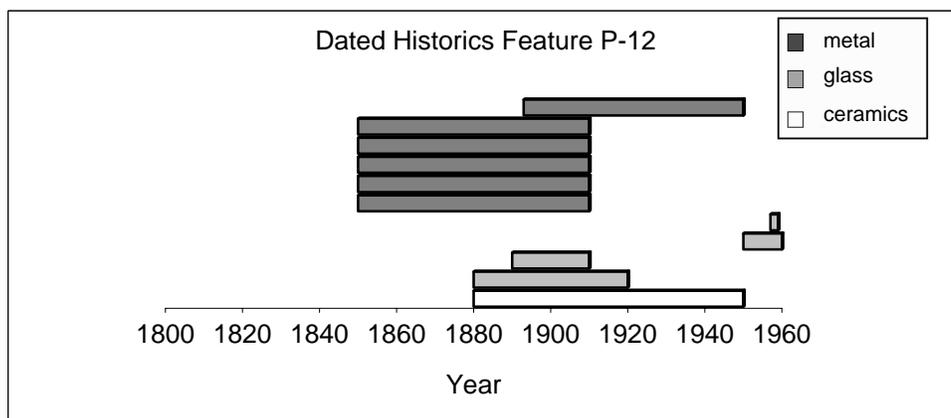


Figure 5.72: Date ranges of diagnostic historic artifacts from house complex P-12.

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

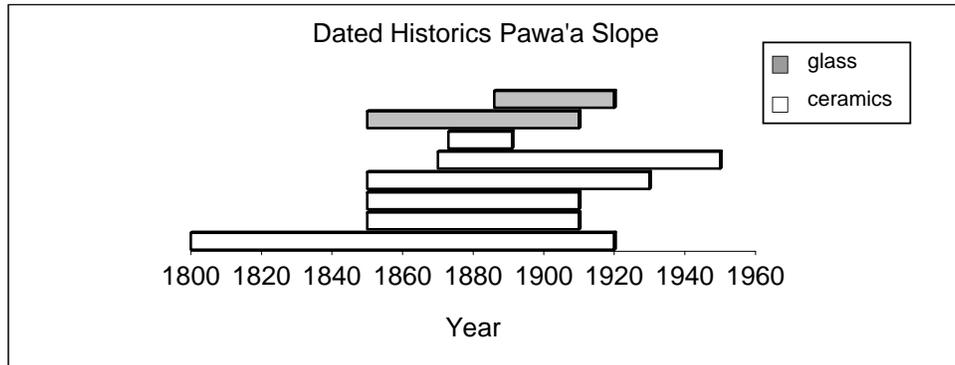


Figure 5.73: Date ranges of diagnostic historic artifacts from the Pawa‘a slope.

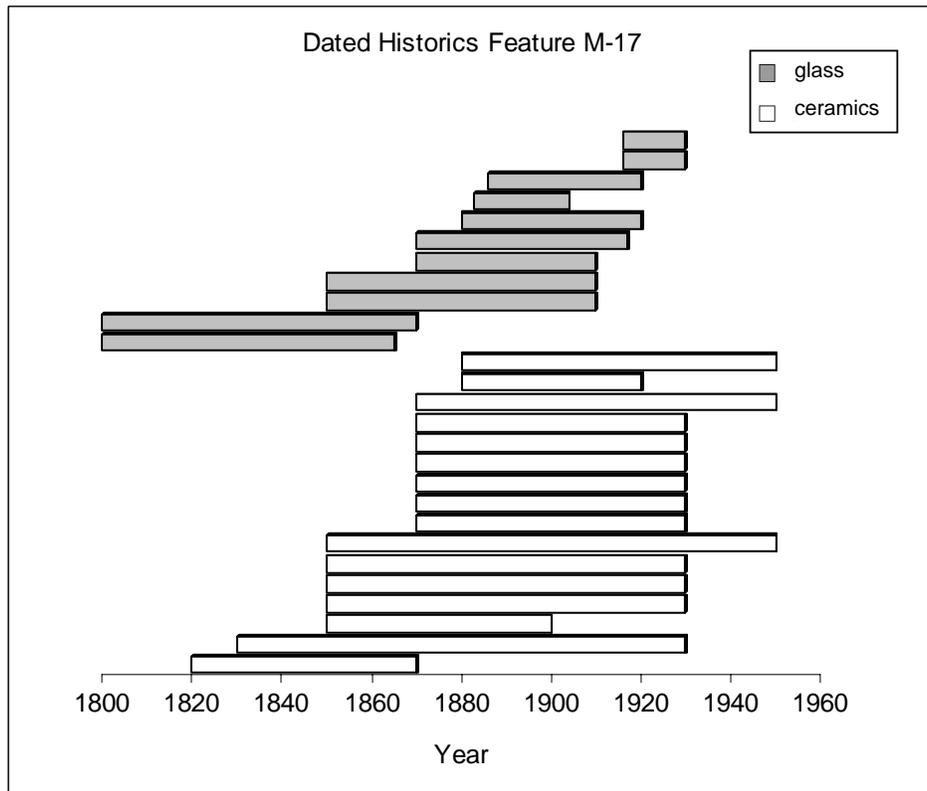


Figure 5.74: Date ranges of diagnostic historic artifacts from house platform M-17.

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.

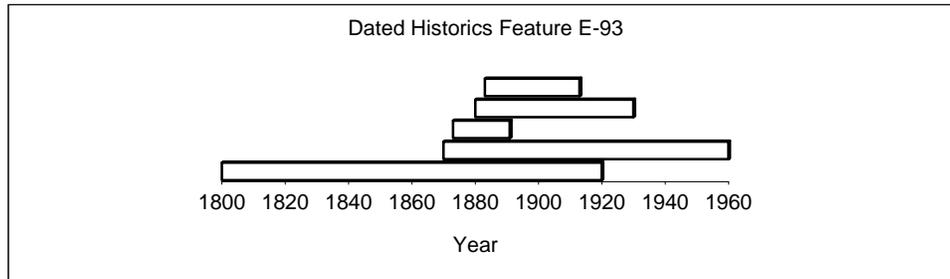


Figure 5.75: Date ranges of diagnostic ceramics from historic house platform E-93.

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.

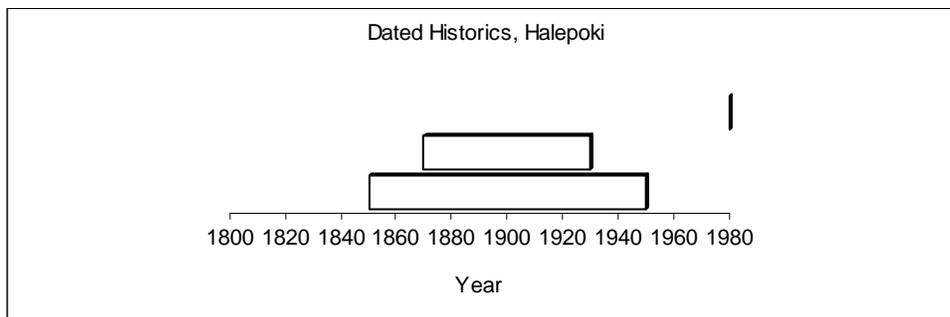


Figure 5.76: Date ranges of diagnostic ceramics from Halepoki Makai.

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

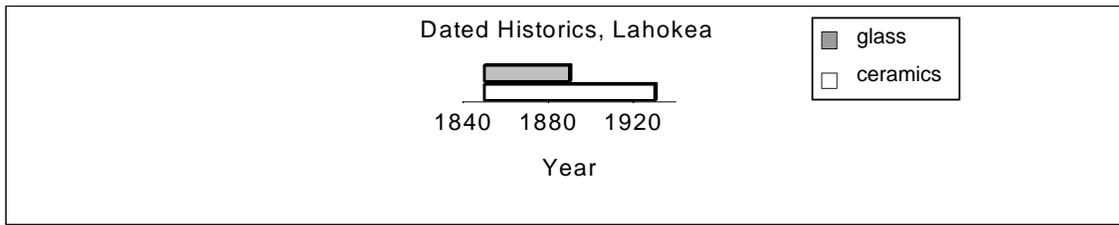


Figure 5.77: Date ranges of diagnostic historic artifacts from *lo'i* terraces L-1 and L-2.

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'ele, 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 | |
| Ku'ele - Coastal | TR 14 | tr. | |
| | TU 25 | 11.7 | |
| | TU 26 | 118.5 | |
| | TU 27 | 83.3 | |
| Central | TR 16 | 0.1 | |
| | TR 37 | 0.2 | |
| | TR 38 | 14.6 | |
| | Ku'ele - Coastal | TU 21 | 0 |
| | West | 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 | |
| Kukuinui | TR 17 | 0.1 | |
| | TR 18 | 1.5 | |
| | TR 19 | 0.1 | |
| | TR 20 | tr. | |

Table 5.4 Excavated Charcoal Weight (continued)

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.

| 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. |
| | TR 28 | 0.3 |
| Halepoki | 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 |
| Lahoeka | TU 16 | 30 |
| | TU 18 | 37.3 |
| | TU 17 | 0.8 |
| Palalooa | TU 28 | 37.9. |
| | TR 36 | tr. |

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

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 Palalooa (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 Palalooa 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 Palalooa. *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 Palalooa. 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 <i>ahupua'a</i> 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 <i>ahupua'a</i> 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.) | | | | | cf. <i>Antidesma pulvinatum</i> | <i>Hame</i> | Native/Tree | Wood | |
| | | | | | | cf. <i>Artocarpus altilis</i> | <i>'Ulu</i> | Polynesian Introduction/Tree | Wood | |
| | C-9 | TR 16 | 284 | Directly under wall | 43 cmbs | cf. <i>Psychotria</i> sp. cf. <i>Psychotria</i> sp. | <i>Kōpiko</i> <i>Kōpiko</i> | Native/Shrub-Tree Native/Shrub-Tree | Wood 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, coconut</i> | 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> | <i>‘Ōhi‘a lehua</i> | Native/Tree | Wood | |
| | | | | | | cf. <i>Psychotria</i> sp. | <i>Kōpiko</i> | Native/Shrub-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>Rauvolfia sandwicensis</i> | <i>Hao</i> | Native/Tree | Wood | |
| | | | | | cf. <i>Aleurites moluccana</i> | <i>Kukui</i> | Polynesian Introduction/Tree | Wood | | |
| Makea Lowland | M-2 | TU 6 | 47 | Below wall | I/6 | cf. <i>Metrosideros polymorpha</i> | <i>‘Ōhi‘a lehua</i> | Native/Tree | Wood | |
| | | | | | | Unknown 1 | | | Wood | |
| | | TU 8 | 59 | Below wall | I/7 | cf. <i>Cheirodendron trigynum</i> | <i>‘Ōlapa</i> | 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 | |
| | | | TR 8 | 178 | Below wall | I | cf. <i>Psychotria</i> sp. cf. <i>Pouteria sandwicensis</i> | <i>Kōpiko</i> <i>‘Āla‘a</i> | Native/Shrub-Tree Native/Shrub-Tree | Wood Wood |
| M-10 | TU 11 | 107 | Below wall | I/7 | Not identified cf. <i>Rhizophora mangle</i> | American or red mangrove | Historic Introduction/ Shrub-Tree | Bark 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. cf. <i>Cheirodendron trigynum</i> cf. <i>Aleurites moluccana</i> | <i>Kōpiko</i> <i>‘Ōlapa</i> <i>Kukui</i> | Native/Shrub-Tree Native/Tree Polynesian Introduction/Tree | Wood Wood Wood | |
| | | | 101 | Below wall | II/2 | 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>Metrosideros polymorpha</i> | <i>Kolomona</i> <i>‘Ōhi‘a lehua</i> | Native+Historic Introduction/Tree Native/Tree | Wood 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> cf. <i>Cheirodendron trigynum</i> | <i>‘Ōhi‘a lehua</i> <i>‘Ōlapa</i> | Native/Tree Native/Tree | Wood Wood | |
| | | | | | | 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 | √ |
| | | | | | | cf. <i>Psychotria</i> sp. | <i>Kōpiko</i> | Native/Shrub-Tree | Wood | |
| | | | | | | Unknown 3 | | | Wood | |
| | E-23 | TU 19 | 153 | Directly under wall | I/4 | cf. <i>Osteomeles anthyllidifolia</i> | 'Ūlei | Native/Shrub | Wood | |
| | | | | | | cf. <i>Scaevola</i> sp. | <i>Naupaka</i> | Native/Shrub | Wood | √ |
| Halepoki Makai | H-20 | TR 28 | 312 | Directly under wall | 6 cmbs | 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> |
| | | TR 34 | 331 | Directly under wall | 15 cmbs | cf. <i>Bobea</i> sp. cf. <i>Rauwolfia sandwicensis</i> | <i>‘Ahakea</i> <i>Hao</i> | Native/Tree Native/Tree | Wood Wood | |
| Lahoeka | L-2 | TU 18 | 148 | Below wall | 1/3 | 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 | cf. <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 kuahiwī*, 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'ele Central, one from the Ku'ele West hearth, one from the Ku'ele 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 Palaloo 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 |
| Palaloo | 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).

