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Tabulation of CO_2, SO_2, and He Concentrations in Summit Fumarole Gases and Wind and Rainfall Data at Kilauea Volcano, Hawaii, for the Period June 1987 - February 1989

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ABSTRACT

Concentrations of air, CO_2, SO_2, and He were measured in gases collected from the Halemaumau and 1971 fissure summit fumaroles on Kilauea volcano, Hawaii, from June 1987 to February 1989. Sampling and analysis of the gases are described and gas measurements are listed. Wind direction and speed and rainfall measurements made during the same time period are also listed.

INTRODUCTION

Kilauea volcano is located on the southeastern flank of Mauna Loa volcano. The summit and east rift zone of Kilauea are the most active eruption and intrusion areas on the volcano (Gerlach, 1986). The summit area of Kilauea is occupied by a caldera that has a roughly eliptical shape of about 2.8 x 4.0 km.

The Halemaumau pit crater lies within the summit caldera and, historically, has been the most active vent on the volcano. Most of the non-eruptive degassing of Kilauea originates from fumaroles located within and adjacent to Halemaumau (Greenland and others, 1985). A summit magma chamber, located about 2 to 6 km beneath the caldera, supplies magmatic gases to the fumaroles (Gerlach, 1986).

Fumarole gases have been collected and analyzed on occasion for many years. However, in the last 10 years, effort has concentrated on systematically collecting and analyzing non-eruptive gases from two of the summit fumaroles, in an attempt to monitor movement of magma beneath the summit and to possibly forecast eruptions in the summit or even along the east rift zone by changes in fumarole gas composition. Greenland and others (1985) suggested that at least some of the day-to-day variations in SO_2 emissions reflect short-term variations in magma supply to the reservoir. Gerlach (1986) suggested that changes in summit CO_2 emissions may reflect changes in the rate of supply of parental magma to the summit chamber, which in turn may affect reservoir stresses and the probability of eruptions of magma already in storage.

Measurement of total C/S gas ratios have been used to distinguish gases exsolving from magma that is stored in summit reservoirs from gases associated with eruptions of magma that has come directly from the mantle (Greenland, 1987); ratios of total C/S gas contents of fumarole gases have also been proposed for monitoring and predicting magma movement. Increases in the He/CO_2 ratio at the 1971 fissure fumarole were proposed as a means of predicting impending eruptive activity; this fumarole is thought to be located almost directly above the summit reservoir (Thomas and Naughton, 1979).

For this study, gases were collected from two summit fumaroles. The Halemaumau fumarole (HMM) is located on the east side of the Halemaumau pit crater, close to the Halemaumau trail. The 71F fumarole is located on the 1971 fissure, and is actively depositing sulfur. Both fumaroles have temperatures of approximately 93°C (B. Stokes, unpublished data). This report describes the methods used to collect gases from the HMM and 71F fumaroles, the methods used for gas analysis, and tabulates the results of the analyses. Wind and rainfall data are also listed.

SAMPLE COLLECTION

The fumarole samples were obtained using 2-meter-long teflon or polyethylene tubes, 0.5 cm-i.d., inserted into the vents. The vent gas was pumped through the tube with a hand pump and stored in 125 cc flow-through glass bottles with teflon stopcocks on both ends; these samples were analyzed for air, CO_2, and SO_2. Splits of the gas samples in the flow-through glass bottles were taken for N_2 and He analysis using a plastic syringe and needle. The gas splits were injected into 5 cc evacuated glass vials with air-tight rubber stoppers; gas samples were allowed to flow into the evacuated tubes using only the vacuum present in the tubes. The needle hole in the rubber stopper was covered with silicone glue.

Wind direction and wind speed were recorded on days when SO_2 concentrations in plume gases were analyzed by correlation spectrometer (COSPEC). Wind direction and speed were measured on COSPEC data collection days by windmeter; details of the methods used were given by Casadevall and others (1987) and by Chartier and others (1988). Rainfall was measured daily at the Uwekahuna vault, about 0.5 km from the Hawaiian Volcano Observatory.

SAMPLE ANALYSIS

The gas samples in the flow-through bottles were analyzed by gas chromatography for air, CO_2, and SO_2 within 1 hour of collection. Operating conditions for the gas chromatograph are shown in table 1. Gas sample size was 0.1 mL. Concentrations of CO_2, SO_2, and air were measured compared to standard curves, and are reported as volume percents of the total gas sample.

The gas samples in the evacuated glass tubes were analyzed for N_2 and He approximately 4 to 20 days after collection. For N_2 analysis, gas in the vials was removed by injecting 5 ml of He (equal to the volume of the vial) into the vial and removing the mixture of fumarole gas and added He. These gas mixtures were analyzed by gas chromatography. Operating conditions for the gas chromatograph are shown in table 2. Concentrations of N_2 were measured compared to standard curves and reported as volume percent of the total gas sample. Known concentrations of N_2 were analyzed several times per day to ensure stability of the instrument.

