

TABLE DR-1 REFRACtORY ELEMENT CONCENTRATIONS IN CHRONOSEQUENCE SOIL PROFILES

	Nb (ppm)	Ta (ppm)	Zr (ppm)	Hf (ppm)	Th (ppm)	Al ₂ O ₃ (wt%)	Zr/Nb	Hf/Nb	Th/Nb	Al/Nb	Nb/Ta	ρ * (g/cm ³)	LOI † (wt%)
<u>Laupahoehoe (20 ka)</u>													
0-5 cm	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.						0.3	76
5-12	352	22.5	747	16.2	6.9	6.7	2.1	0.05	0.02	100	15.7	0.3	43
12-28	93.8	6.0	949	22.8	9.2	29.2	10.1	0.24	0.10	1650	16	0.3	41
28-38	109	6.7	989	24.1	8.5	33.9	9.1	0.22	0.08	1650	16	0.3	47
38-54	81.0	5.0	851	22.4	8.5	39.4	10.5	0.28	0.11	2570	16	0.5	46
54-80	92.7	6.4	795	19.5	8.3	31.4	8.6	0.21	0.09	1790	14	0.5	39
80-100	77.2	4.9	543	13.8	7.6	29.5	7.0	0.18	0.10	2020	16	0.6	35
<u>Kohala (150 ka)</u>													
0-5 cm	315	20.4	642	15.1	14.8	15.3	2.0	0.05	0.05	257	15.4	0.3	79
5-15	316	19.4	790	17.4	20.0	17.7	2.5	0.06	0.06	296	16.3	0.5	36
15-24	356	21.4	794	17.4	20.8	15.0	2.2	0.05	0.06	222	16.7	0.6	14
24-30	388	24.7	904	19.5	22.6	16.3	2.3	0.05	0.06	222	15.7	0.6	16
30-42	368	22.7	1460	33.4	32.2	21.9	4.0	0.09	0.09	316	16.2	0.6	24
42-60	133	7.9	2050	50.8	21.2	44.2	15.5	0.38	0.16	1760	17	0.7	41
<u>Molokai (1400 ka)</u>													
0-5 cm	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.						0.3	77
5-11	649	36.7	2090	42.3	24.6	9.2	3.2	0.07	0.04	75	17.7	0.4	20
11-32	535	36.8	1980	40.0	24.3	13.3	3.7	0.07	0.05	132	14.5	0.6	11
32-45	181	10.9	1270	29.0	15.3	17.7	7.0	0.16	0.08	516	16.6	0.6	19
45-70	171	11.2	1180	26.6	14.0	34.2	6.9	0.16	0.08	1060	15.2	0.7	20
70-115	81.5	5.0	922	23.2	9.8	43.7	11.3	0.28	0.12	2840	16	1.0	24
115-120	36.9	2.3	727	19.8	6.6	49.7	19.7	0.54	0.18	7120	16	1.2	28
<u>Kauai (4100 ka)</u>													
0-11 cm	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.						0.5	89
11-29	236	13.2	814	18.8	11.2	4.3	3.5	0.08	0.05	96	17.9	0.9	15
29-37	384	22.3	1810	40.4	27.3	15.3	4.7	0.11	0.07	211	17.2	0.9	20
37-52	251	15.5	2020	55.9	36.5	25.3	8.0	0.22	0.15	534	16.2	1.0	20
52-65	210	13.1	1480	42.8	21.0	30.5	7.1	0.20	0.10	771	15.9	1.2	19
65-76	220	12.9	1510	37.5	22.1	32.9	6.9	0.17	0.10	791	17.1	1.2	15
76-92	197	13.2	1440	34.8	21.1	27.3	7.3	0.18	0.11	736	14.9	1.2	15
92-108	196	11.9	1260	32.9	20.0	23.0	6.4	0.17	0.10	621	16.4	1.2	14

*Density is measured on dry soil before 500°C ashing, while element concentrations are based on weight after ashing

†Loss on ignition (LOI) is a measure of change in soil weight before and after ashing, and largely reflects combustion of soil organic matter.

Soil elemental concentrations before ashing can be recovered by normalizing to LOI.