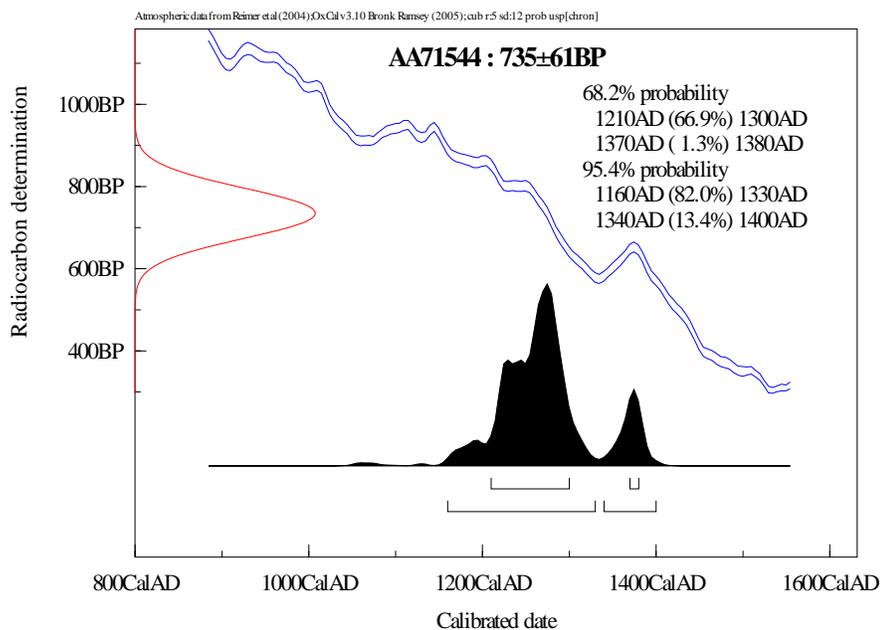


Figure 5.78: Calibrated radiocarbon age for sample AA71544.

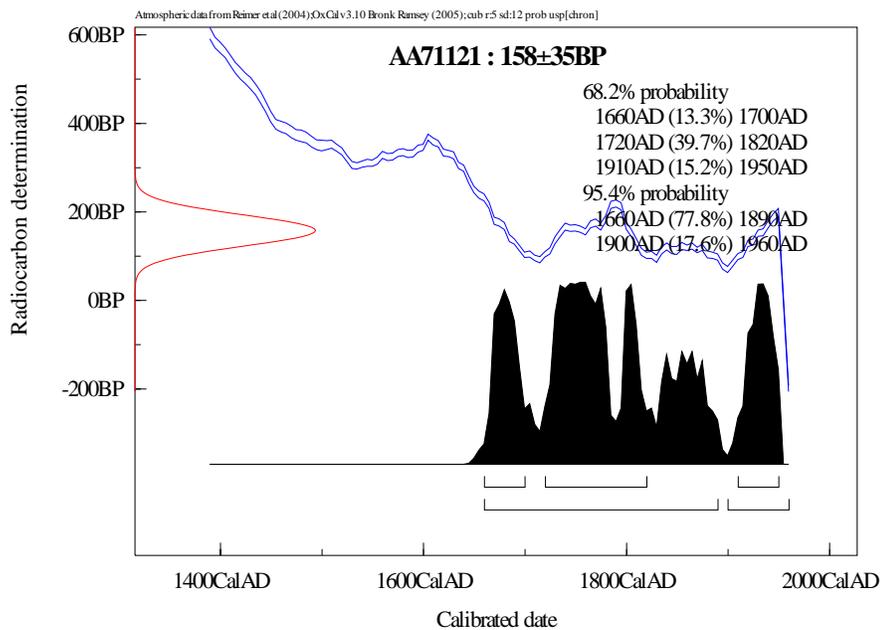


Figure 5.79: Calibrated radiocarbon age for sample AA71121.

Sample AA71549 was collected from TR 16, which was located within *lo'i* terrace C-9 in Ku'ele 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).

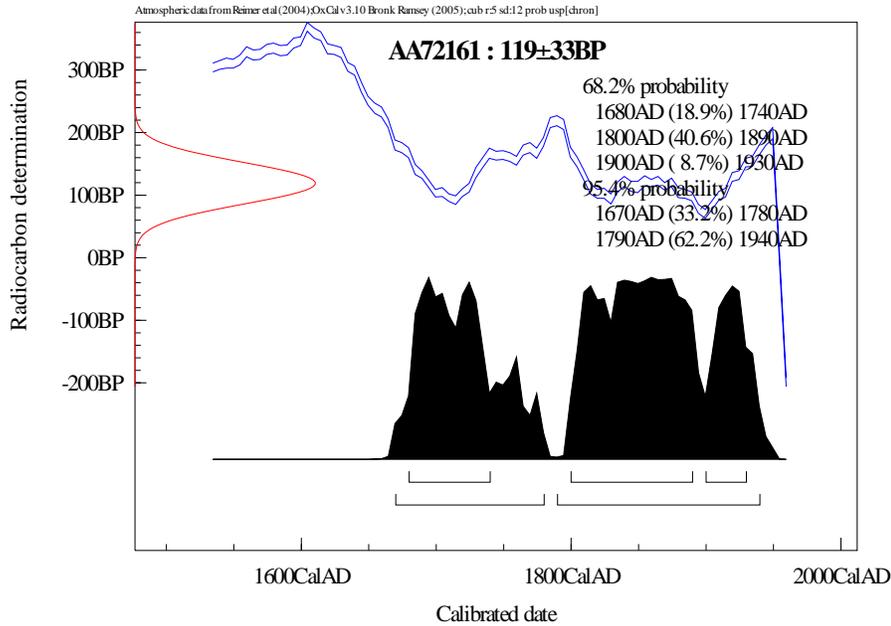


Figure 5.80: Calibrated radiocarbon age for sample AA72161.

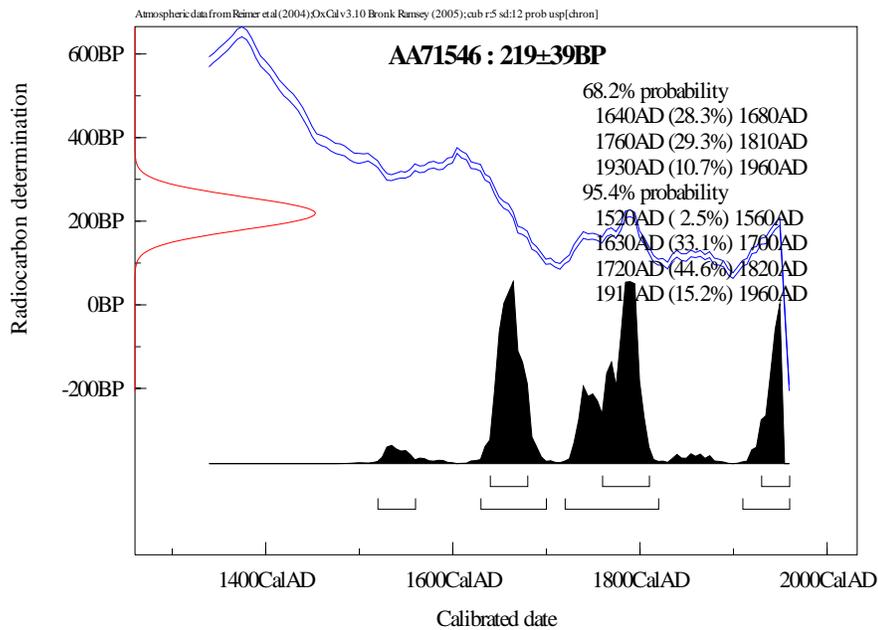


Figure 5.81: Calibrated radiocarbon age for sample AA71546.

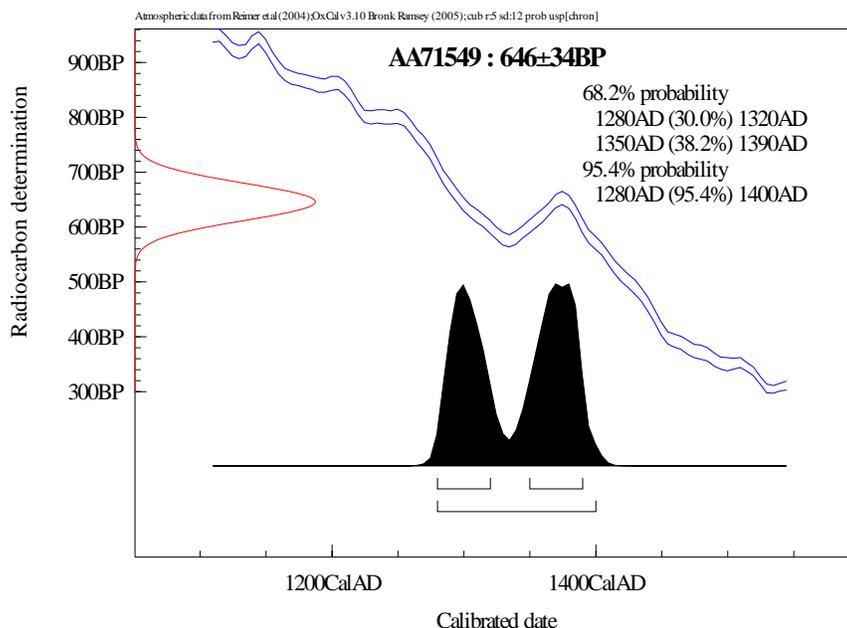


Figure 5.82: Calibrated radiocarbon age for sample AA71549.

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).

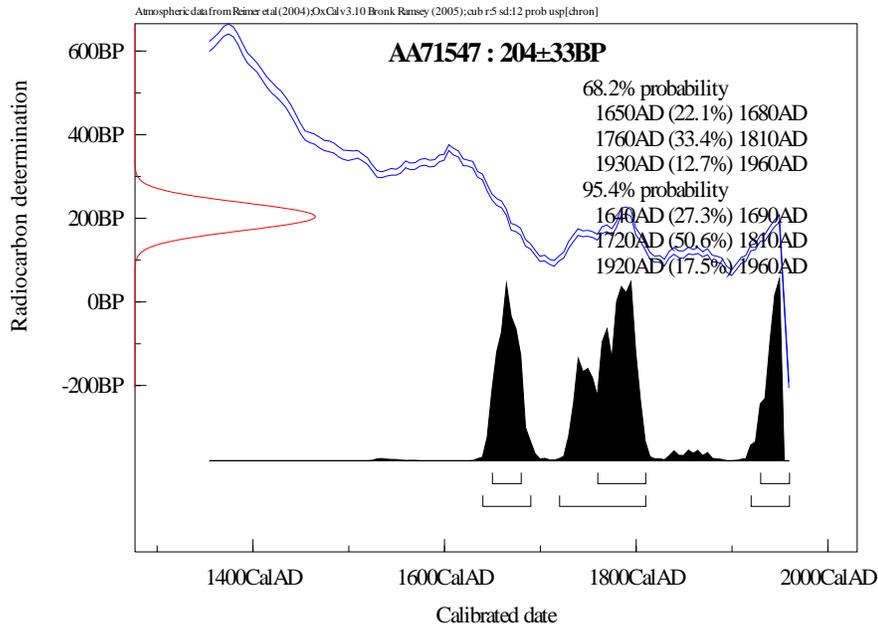


Figure 5.83: Calibrated radiocarbon age for sample AA71547.