For He analysis, gas in the vials was removed by injecting 5 cc of air (equal to the volume of the vial) into the vial and removing the mixture of fumarole gas and added air. This mixture was analyzed for He using mass spectrometry (Reimer and Denton, 1978). Results of sample analysis were recorded as ppb He above or below the concentration of He in air. Standard samples of air containing known concentrations of He were run several times per day to insure stability of the instrument. Reproducibility of the determination was +/- 25 parts per billion (ppb) above or below the concentration of He in air. In addition to the He from the fumarole gas, the He measured in the samples included a mixture of (1) residual He in the evacuated vials, (2) atmospheric He from air contamination of the fumarole, (3) He in air accidently added to the gas sample during the transfer of sample from the flow-through sampling bulb to the 5 cc evacuated tube, and (4) any He in air that may have leaked into the

vial before analysis. However, these evacuated vials generally do not show any leakage into or out of the vial for periods up to 2 months (Hinkle and Kilburn, 1979).

The glass vials used for sample storage were approximately 80% evacuated and contained a residual concentration of He, which had been introduced during the manufacturing process. The amount of residual He was the same for all the tubes in each lot produced by the manufacturer. This residual He concentration was measured and subtracted from the raw measurement of He in each sample.

Excess helium in the sample from air contamination of the fumarole or of the sample was calculated from measurement of the N_2 content of each sample, assuming that normal air contains 78.08% N_2 and 5240 parts per billion (ppb) He (Glueckhauf, 1946; Oliver and others, 1984). The calculated He in the air component of the sample was subtracted from the measured He, after subtracting the residual He in the tube. The remaining He was considered to be the true He content of the fumarole gas that was in excess of the He content of air. All of the gas samples were at or above the He concentration in air. The He concentration in fumarole gas was converted to parts per million and is shown in tables 3 and 4.

DESCRIPTION OF DATA TABLES

Data from the analyses were entered into an IBM personal computer and stored on disks, using STATPAC programs developed for personal computers by the U.S. Geological Survey (Grundy and Miesch, 1987). Data for all measurements obtained during the study are listed in tables 3-5. Data listed are volume/volume concentrations of air (%), CO_2 (%), SO_2 (%), CO_2/SO_2, N_2 (%), He (ppm), wind direction (degrees), wind speed (meters/second), day after start of sample collection (day 1 = January 1, 1987), and rainfall (inches).

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TABLE 1. Operating conditions for the gas chromatograph used for analysis of air, CO_2, and SO_2

Type of gas chromatograph	Hewlett-Packard 5840A/1810A
Detector	dual thermal condictivity 5840A-220
Lower limit of detection	0.1 %
Reproducibility of replicate samples	+/- 1%
Column	Stainless steel: pre-column---12 in x 1/8 in silica gel (100/120 mesh) primary column---48 in x 1/8 in chromasorb 107 (80/100 mesh)
Carrier gas	helium at 16 mL/minute
Temperature	column: 145°C detector: 350°C
Integrator	Hewlett-Packard 5840A

TABLE 2. Operating conditions for the gas chromatograph used for N_2 analysis.

Type of gas chromatograph	Carle AGC-100
Detector	thermistor detector
Lower limit of detection	1% N_2 (vol/vol)
Reproducibility of replicate samples	+/- 1%
Column	concentric stainless steel: outer column--72 in x 1/4 in molecular sieve inner column--72 in x 1/8 in porapak mixture Alltech Associates, Deerfield, IL)
Carrier gas	helium at 90 mL/minute
Temperature	column: 70°C detector: "low" mode
Integrator	Varian control data system 401

Table 3. Data for the HMM fumarole.

Date	Day	Air-%	CO2-%	SO2-%	CO2/SO2	N2-%	He-ppm
62287	173	8.0	81.5	10.5	7.8	34.5	4.39
62387	174	7.7	80.9	11.3	7.2	40.1	5.09
62587	176	8.0	82.0	10.0	8.1	35.7	4.91
62987	180	7.3	82.4	10.3	7.9	37.9	6.74
70187	182	14.2	75.2	10.6	7.1	47.2	4.92
70287	183	15.9	75.0	9.2	8.2	47.1	4.98
70787	188	10.4	77.5	12.1	6.5	42.4	5.30
70987	190	9.9	79.3	10.8	7.4	44.4	5.34
71587	196	14.1	76.3	9.6	7.8	41.6	5.77
71687	197	14.8	74.8	10.4	7.3	37.7	4.41
72387	204	9.4	81.0	9.7	8.0	32.4	5.85
72787	208	11.5	77.4	11.1	7.0	34.9	9.28
72887	209	10.0	78.6	11.4	7.1	25.6	7.75
72987	210	17.6	72.1	10.3	7.0	65.9	4.68
80387	215	10.0	78.4	11.7	6.7	46.0	5.43
80487	216	8.5	80.1	11.4	7.1	73.0	5.29
80587	217	11.7	77.3	11.0	7.0	60.2	6.42
80687	218	7.4	80.8	11.8	6.9	42.0	7.29
81087	222	12.0	77.3	10.6	7.3	41.2	5.85
81187	223	15.2	74.0	10.8	6.8	38.0	5.52
81287	224	11.8	75.8	12.4	6.1	37.2	6.51
81387	225	11.6	76.1	12.3	6.2	37.0	7.26
81787	229	8.5	81.1	10.4	7.8	35.5	7.42
81887	230	11.7	78.6	9.7	8.1	54.6	3.81
81987	231	12.3	77.3	10.4	7.4	39.7	6.61
82487	236	8.6	79.6	11.8	6.7	40.7	6.67
82587	237	15.9	72.8	11.3	6.5	44.1	6.91
82687	238	12.3	75.7	12.0	6.3	36.7	6.08
82787	239	12.6	77.6	9.8	7.9	38.3	5.57
83187	243	12.2	77.8	10.0	7.8	35.5	5.96
90187	244	16.4	74.1	9.5	7.8	37.4	6.70
90287	245	11.5	78.4	10.1	7.8	49.0	4.05
90387	246	12.5	77.5	10.0	7.8	46.6	4.81
91487	257	13.2	76.3	10.6	7.2	44.2	3.78
91587	258	10.1	78.7	11.2	7.1	38.7	4.43
91687	259	10.1	78.8	11.0	7.2	61.9	3.43
92187	264	8.8	80.7	10.5	7.7	43.7	4.58
92287	265	10.0	79.4	10.6	7.5	40.7	3.87
92387	266	11.3	78.5	10.3	7.7	35.8	5.67
92487	267	12.0	77.6	10.3	7.5	56.0	3.13
92887	271	16.3	74.3	9.4	7.9	42.9	5.62
92987	272	11.9	77.8	10.3	7.5	39.8	5.61
93087	273	12.5	77.6	9.9	7.8	42.8	3.45
100587	278	12.8	76.8	10.4	7.4	40.0	6.44
100687	279	9.1	80.2	10.7	7.5	41.8	5.03
100787	280	7.7	81.4	10.9	7.5	39.2	5.27
101387	286	15.2	75.4	9.4	8.0	45.5	6.72
101487	287	13.5	77.0	9.5	8.1	30.0	5.82
101987	292	12.6	76.7	10.7	7.2	44.9	5.54
102287	295	8.5	80.2	11.3	7.1	26.5	6.56
102687	299	11.2	77.6	11.2	6.9	26.7	6.18