TABLE DR-2 DATA FOR KOHALA RAINFALL GRADIENT SITES

	Nb (ppm)	Zr (ppm)	Zr/Nb	ρ (g/cm ³)	LOI (wt %)	coarse * (wt %)
<u>Site B (20 cm rain)</u>						
0-16 cm	110	741	6.73	1.00	18	54
16-35	138	825	5.96	1.03	17	10
35-54	174	1070	6.15	0.94	18	5
54-82	117	764	6.55	0.99	9	41
82-109	92.7	675	7.29	1.62	3	51
<u>Site E (50 cm)</u>						
0-13 cm	93.3	550	5.90	1.00	21	65
13-30	96.8	549	5.67	0.99	18	12
30-44	106	601	5.68	1.03	18	15
44-62	97.5	707	7.24	0.81	19	13
62-85	115	710	6.20	0.80	19	56
85-103	120	720	6.01	0.94	16	50
<u>Site J (135 cm)</u>						
0-22 cm	87.9	424	4.83	0.48	40	3
22-47	108	551	5.09	0.45	27	2
47-67	119	604	5.07	0.58	30	6
67-92	74.6	626	8.38	0.58	24	39
92-125	109	627	5.75	0.32	21	24
<u>Site M (250 cm)</u>						
0-10 cm	175	573	3.27	0.40	37	0
10-28	435	1000	2.30	0.39	35	0
28-42	632	1190	1.88	0.35	33	0
42-58	306	1840	6.02	0.37	32	0
58-79	183	1700	9.31	0.39	30	0
79-101	146	995	6.81	0.42	24	0
101-110	161	1150	7.14	0.44	23	0

*"Coarse" refers to the mass fraction of (essentially unweathered) soil fragments greater than 2 mm in diameter. These fragments were sieved from the soil prior to geochemical analysis. Coarse fragments decrease in abundance with rainfall, and were not present in chonosequence soils. We calculated Zr loss (eq. 2, 3) on the basis of the mass of soil in the <2 mm fraction.

TABLE DR-3 HAWI SERIES LAVAS, KOHALA MOUNTAIN, HAWAII*

sample	SiO ₂ wt%	TiO ₂ wt%	Al ₂ O ₃ wt%	Fe ₂ O ₃ wt%	MnO wt%	MgO wt%	CaO wt%	Na ₂ O wt%	K ₂ O wt%	P ₂ O ₅ wt%	Rb ppm	Sr ppm	Ba ppm	Zr ppm	Nb ppm	Y ppm
BL	53.0	1.8	17.4	9.2	0.2	2.9	4.7	6.1	2.1	1.4	47	1710	831	490	69	56
CL	46.7	3.2	16.7	12.5	0.2	5.0	7.1	5.2	1.5	2.2	28	1630	649	292	41	44
DL	53.4	1.8	17.6	9.4	0.3	3.0	4.8	6.1	2.1	1.3	46	1680	849	482	75	51
EL	50.4	2.3	17.1	11.2	0.2	3.5	5.9	5.2	1.8	1.7	44	1680	747	405	62	52
FL	49.4	2.6	16.8	11.8	0.2	4.0	6.6	5.3	1.7	1.9	48	1620	700	346	56	53
GL	48.7	2.6	16.4	11.8	0.2	4.6	6.5	5.3	1.7	1.8	31	1610	682	361	54	50
PRB-1	47.7	3.1	16.2	12.9	0.2	4.5	6.1	4.4	1.5	2.1	23	1640	549	379	54	56
PRB-2	47.2	3.0	16.0	12.8	0.2	4.4	6.1	4.5	1.7	2.0	22	1630	543	346	60	57
PRB-3	47.2	3.0	16.0	12.8	0.2	4.4	6.1	4.5	1.8	2.0	24	1600	543	293	56	57
HI-8A-Rf	50.2	2.4	17.1	11.3	0.2	2.9	5.1	5.0	1.9	1.6	27	1530	710	395	67	54
HI-8-8r	49.1	2.6	17.4	11.9	0.2	3.2	5.6	5.2	1.6	1.7	26	1320	769	356	67	50

*Data from ICP-OES analysis on Li-metaborate fusions at UC Santa Barbara