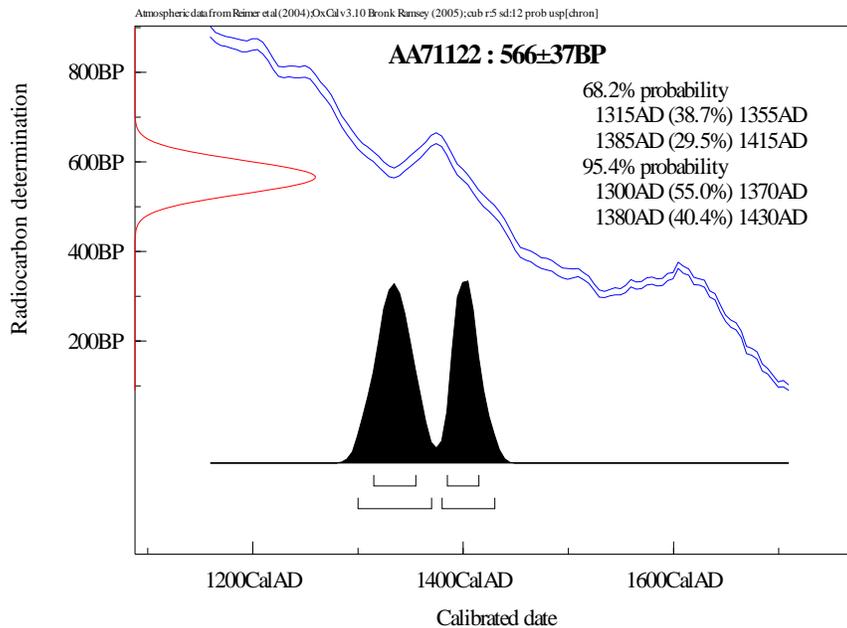


Figure 5.84: Calibrated radiocarbon age for sample AA71122.

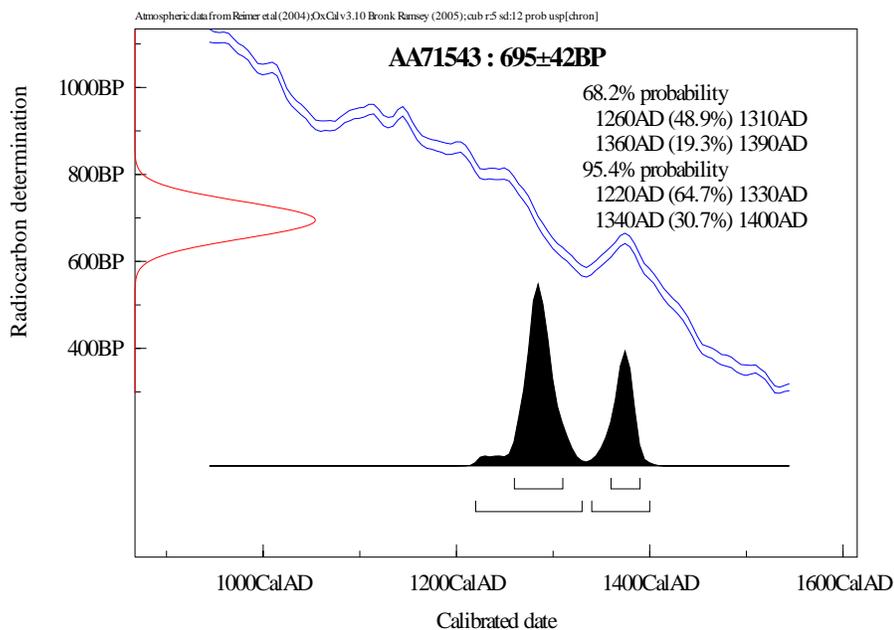


Figure 5.85: Calibrated radiocarbon age for sample AA71543.

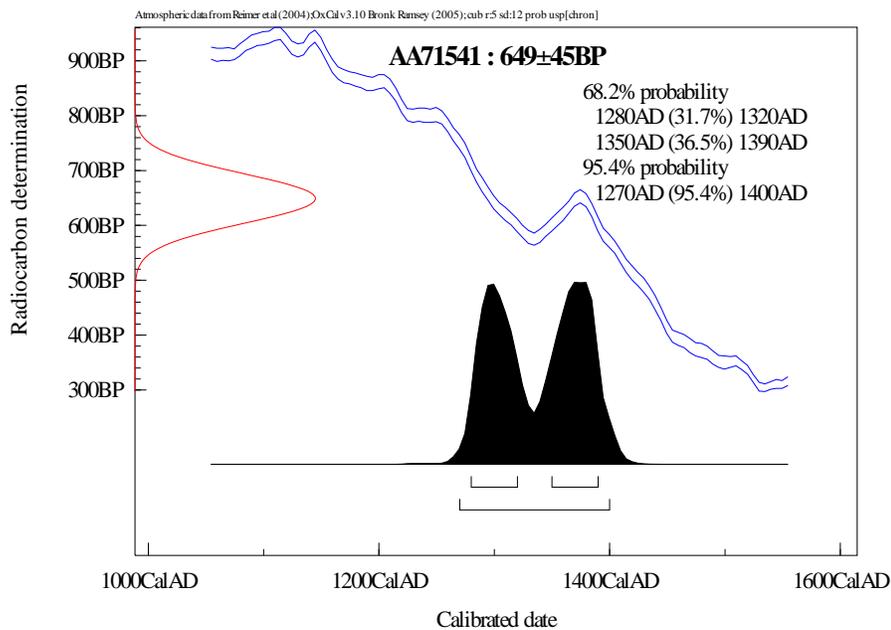


Figure 5.86: Calibrated radiocarbon age for sample AA71541.

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).

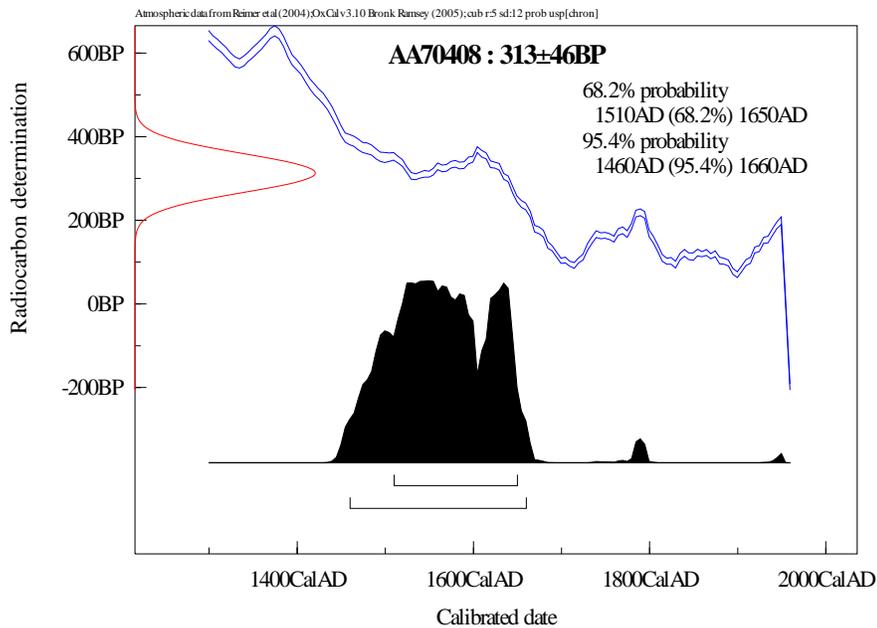


Figure 5.87: Calibrated radiocarbon age for sample AA70408.

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).

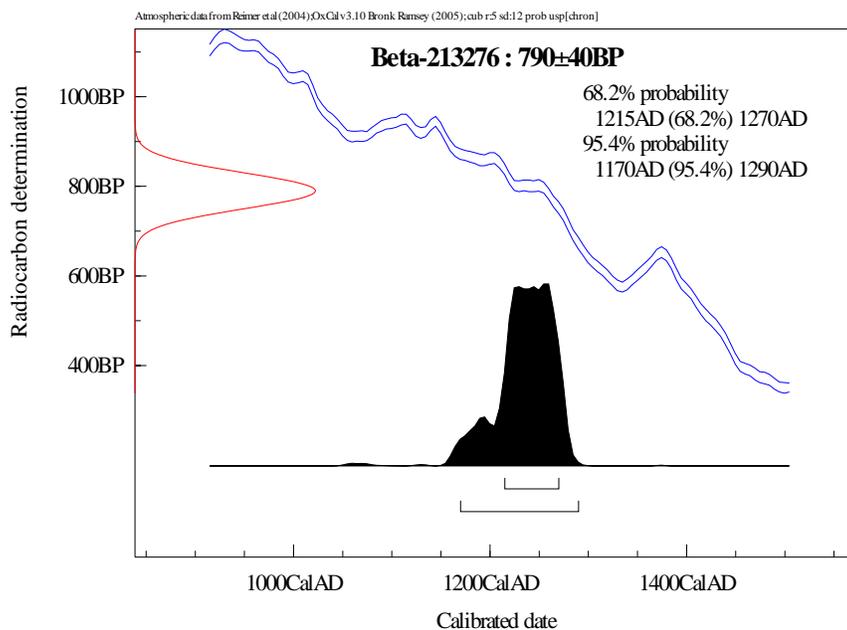


Figure 5.88: Calibrated radiocarbon age for sample Beta-213276.

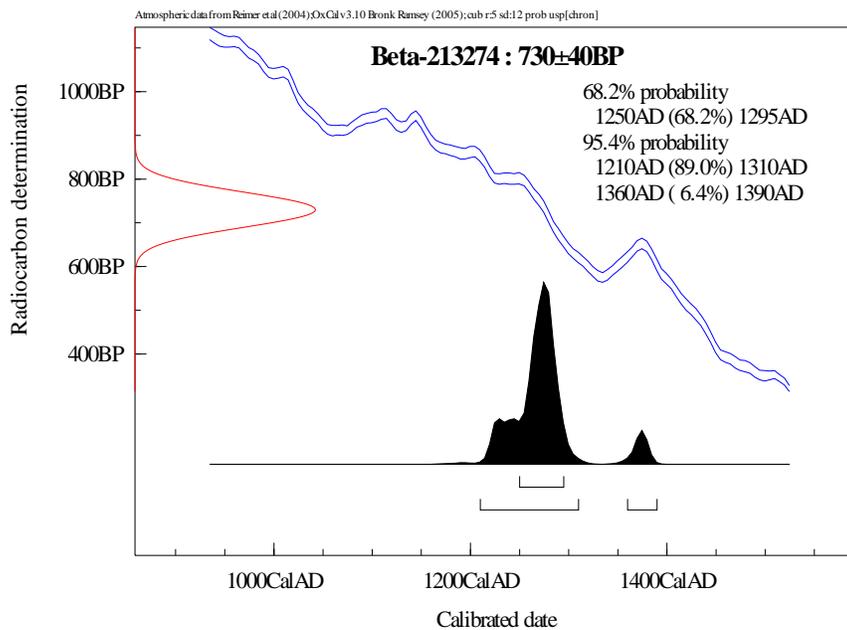


Figure 5.89: Calibrated radiocarbon age for sample Beta-213274.

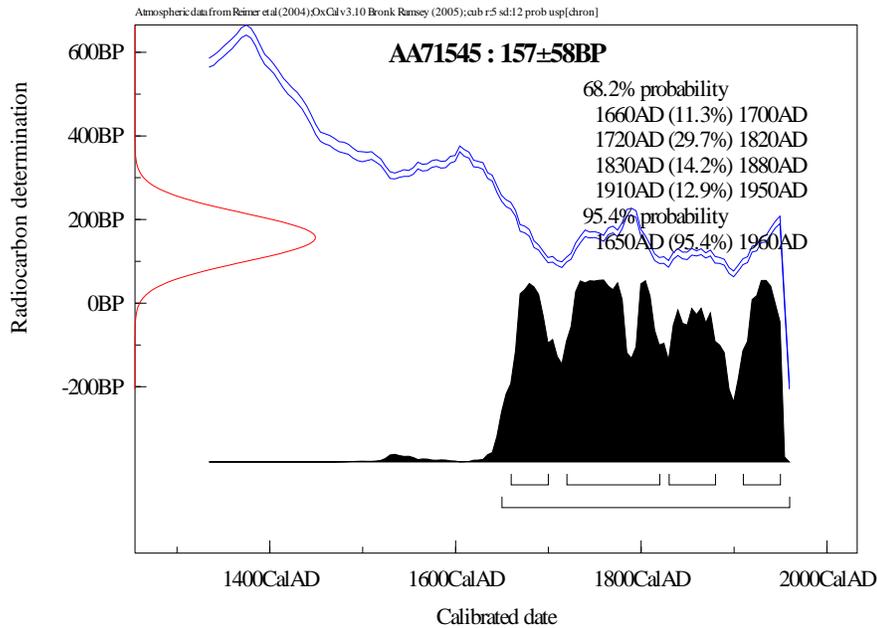


Figure 5.90: Calibrated radiocarbon age for sample AA71545.