Table 3. Data for the HMM fumarole.

Date	Day	Air-%	CO2-%	SO2-%	CO2/SO2	N2-%	He-ppm
102887	301	13.4	75.7	10.9	6.9	38.3	7.85
110287	306	9.1	81.1	9.8	8.3	30.6	5.25
110987	313	11.2	77.4	11.3	6.8	41.3	7.17
111087	314	8.0	80.7	11.3	7.1	31.4	14.64
111787	321	14.1	76.1	9.8	7.8	42.2	7.51
112787	331	13.2	76.7	10.1	7.6	26.5	6.31
113087	334	14.2	76.0	9.8	7.8	28.6	6.17
120187	335	13.1	76.0	10.9	7.0	31.1	6.34
120787	341	12.0	77.5	10.5	7.4	34.7	7.38
120887	342	10.1	78.1	11.9	6.7	30.1	6.56
120987	343	11.8	76.7	11.5	6.7	32.0	8.92
121487	348	10.9	80.7	8.4	9.6	35.4	8.60
121587	349	5.2	89.4	5.5	16.3	29.0	6.97
121687	350	5.3	90.9	3.8	24.1	38.2	8.92
121787	351	8.4	88.3	3.3	26.5	61.3	4.12
122187	355	10.4	87.6	2.0	43.2	18.4	7.67
122287	356	7.8	90.3	2.0	45.4	31.7	7.58
122387	357	8.6	89.2	2.2	40.8	26.3	6.74
122487	358	12.5	84.9	2.6	32.4	51.6	2.36
122587	359	11.5	83.8	4.8	17.5	43.6	3.16
11488	379	19.0	69.0	12.0	5.8	77.8	2.92
11988	384	24.3	64.9	10.8	6.0	70.8	3.09
12588	390	19.4	69.3	11.3	6.1	58.8	4.80
12788	392	14.0	74.1	11.9	6.2	64.4	3.97
12988	394	16.9	71.7	11.3	6.3	60.8	3.31
20188	397	19.2	70.8	10.1	7.0	40.2	4.40
20288	398	14.2	74.5	11.4	6.6	38.7	5.25
20388	399	17.6	71.6	10.8	6.6	39.0	5.68
20888	404	13.7	74.6	11.7	6.4	35.2	5.37
20988	405	13.6	75.2	11.1	6.8	53.3	4.57
21088	406	12.7	75.8	11.5	6.6	22.6	6.54
21688	412	14.3	73.8	12.0	6.2	23.9	5.82
30888	433	12.5	76.4	11.1	6.9	31.4	10.54
33188	456	16.0	73.5	10.6	6.9	40.2	5.03
40488	460	18.3	71.9	9.8	7.3	42.4	5.30
40688	462	17.3	72.6	10.1	7.2	37.0	5.49
40788	463	17.6	71.7	5.8	12.4	23.6	7.40
41188	467	14.0	75.4	10.5	7.2	28.6	7.49
41288	468	15.6	74.5	9.9	7.5	27.9	5.68
41388	469	26.0	65.1	9.0	7.2	35.1	5.96
41488	470	15.1	75.1	9.8	7.7	33.3	5.15
42288	478	34.8	57.1	8.2	7.0	37.2	5.98
42688	482	12.3	77.1	10.6	7.3	38.2	6.46
42788	483	15.3	75.0	9.7	7.7	33.3	6.69
42888	484	9.9	79.4	10.8	7.4	44.5	4.44
50288	488	13.4	77.1	9.5	8.1	50.5	5.82
50388	489	11.9	78.5	9.6	8.2	28.7	8.03
50488	490	13.5	77.0	9.5	8.1	24.8	6.70
50588	491	15.3	75.4	9.3	8.1	36.2	6.78
50988	495	12.1	78.0	10.0	7.8	37.4	7.83
51188	497	13.5	77.2	9.3	8.3	34.0	10.24

Table 3. Data for the HMM fumarole.