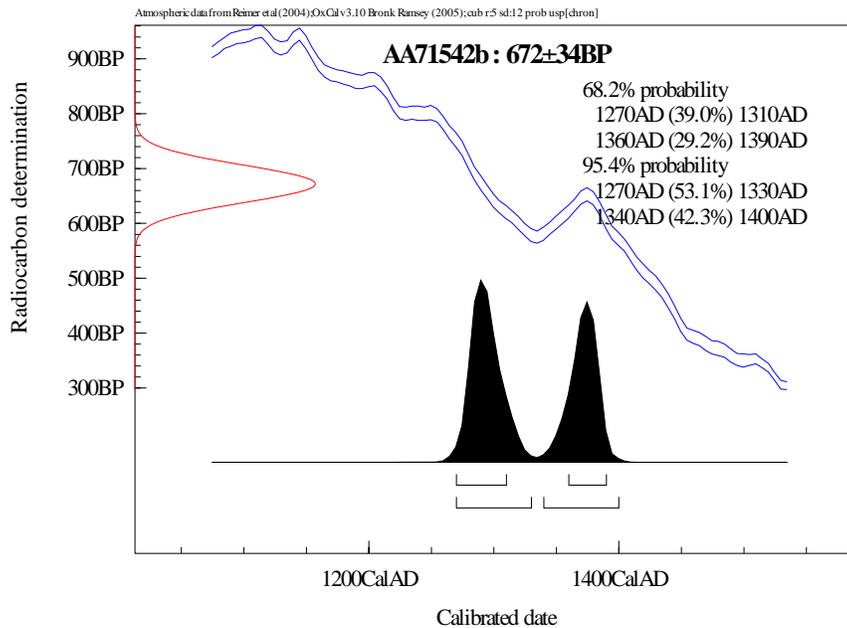


Figure 5.91: Calibrated radiocarbon age for sample AA71542b.

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).

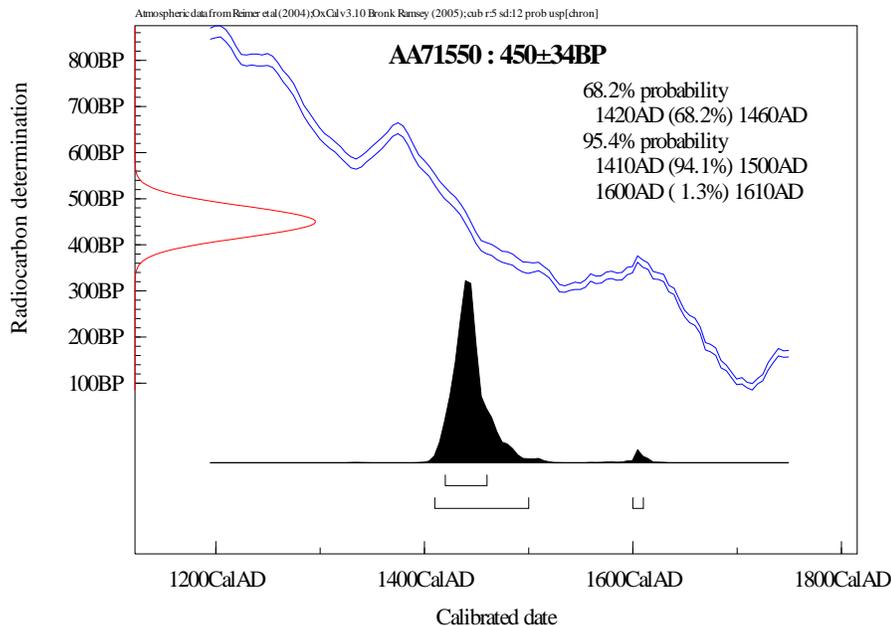


Figure 5.92: Calibrated radiocarbon age for sample AA71550.

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.

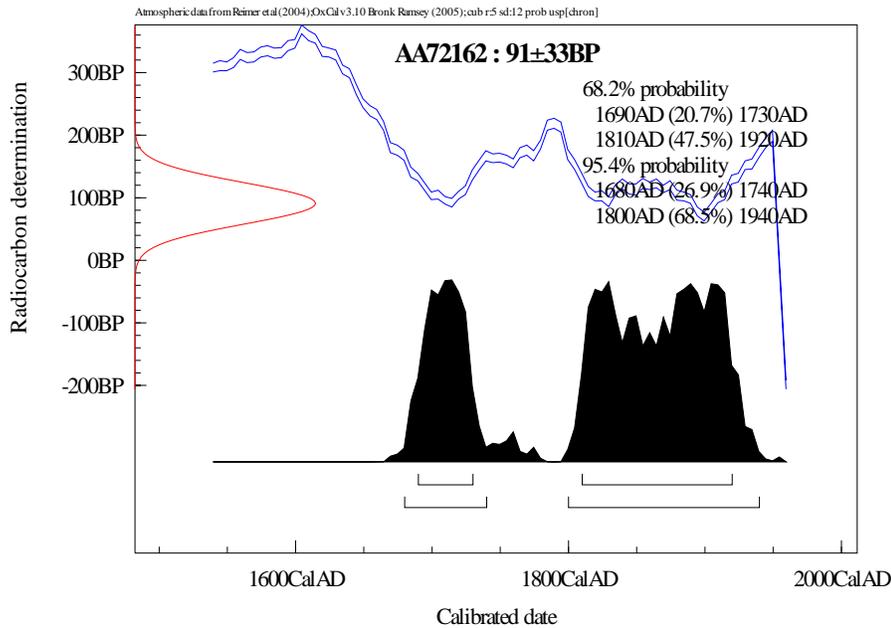


Figure 5.93: Calibrated radiocarbon age for sample AA72162.

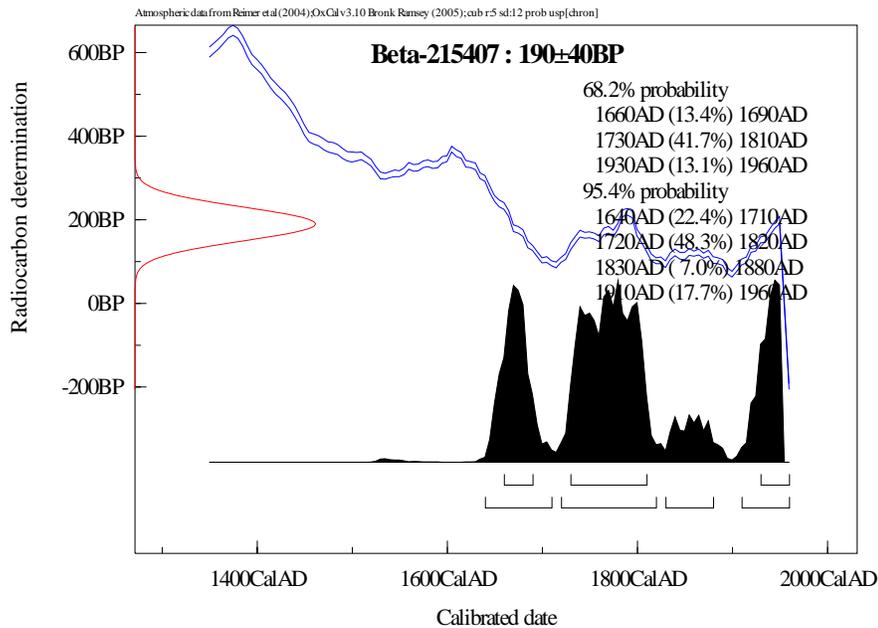


Figure 5.94: Calibrated radiocarbon age for sample Beta-215407.

Sample AA71551 came from TU 28. The unit bisected a hearth feature in Palaloo, 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).

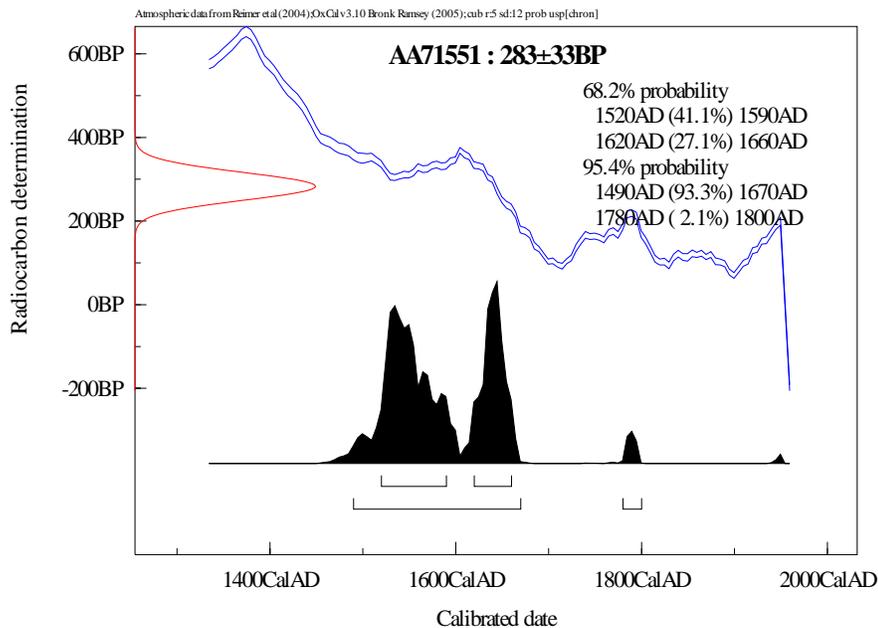


Figure 5.95: Calibrated radiocarbon age for sample AA71551.

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.

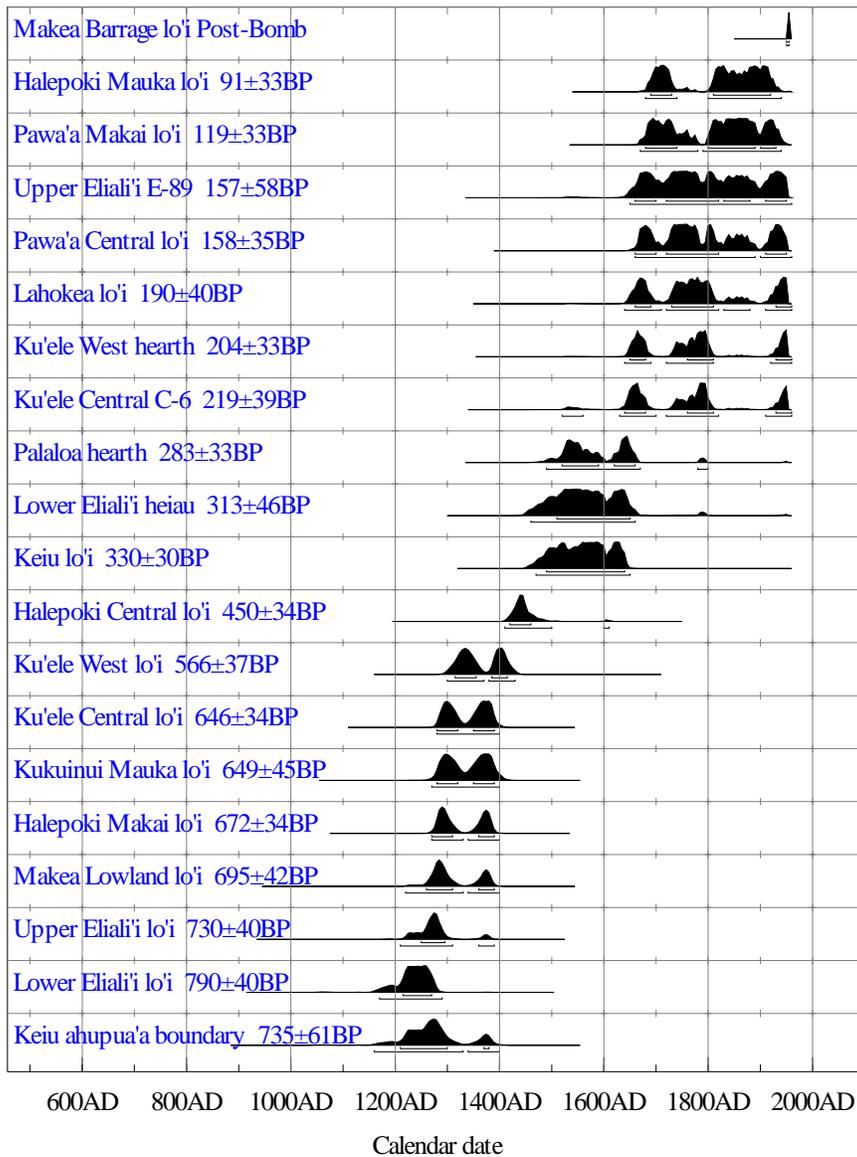


Figure 5.96: Calibrated radiocarbon dates for Wailau Valley.