Date	Day	Air-%	CO2-%	SO2-%	CO2/SO2	N2-%	He-ppm
51288	498	10.9	79.3	9.8	8.1	36.3	10.40
51688	502	13.6	77.3	9.3	8.3	39.7	4.78
51788	503	13.6	77.6	8.9	8.7	39.2	8.95
52388	509	9.1	80.8	10.2	7.9	36.5	6.19
52588	511	13.0	77.0	10.1	7.6	33.2	5.66
53188	517	12.0	77.8	10.2	7.6	40.6	4.89
60188	518	13.3	76.7	10.1	7.6	40.5	5.17
60288	519	10.5	78.6	10.9	7.2	33.3	6.20
60688	523	12.2	77.3	10.6	7.3	40.3	4.94
61388	530	9.7	79.2	11.2	7.1	34.4	5.20
61488	531	10.1	78.8	11.1	7.1	34.8	6.20
61688	533	9.9	79.9	10.3	7.8	37.5	5.52
62188	538	8.2	80.3	11.5	7.0	38.9	5.80
62288	539	10.7	78.1	11.2	7.0	39.6	5.01
62388	540	11.1	77.8	11.2	6.9	40.7	5.80
62788	544	11.2	78.5	10.2	7.7	31.7	5.54
62888	545	10.5	78.7	10.8	7.3	32.6	5.25
62988	546	10.9	78.2	10.9	7.2	28.4	5.90
63088	547	8.7	80.0	11.3	7.1	37.2	5.22
70588	552	13.5	75.4	11.0	6.9	40.0	6.10
70688	553	22.9	67.0	10.0	6.7	49.7	5.13
71188	558	11.4	76.9	11.6	6.6	34.7	7.54
71288	559	9.3	78.8	11.9	6.6	40.9	5.72
71888	565	9.3	78.9	11.8	6.7	36.0	5.29
71988	566	16.0	73.5	10.6	6.9	40.1	4.97
72088	567	9.5	78.8	11.7	6.7	36.6	5.43
72188	568	11.8	78.0	10.2	7.6	48.1	4.49
72688	573	10.7	78.5	10.8	7.3	40.5	4.35
72788	574	10.5	78.1	11.4	6.9	31.1	6.27
72888	575	11.6	77.2	11.1	7.0	32.7	4.42
80188	579	14.0	75.2	10.8	7.0	41.7	4.55
80388	581	12.3	77.6	10.1	7.7	35.2	4.53
80488	582	11.3	76.9	11.7	6.6	31.1	5.92
80888	586	9.7	79.3	11.1	7.1	31.8	6.22
80988	587	9.8	78.2	12.0	6.5	31.8	6.33
81088	588	11.7	77.3	11.0	7.0	38.8	4.11
81588	593	11.5	77.3	11.2	6.9	34.9	5.96
81688	594	13.6	75.8	10.6	7.2	28.7	5.45
81788	595	29.7	62.1	8.3	7.5	27.4	7.52
81988	597	8.6	79.1	12.3	6.4	48.4	2.81
91388	622	10.9	78.2	10.9	7.2	29.8	6.36
91488	623	12.4	77.4	10.1	7.7	34.0	6.35
91588	624	10.6	79.1	10.4	7.6	34.5	6.78
91988	628	11.2	78.4	10.4	7.5	33.5	5.74
92288	637	10.4	79.5	10.1	7.9	39.0	5.74
92688	635	9.4	80.2	10.4	7.7	30.5	7.33
92888	637	7.9	81.4	10.7	7.6	37.4	5.76
92988	638	9.6	80.3	10.1	8.0	37.1	4.95
100388	642	7.9	81.5	10.6	7.7	36.7	5.35
100688	645	9.0	80.2	10.8	7.4	44.9	4.89
101288	651	9.9	80.8	9.3	8.7	34.3	2.97

Table 3. Data for the HMM fumarole.

Date	Day	Air-%	CO2-%	SO2-%	CO2/SO2	N2-%	He-ppm
101388	652	9.5	79.3	11.1	7.1	32.3	5.44
101788	656	12.6	78.2	9.2	8.5	34.3	5.40
101888	657	8.6	81.4	10.0	8.1	28.9	6.52
101988	658	13.3	77.5	9.3	8.3	31.9	5.00
102088	659	8.0	81.4	10.6	7.7	37.5	6.32
102488	663	7.9	81.6	10.5	7.8	27.2	6.63
102588	664	6.6	82.0	11.4	7.2	26.0	6.99
102688	665	9.3	80.7	10.0	8.1	25.3	6.01
102788	666	8.0	81.1	10.9	7.4	39.3	5.91
103188	670	4.8	83.6	11.6	7.2	35.7	6.09
110188	671	5.3	83.7	11.1	7.5	29.8	7.16
110388	673	13.8	77.1	9.2	8.4	31.1	6.15
110988	679	11.8	78.8	9.3	8.5	29.4	6.61
111088	680	11.1	79.4	9.6	8.3	47.4	3.43
111588	685	3.8	85.0	11.2	7.6	29.0	6.16
111688	686	7.9	81.8	10.3	7.9	34.8	5.46
112388	693	8.5	81.2	10.3	7.9	31.2	6.74
112888	698	12.8	77.8	9.4	8.2	27.7	7.39
112988	699	14.6	77.2	8.2	9.4	30.2	5.56
113088	700	13.5	76.9	9.6	8.0	34.1	5.09
120188	701	9.5	80.3	10.3	7.8	31.8	7.11
120688	706	6.1	83.6	10.3	8.1	27.0	6.29
120788	707	8.1	82.7	9.2	9.0	23.7	8.07
121288	712	10.6	79.4	10.0	7.9	28.3	6.93
121488	714	5.7	84.5	9.8	8.6	27.5	7.51
121588	715	8.9	81.4	9.7	8.4	26.1	6.77
121988	719	6.5	79.9	8.5	9.4	24.2	6.79
122088	720	7.0	82.0	10.9	7.5	39.1	4.96
122188	721	9.0	80.9	10.1	8.0	49.6	5.82
122888	728	6.3	83.0	10.7	7.8	38.7	7.07
122988	729	11.6	78.5	9.9	7.9	37.6	6.52
10389	734	12.4	77.3	10.3	7.5	55.7	4.89
10489	735	8.8	80.3	10.9	7.4	42.1	6.42
10589	736	10.1	79.9	10.1	8.0	40.7	6.62
11189	742	7.4	83.0	9.8	8.5	48.4	6.31
11289	743	12.7	77.9	9.4	8.3	37.3	6.75
11789	748	12.6	84.0	3.4	24.7	36.1	7.14
11889	749	18.1	79.2	2.6	30.5	57.2	4.79
11989	750	10.9	86.3	2.8	30.8	64.6	3.46
12089	751	15.9	81.3	2.8	29.0	61.9	2.18
12389	754	5.2	90.5	4.3	21.0	52.1	3.57
12489	755	12.4	82.7	4.9	16.9	28.4	7.76
12589	756	14.7	79.9	5.5	14,5	36.2	7.55
12689	757	13.0	80.4	6.6	12.2	52.3	2.68
12789	758	12.5	80.6	7.0	11.6	67.9	1.37
13089	761	21.0	71.4	7.6	9.4	54.5	4.51
13189	762	11.6	79.8	8.6	9.3	57.6	3.64
20189	763	22.0	70.3	7.8	9.1	41.1	5.54

Table 4. Data for the 71F fumarole.

Date	Day	Air-%	CO2-%	SO2-%	CO2/SO2	N2-%	He-ppm
61787	168	3.1	55.6	41.3	1.4	33.4	5.30
61887	169	24.9	43.9	31.2	1.4	43.6	4.08
62287	173	4.3	54.7	41.0	1.3	37.4	4.79
62387	174	2.8	55.4	41.8	1.3	28.9	6.09
62487	175	2.7	55.3	42.0	1.3	36.7	5.02
62587	176	5.1	53.7	41.2	1.3	38.7	6.93
62987	180	5.7	53.1	41.3	1.3	40.5	5.91
63087	181	43.6	32.1	24.3	1.3	54.4	4.01
70287	183	72.4	15.7	12.0	1.3	74.4	2.25
70787	188	70.9	16.8	12.3	1.3	73.8	1.57
70887	189	4.9	53.3	41.9	1.3	56.6	2.49
70987	190	6.5	51.9	41.6	1.2	57.4	4.83
71487	195	3.8	53.3	42.9	1.3	32.8	6.60
71587	196	3.7	53.8	42.5	1.3	36.4	6.60
71687	197	6.3	51.9	41.8	1.3	37.0	6.44
72387	204	5.9	52.4	41.8	1.3	33.7	7.32
72787	208	2.2	53.9	43.4	1.3	68.4	3.31
72887	209	6.8	51.5	41.6	1.2	37.0	6.74
72987	210	2.5	53.7	43.8	1.2	37.1	4.21
80387	215	3.1	53.5	43.5	1.2	45.1	5.49
80487	216	4.3	52.9	42.9	1.2	39.8	6.73
81087	222	3.5	53.6	42.9	1.3	43.5	4.74
81187	223	5.5	60.8	33.8	1.8	40.7	5.81
81287	224	29.3	39.0	31.8	1.2	51.3	3.76
81387	225	6.0	51.5	42.5	1.2	41.5	6.89
81787	229	30.0	38.4	31.6	1.2	52.5	6.02
81887	230	57.3	23.3	19.4	1.2	64.9	2.12
81987	231	3.4	52.6	44.0	1.2	53.5	3.42
82487	236	9.6	48.9	41.4	1.2	54.4	4.09
82587	237	10.7	48.2	41.2	1.2	44.4	4.23
82687	238	28.8	38.2	33.0	1.2	53.4	4.36
82787	239	8.0	49.5	42.5	1.2	43.2	4.78
83187	243	3.0	52.0	45.4	1.2	37.9	4.13
91087	244	2.3	52.3	45.4	1.2	39.0	6.19
90287	245	3.1	51.8	45.2	1.2	44.4	3.63
90387	246	3.2	51.7	45.2	1.1	39.2	5.38
91487	257	3.5	51.5	45.0	1.1	49.6	3.21
91587	258	9.0	48.8	42.3	1.1	40.9	3.44
91687	259	2.9	51.7	45.4	1.1	38.5	3.60
92187	264	2.1	52.3	45.6	1.2	29.1	5.35
92287	265	4.2	51.0	44.9	1.1	31.1	3.89
92387	266	3.3	51.7	45.0	1.2	24.8	5.71
92487	267	3.3	51.6	45.2	1.1	33.5	3.24
92887	271	4.7	51.1	44.3	1.2	54.5	4.35
92987	272	4.5	51.2	44.4	1.2	44.0	3.86
93087	273	3.5	51.7	44.8	1.2	46.7	3.47
100587	278	3.2	52.0	44.8	1.2	37.7	4.22
100687	279	3.3	51.6	45.1	1.1	39.4	3.96
100787	280	4.0	51.3	44.7	1.2	42.7	4.25
101387	286	2.6	51.7	45.7	1.1	36.8	5.58
101487	287	2.9	51.7	45.5	1.1	34.1	3.82