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'ele West hearth returned a date of 204 BP, much later than the Ku'ele West *lo'i* complex, suggesting that the hearth is unassociated with the *lo'i*. The Palalooa hearth dated to 283 BP. No dates were obtained from the Palalooa *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'ele Central was detached from the Ku'ele 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'ele, Makea, Eliali'i, Halepoki, Lahokea, and Palalooa. 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'ele, 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'ele 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'ele 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'ele (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 Lahoeka *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'ele Central, hearth C-18 in Ku'ele 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

Lo'i Artifact Frequency

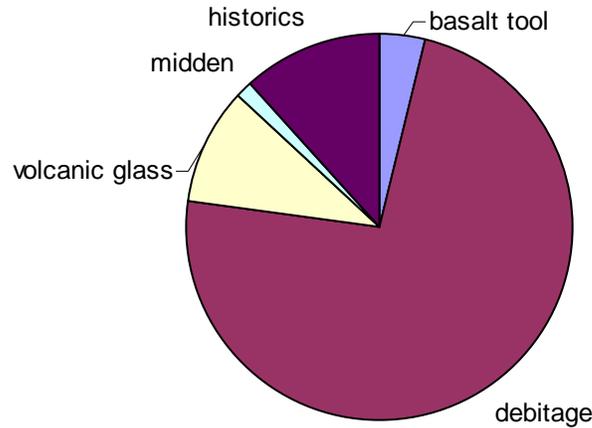


Figure 5.97: Frequency of artifacts found in agricultural terraces, by count (n=326).

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'ele Central | 7 | 179 | 16 | 0 | 1 | 2.00 |
| Ku'ele 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 |
| Lahoeka | 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'ele 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 | m² 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 |
| Palalooa 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 Palalooa, 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

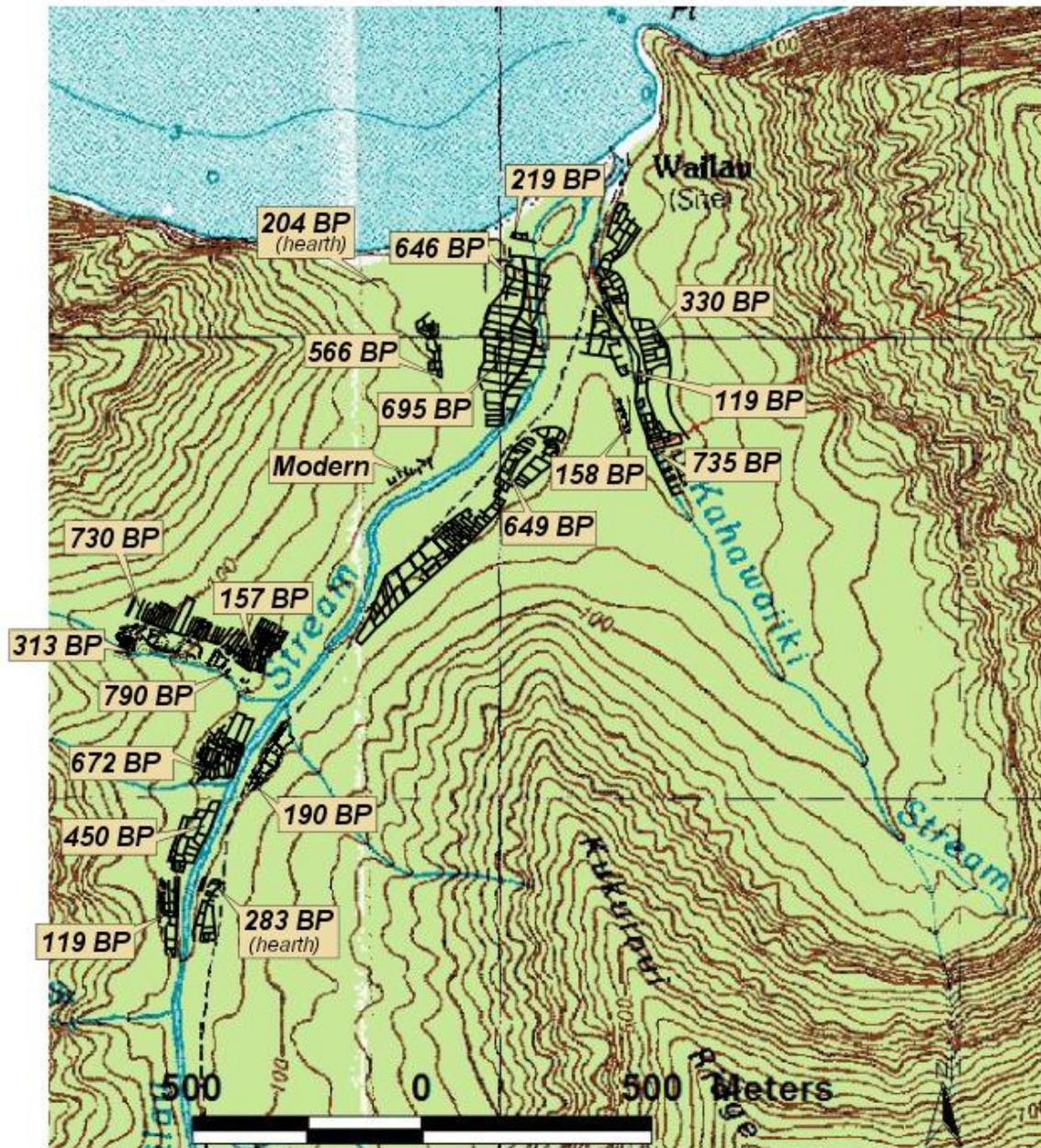


Figure 5.98: Dates for Wailau agricultural systems; only the dated *lo'i* complexes are shown.

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 'u'lei 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.



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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 tiliaceous*, 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 tiliaceous*, 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'ele 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'ele 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'eie 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 | |
| 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 | KU-1 | terrace | <i>lo'i</i> |
| Makai | 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 | E-1 | <i>heiau</i> | Heiau at Kanane, Site 273 (Stokes 1909) |
| Eliali'i | E-2 | two walls | | |

Appendix A: List of Features (continued)

| Study Area | Feature | Description | Notes | GPS Position |
|---------------------|---------|--------------------|--|------------------------|
| Lower | E-3 | wall | <i>L</i> -shaped | |
| Eliali'i (cont.) | 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'ili</i> 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 (cont.) | E-64 | terrace | <i>lo'i</i> | |
| | 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 (cont.) | E-94 | terrace | <i>lo'i</i> | |
| | 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 | L-21 | terrace | <i>lo'i</i> | |
| (cont.) | 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. part of cache; >1893 |
| | 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 | |
| | 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 | |
| P-15 | N/A | surface | 121 | hammer-stone | 1 | 364 | waterworn cobble with crushing wear on one surface | | |
| Ku'eie Central | 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'ele 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/L) ^{**} | Bag | Material | Count | Weight (g) | Description | Notes |
|------------------------|-------------|-------|---------------------------|-----|---------------------------|---------------|------------|--|-------|
| Ku'eke 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 | | |
| | Ku'eke West | 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/L)** | 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 | I | 214 | basalt flake | 1 | 15.8 | | |
| | M-31 | TU 24 | I/4 | 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 Eliali'i (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 | H-5 | N/A | surface | 325 | ceramics | 3 | 445.2 | modern | |
| Makai | 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 |
| | H-50 | N/A | surface | 326 | ceramics | 3 | 22.5 | E/A saucer sherds | undecorated |
| | H-50 | N/A | surface | 326 | ceramics | 3 | 79.0 | E/A large bowl sherds | hand-painted |
| | H-50 | N/A | surface | 326 | ceramics | 17 | 379.2 | E/A large bowl sherds | undecorated |
| | 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 | hihiwai 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 |
|------------|---------|-------|---------------|-----|----------------|-------|------------|-------------|-------|
| Palaloa | 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.

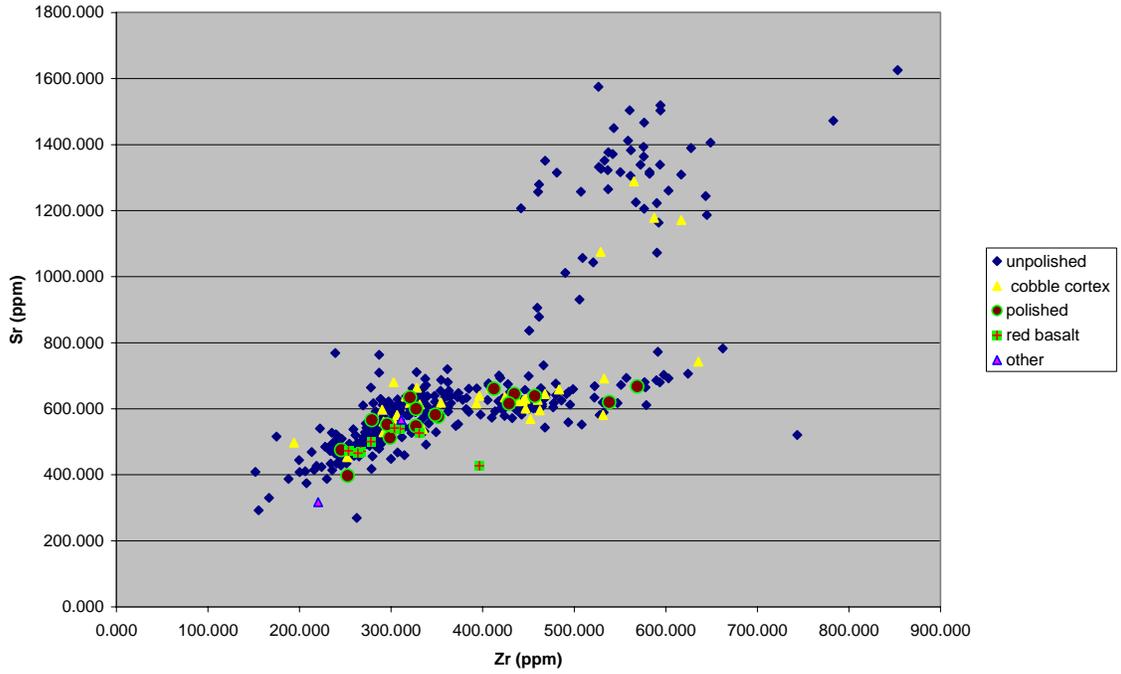
Sample 335-2, from terrace C-9 in Ku'ele exhibited a fresh break, and this was useful for determining potential error due to surface weathering. Elemental abundances were almost the same for the weathered and unweathered surfaces, suggesting that weathering was not a source of error in this assemblage.

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'ele, was somewhat low in Sr and Rb.

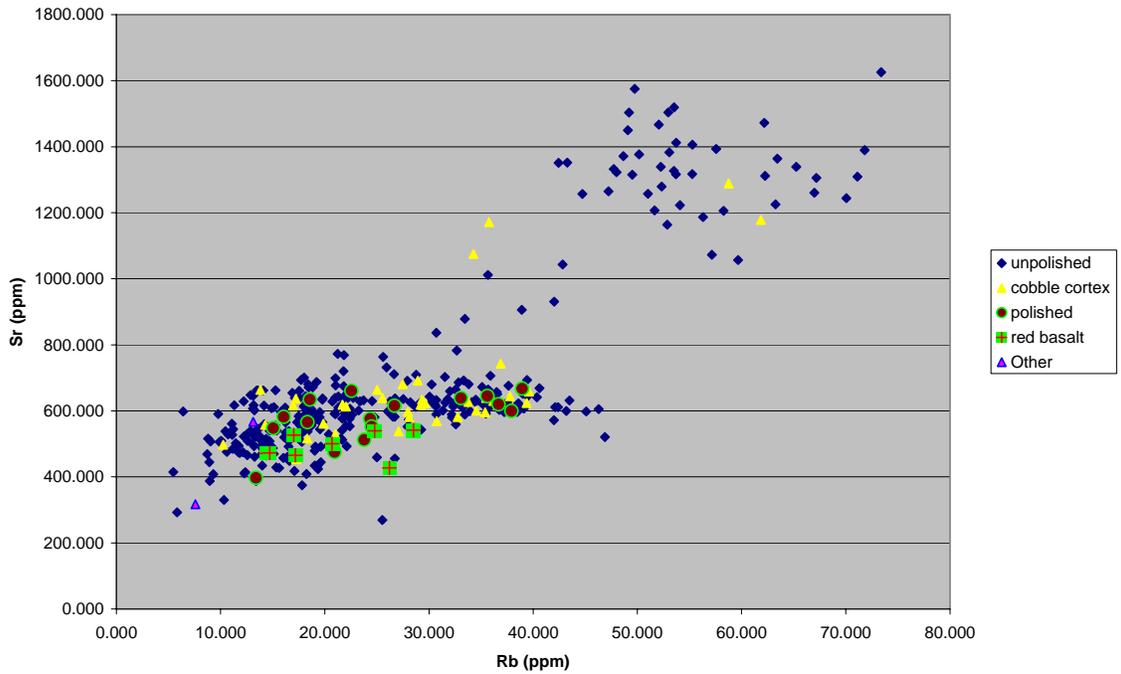
Outliers on the high and low ends of the plots are most likely imported materials. These were all unpolished basalt flakes and most were from Ku'ele, although these two categories dominated the assemblage, with 320 of the 383 samples (83.6%) consisting of unpolished flakes, and 320 of the 383 samples (83.6%) collected from Ku'ele. The most obvious outlier was sample 283-3, from terrace C-9 in Ku'ele. 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'ele, 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.