Table 4. Data for the 71F fumarole.

Date	Day	Air-%	CO2-%	SO2-%	CO2/SO2	N2-%	He-ppm
101987	292	5.5	50.2	44.4	1.1	30.5	6.07
102287	295	3.0	51.3	45.7	1.1	38.9	4.21
102687	299	4.3	50.7	45.1	1.1	28.0	4.73
101887	301	4.6	51.1	44.3	1.2	38.2	4.55
110287	306	3.6	51.1	45.4	1.1	28.4	6.52
110387	307	4.0	50.9	45.2	1.1	37.6	6.52
110987	313	3.8	50.8	45.4	1.1	47.6	3.57
111087	314	3.3	51.1	45.7	1.1	32.5	10.72
113087	334	19.2	43.3	37.5	1.2	38.2	5.06
120187	335	14.1	45.6	40.3	1.1	47.5	3.80
120787	341	3.6	51.2	45.3	1.1	48.3	5.18
120887	342	2.9	51.3	45.8	1.1	33.5	5.14
120987	343	2.5	51.3	46.2	1.1	32.5	6.39
121487	348	7.8	49.6	42.6	1.2	32.8	5.86
121587	349	6.0	49.9	44.1	1.1	29.2	5.58
121687	350	3.4	50.4	46.3	1.1	37.7	9.13
121787	351	4.1	50.1	45.9	1.1	26.3	4.75
122187	355	3.4	50.8	45.8	1.1	16.8	6.30
122287	356	4.2	51.1	44.7	1.1	34.4	8.74
122387	357	4.3	49.8	45.9	1.1	31.5	4.64
122487	358	2.9	50.9	46.3	1.1	49.2	2.79
122587	359	3.9	50.1	46.0	1.1	48.5	2.70
11488	379	2.5	50.5	47.0	1.1	57.6	4.58
11988	384	8.0	48.7	43.3	1.1	53.6	2.90
12188	386	2.6	49.6	47.8	1.0	60.7	2.42
12588	390	2.1	50.9	47.0	1.1	51.9	3.76
12788	392	3.9	49.1	47.1	1.0	38.6	4.80
12988	394	3.9	48.8	47.4	1.0	54.6	2.53
20188	397	3.5	48.8	47.7	1.0	36.3	3.61
20288	398	3.6	48.6	47.9	1.0	50.8	2.34
20388	399	5.7	47.7	46.6	1.0	47.5	4.06
20888	404	3.4	49.1	47.5	1.0	21.0	4.91
20988	405	2.6	49.2	48.2	1.0	33.9	4.83
21088	406	3.0	49.1	48.0	1.0	25.0	4.95
21688	412	29.4	35.2	35.5	1.0	59.8	1.91
30888	433	4.5	47.9	47.6	1.0	33.4	8.06
32188	446	4.7	48.4	46.8	1.0	37.7	4.27
33188	456	17.9	42.2	39.9	1.1	47.6	2.77
40488	460	9.9	46.5	43.7	1.1	54.4	2.39
40688	462	2.9	50.4	46.7	1.1	42.5	3.19
40788	463	13.9	45.1	41.1	1.1	40.8	3.64
41188	467	37.7	33.1	29.2	1.1	48.6	3.03
41288	468	34.7	35.1	30.2	1.2	28.5	4.22
41388	469	4.0	52.1	44.0	1.2	32.4	4.21
41488	470	5.7	51.6	42.6	1.2	44.2	3.50
42288	478	3.5	55.2	41.4	1.3	23.1	5.08
42688	482	8.5	53.4	38.2	1.4	54.1	3.32
42788	483	4.3	56.2	39.6	1.4	67.9	2.11
42888	484	4.6	56.2	39.2	1.4	53.2	2.25
50288	488	4.2	58.0	37.8	1.5	31.2	3.92
50388	489	4.9	57.9	37.2	1.6	29.5	4.79

Table 4. Data for the 71F fumarole.