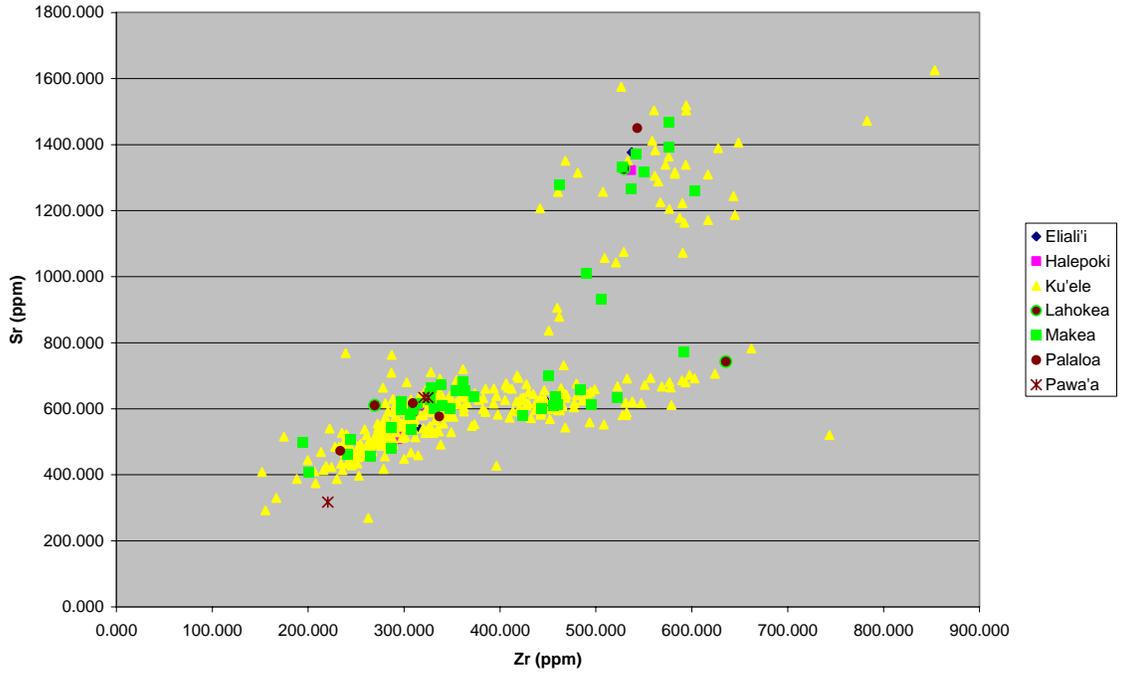
Zr to Sr, by Macroscopic Characteristics



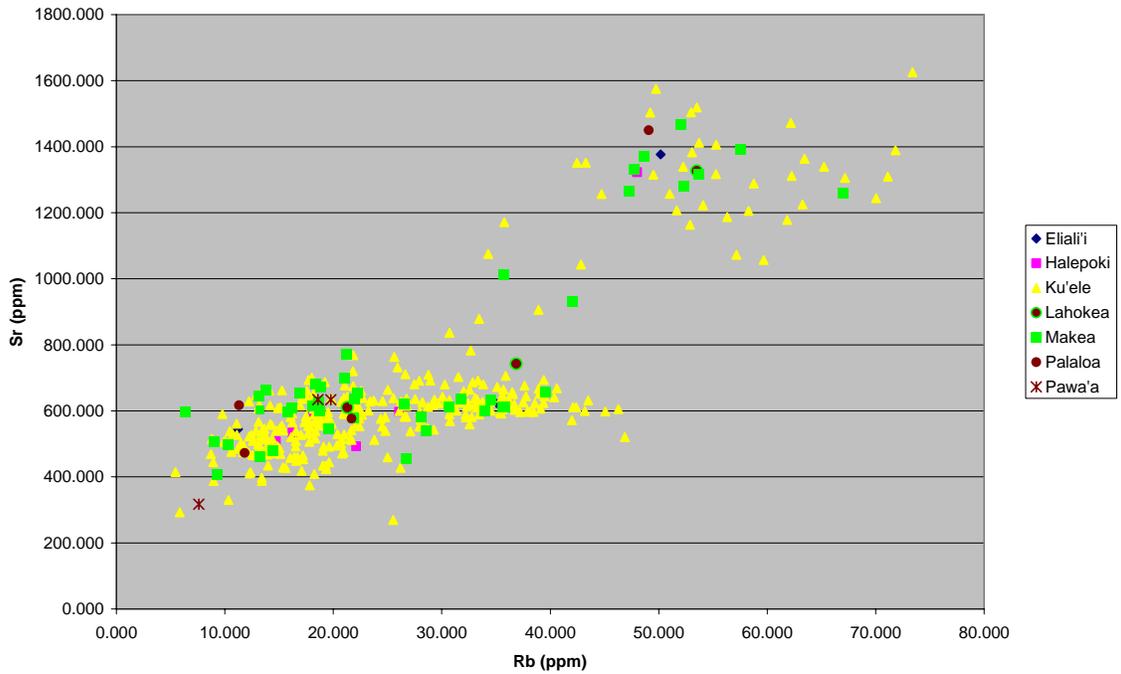
Rb to Sr, by Macroscopic Characteristics



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 |

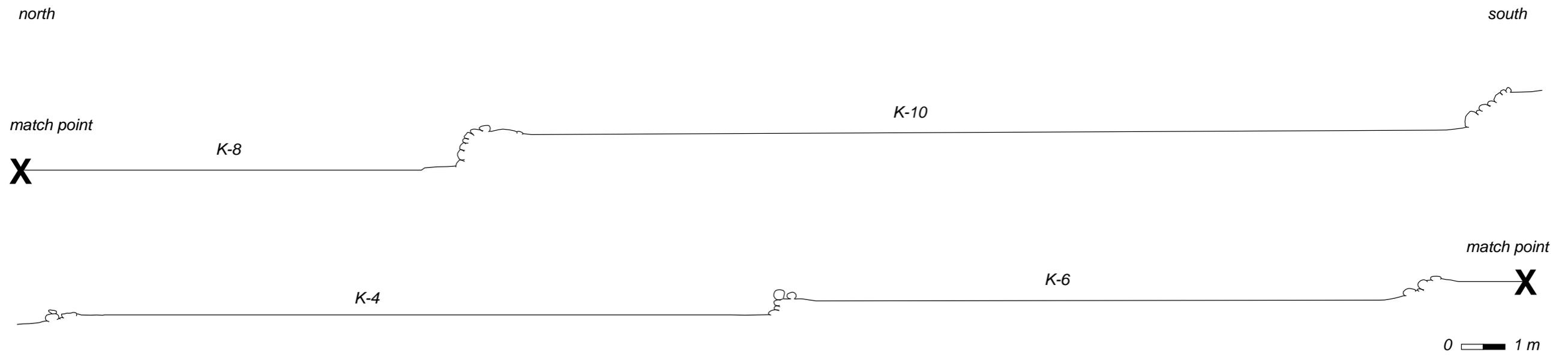
Geochemical Analysis: Raw Data (continued)

| 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 |

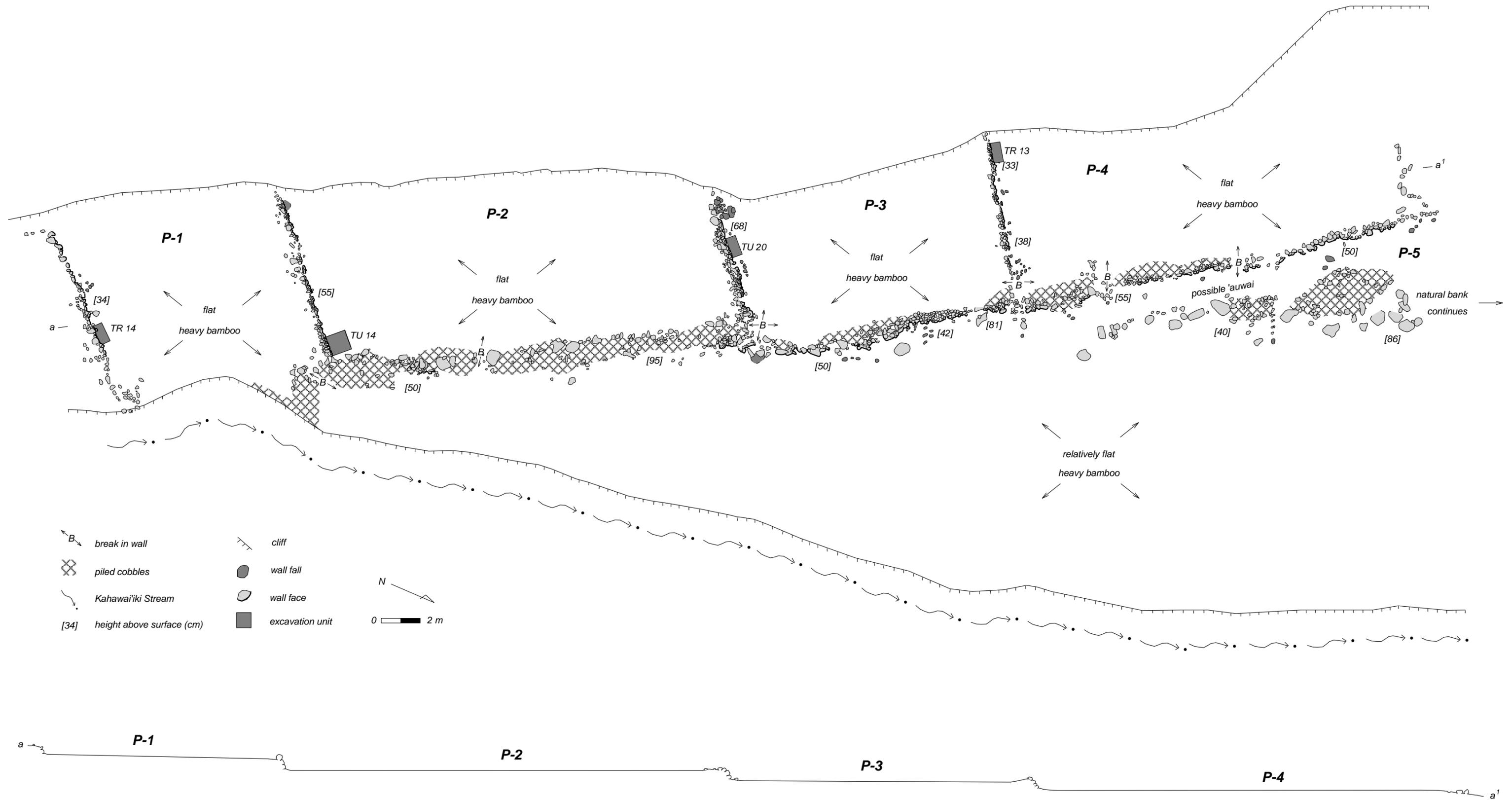
Geochemical Analysis: Raw Data (continued)

| 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 |

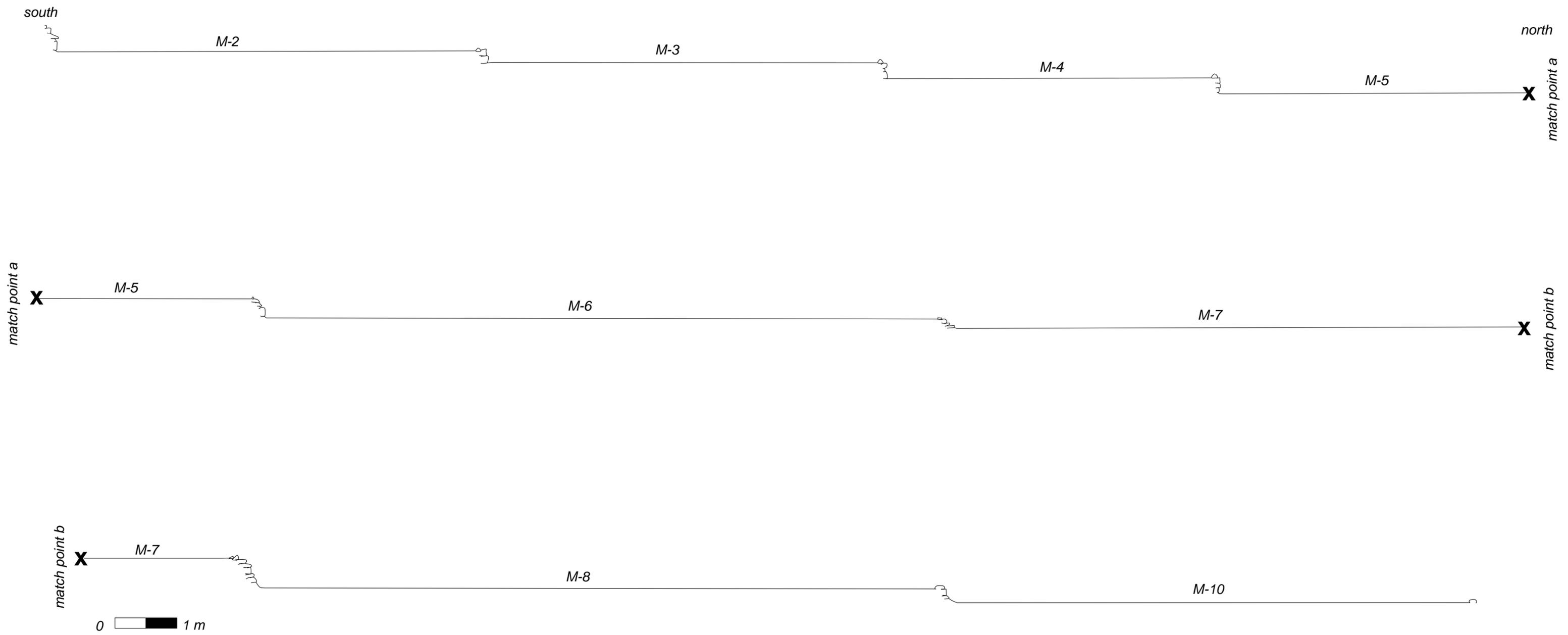
APPENDIX D: OVERSIZE FIGURES



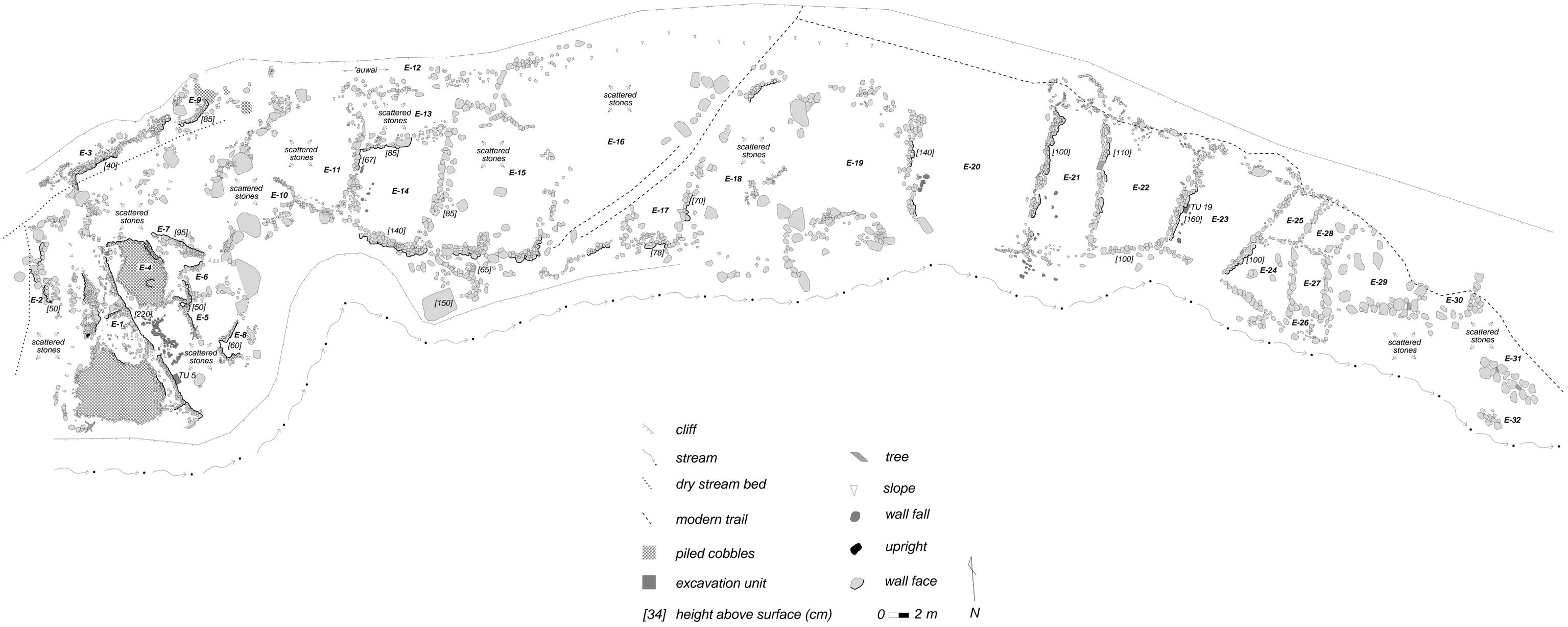
Oversize Figure 1: Cross-section of the Keiu lo'i complex.



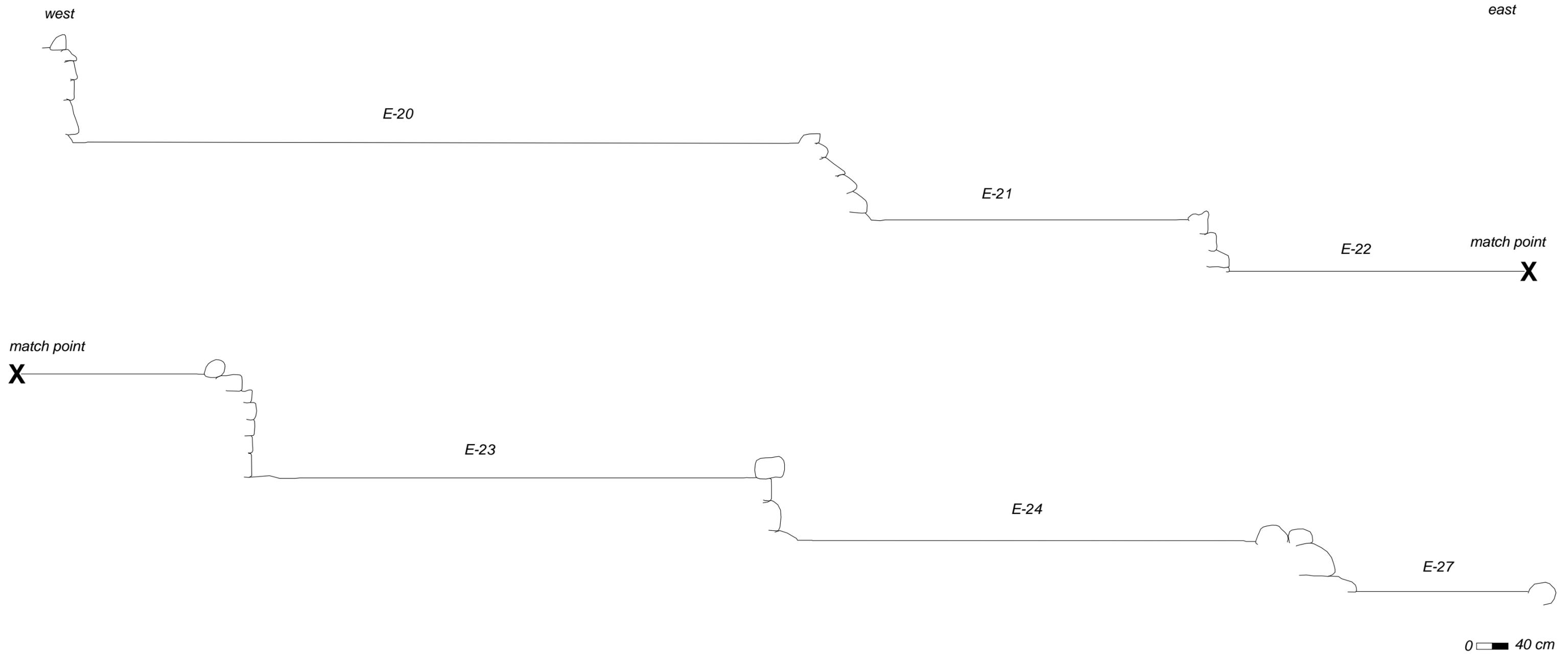
Oversize Figure 2: Pawa'a lo'i complex, plan view and cross-section.



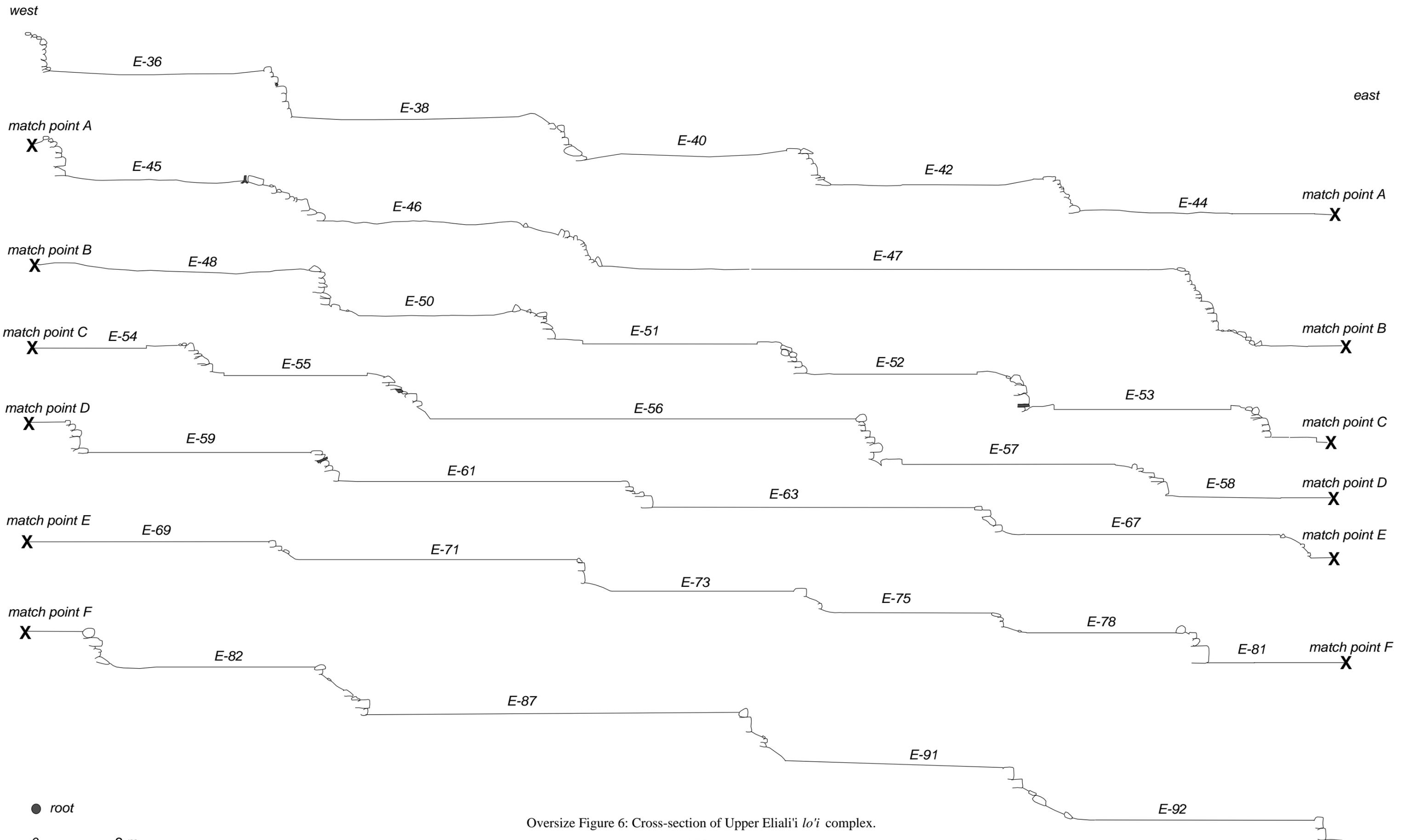
Oversize Figure 3: Cross-section of the Makea and Ku'ele lo'i complex.