Date	Day	Air-%	CO2-%	SO2-%	CO2/SO2	N2-%	He-ppm
50488	490	6.3	57.3	36.4	1.6	24.0	5.15
50588	491	5.5	58.2	36.3	1.6	27.5	6.31
50988	495	4.9	59.5	35.6	1.7	49.4	5.47
51188	497	4.7	60.0	35.3	1.7	39.5	5.82
51288	498	4.8	59.9	35.3	1.7	38.4	7.30
51688	502	10.2	56.8	32.3	1.8	31.3	4.69
51788	503	5.2	60.7	34.1	1.8	48.2	8.71
52388	509	5.6	61.0	33.5	1.8	28.9	5.23
52588	511	7.1	60.2	32.7	1.8	40.7	5.44
53188	517	3.8	62.4	33.6	1.9	44.9	3.66
60188	518	5.8	61.5	32.7	1.9	30.3	5.39
60288	519	6.0	61.3	32.8	1.9	33.6	5.39
60688	523	4.8	61.8	33.4	1.9	31.8	5.51
61388	530	31.7	44.5	23.8	1.9	34.4	4.27
61488	531	43.7	37.4	19.0	2.0	40.2	4.97
61688	533	9.8	58.3	32.0	1.8	39.3	5.40
62188	538	4.7	61.3	34.1	1.8	29.9	4.67
62288	539	19.9	51.7	28.5	1.8	40.6	4.19
62388	540	8.0	59.3	32.7	1.8	51.2	2.49
62788	544	7.3	59.4	33.3	1.8	39.2	3.55
62888	545	4.3	61.2	34.5	1.8	30.4	5.40
62988	546	8.6	58.5	33.0	1.8	35.5	4.41
63088	547	3.5	61.6	34.8	1.8	25.6	4.99
70588	552	36.4	40.3	23.3	1.7	37.7	5.94
71188	558	76.1	15.5	8.5	6.6	77.1	0.45
71888	565	42.5	36.8	20.8	1.8	47.4	2.85
71988	566	39.0	38.6	22.3	1.7	42.1	4.60
72088	567	30.1	44.5	25.4	1.8	44.7	3.38
72188	568	21.1	50.0	28.9	1.7	40.0	5.77
72688	573	10.4	56.2	33.4	1.7	32.6	4.79
72788	574	35.0	41.1	23.9	1.7	29.7	5.63
72888	575	66.2	21.5	12.3	1.7	59.9	2.68
80188	579	4.6	59.6	35.8	1.7	40.0	3.56
80388	581	3.2	60.3	36.5	1.7	38.9	4.59
80488	582	11.9	55.1	33.0	1.7	37.5	4.80
80888	586	3.7	59.9	36.4	1.6	33.9	4.34
80988	587	4.2	59.4	36.2	1.6	28.2	5.30
81088	588	7.7	57.6	34.8	1.7	44.7	3.72
81588	593	4.7	59.0	36.4	1.6	18.4	6.80
81688	594	4.3	59.7	35.9	1.7	28.3	6.14
81788	595	28.0	44.3	27.8	1.6	44.0	3.76
81988	597	28.8	44.2	26.9	1.6	61.3	1.15
91388	622	4.8	58.2	37.0	1.6	36.2	5.20
91488	623	3.3	58.5	38.1	1.5	47.7	5.20
91588	624	3.2	59.0	37.9	1.6	52.1	5.05
91988	628	3.6	58.2	38.2	1.5	42.4	5.79
92688	635	2.7	58.6	38.8	1.5	43.2	4.63
92888	637	1.3	59.6	39.1	1.5	44.0	4.95
92988	638	3.0	58.3	38.7	1.5	38.1	4.42
100388	642	3.3	58.5	38.2	1.5	38.4	5.14
100688	645	27.3	43.9	28.8	1.5	61.8	3.66

Table 4. Data for the 71F fumarole.