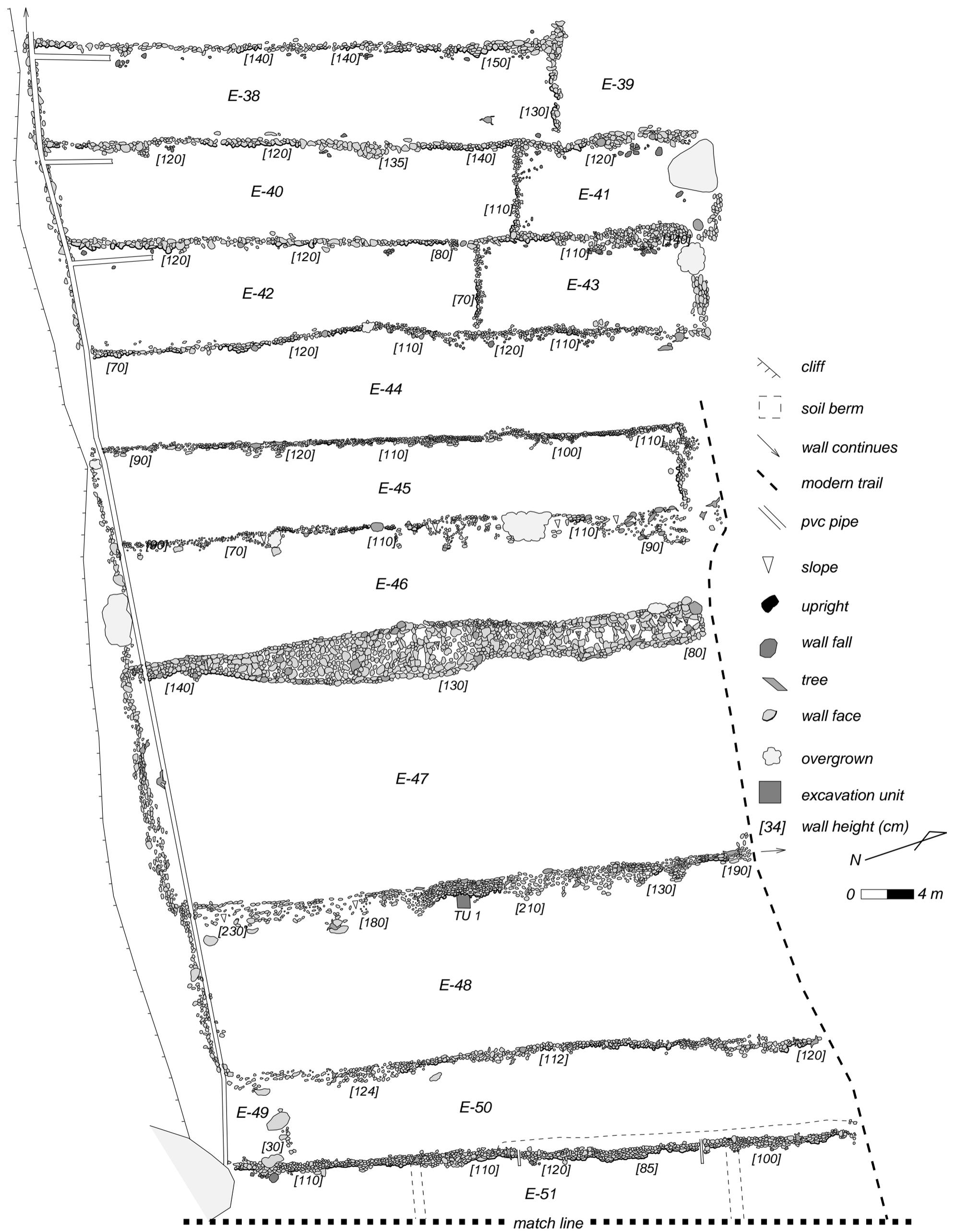
Oversize Figure 4: Lower Eliali'i lo'i complex, plan view.



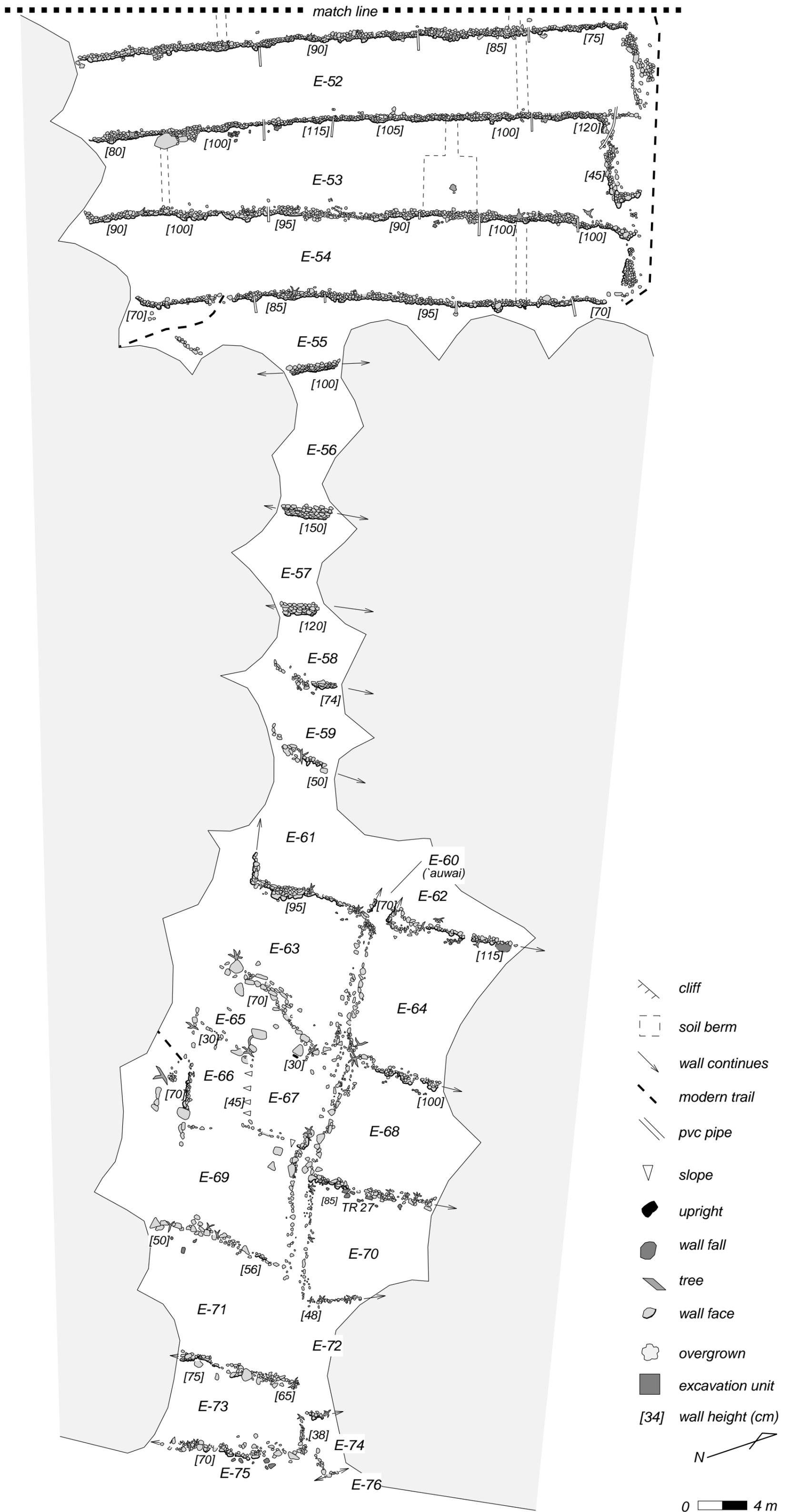
Oversize Figure 5: Cross-section of the Lower Eliali'i lo'i complex.



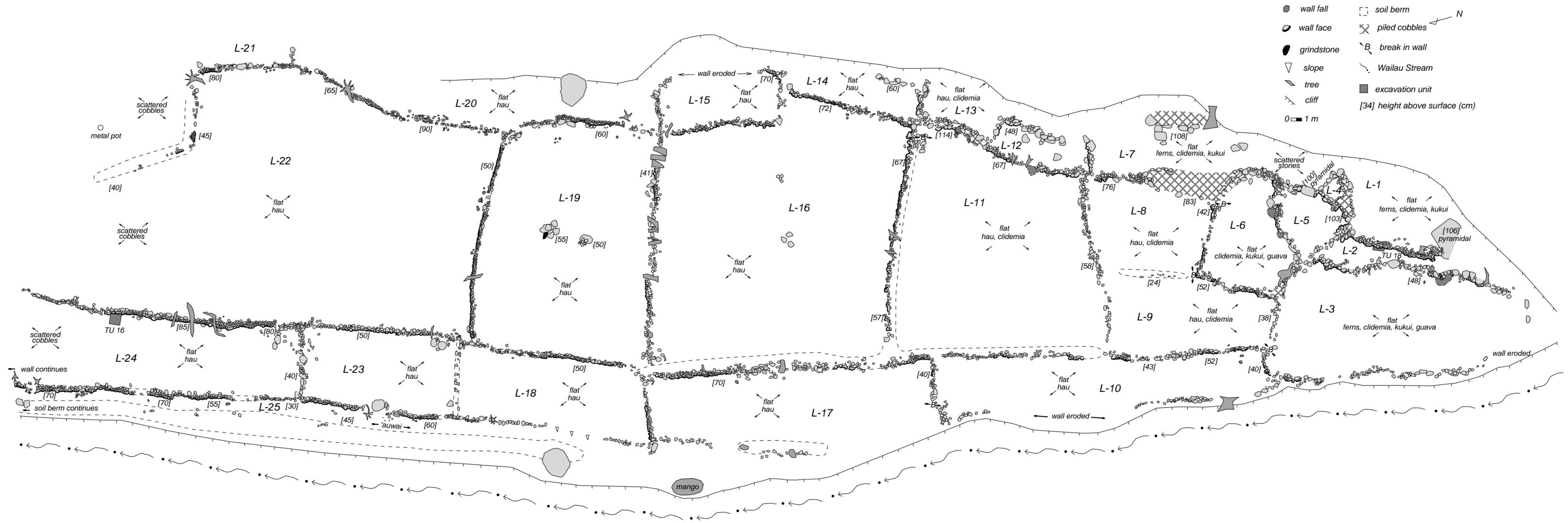
Oversize Figure 6: Cross-section of Upper Eliali'i lo'i complex.



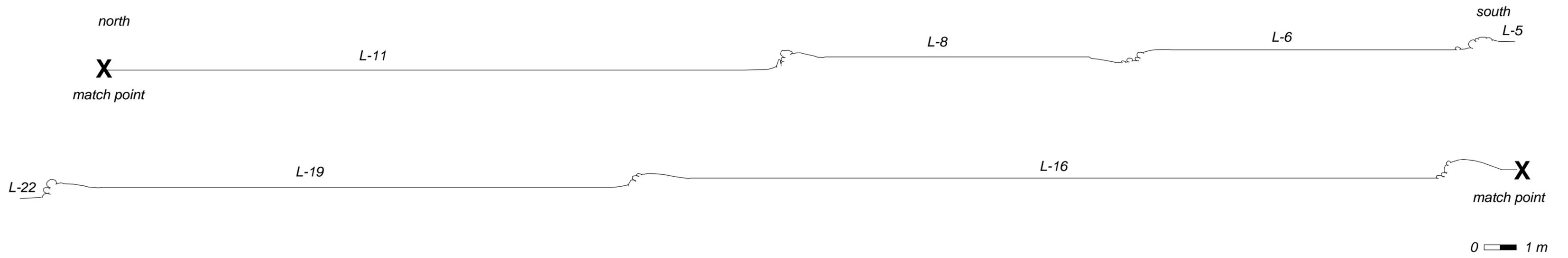
Oversize Figure 7: Upper Eliali'i lo'i complex, plan view.



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.