Date	Day	Air-%	CO2-%	SO2-%	CO2/SO2	N2-%	He-ppm
101288	651	1.5	59.7	38.8	1.5	32.8	5.22
101388	652	50.7	29.6	19.7	1.5	76.7	0.00
101788	656	2.5	59.1	38.4	1.5	39.0	4.24
101888	657	2.5	58.3	39.2	1.5	38.6	3.52
101988	658	1.8	59.3	38.9	1.5	26.9	5.99
102088	659	2.4	58.4	39.2	1.5	44.6	3.11
102488	663	3.9	58.4	37.8	1.5	34.4	5.11
102588	664	4.2	57.5	38.4	1.5	34.9	4.52
102688	665	2.9	59.0	38.1	1.5	37.7	3.48
102788	666	3.0	58.1	39.0	1.5	33.6	6.10
103188	670	4.4	58.6	37.1	1.6	34.1	5.48
110188	671	16.6	50.5	32.9	1.5	43.1	5.00
110388	673	4.0	58.5	37.5	1.6	43.3	4.40
110988	679	43.5	34.6	21.9	1.6	60.4	1.63
111088	680	17.4	50.2	32.4	1.5	72.6	0.70
111588	685	25.9	45.2	29.0	1.6	33.2	5.46
111688	686	3.7	58.5	37.9	1.5	40.6	4.65
112888	698	13.4	52.6	34.0	1.5	29.2	6.25
112988	699	48.0	26.9	19.0	1.4	61.2	2.65
113088	700	63.2	22.7	14.1	1.6	62.9	1.70
120188	701	58.4	25.7	15.9	1.6	59.5	1.93
120688	706	30.0	42.7	27.3	1.6	36.0	5.58
120788	707	58.7	25.2	28.7	0.9	61.7	2.09
121288	712	66.1	20.6	13.3	1.5	65.2	1.96
121488	714	82.3	11.1	6.6	1.7	51.7	4.11
121588	715	76.5	14.3	9.2	1.6	74.0	0.54
121988	719	41.5	35.2	23.2	1.5	64.7	3.45
122888	728	77.4	13.7	8.9	1.5	77.8	0.80
122988	729	70.1	18.0	11.8	1.5	78.9	0.94
10389	734	59.3	24.7	16.0	1.5	75.0	2.34
10489	735	92.7	4.4	2.8	1.6	91.0	0.00
10589	736	57.2	25.8	17.2	1.5	72.9	2.07
11189	742	46.5	32.3	21.3	1.5	67.4	1.61
11289	743	71.7	17.2	11.2	1.5	80.5	0.83
11789	748	64.6	21.6	13.8	1.6	81.5	0.35
11889	749	87.4	7.8	18.1	0.4	88.7	0.00
11989	750	71.2	17.7	11.2	1.6	76.6	0.00
12089	751	51.4	29.3	19.6	1.5	70.9	1.27
12389	754	60.1	24.1	15.7	1.5	52.5	4.69
12489	755	72.4	16.7	10.9	1.5	73.3	2.25
12589	756	77.4	14.1	8.6	1.6	85.7	0.00
12689	757	69.7	18.3	12.0	1.5	82.2	0.14
12789	758	73.8	16.0	10.3	1.6	83.5	0.85
13089	761	60.6	23.4	16.1	1.5	76.5	1.45
13189	762	73.1	16.5	10.6	1.6	81.5	1.11
20189	763	55.6	27.3	17.1	1.6	76.3	0.94
20289	764	71.0	17.8	11.2	1.6	76.8	0.37
20989	771	52.1	28.9	19.0	1.5	88.7	0.00
21089	772	56.2	27.0	16.8	1.6	91.4	0.00
21389	775	73.0	16.8	10.2	1.6	94.2	0.29
21589	777	27.0	45.0	28.0	1.6	79.2	0.72

Table-5. Wind data.

Date	WindDir(degrees)	WindSpeed(m/s)	Day
61787	33.0	4.42	168
61887	30.0	6.85	169
62287	23.0	4.26	173
62587	15.0	3.8	176
63087	28.0	7.41	181
70287	23.0	7.85	183
70787	28.0	9.46	188
70887	43.0	4.4	189
70987	30.0	5.62	190
71387	27.5	5.08	194
71587	35.0	3.94	196
71687	17.5	6.19	197
72087	17.5	6.93	201
72787	40.0	5.76	208
72887	25.0	5.4	209
72987	25.0	6.4	210
80387	27.5	5.7	215
80687	27.5	4.41	218
81087	35.0	4.79	222
81187	22.5	5.59	223
81387	52.5	7.69	225
82487	17.5	7.5	236
82587	30.0	8.36	237
82687	32.5	7.02	238
82787	25.0	7.13	239
91487	22.5	5.58	257
91587	25.0	9	258
100587	35.0	3.87	278
100787	40.0	4.78	280
110987	30.0	6	313
112787	12.5	8.95	331
113087	15.0	7.05	334
120787	15.0	5.7	341
122487	27.5	4.42	358
11488	25.0	4.22	379
11987	10.0	2.75	384
12588	25.0	4.75	390
12788	25.0	4.37	392
21688	30.0	6.04	412
30988	42.5	4.22	434
40688	35.0	6.49	462
40788	47.2	4.93	463
41188	32.5	6.46	467
41288	52.5	4.82	468
42888	37.5	5.55	484
51288	37.5	4.61	498
51688	47.5	4.56	502
52388	40.0	6.81	509
52588	37.5	5.25	511
53188	30.0	5.65	517
60288	32.5	6.14	519

Table-5. Wind data.

Date	WindDir(degrees)	WindSpeed(m/s)	Day
60688	40.0	6.17	523
61488	27.5	7.67	531
62188	35.0	5.87	538
62288	42.5	6.35	539
62788	35.0	6.25	544
62888	30.0	5.71	545
62988	37.5	6.45	546
63088	27.5	5.05	547
70588	7.5	7.48	552
70688	25.0	7.58	553
71188	20.0	7.64	558
71888	25.0	8.24	565
71988	27.5	6.43	566
72088	25.0	6.69	567
72188	50.0	4.6	568
72688	30.0	4.83	573
72788	20.0	7.15	574
72888	20.0	8.42	575
80188	35.0	4.57	579
80488	20.0	6.54	582
80988	25.0	7.07	587
81588	22.5	6.44	593
81788	12.5	7.57	595
91588	27.5	3.86	624
91988	30.0	5.02	628
100688	20.0	5.73	645
101388	23.0	5.79	652
102688	25.0	4.57	665
102788	20.0	5.42	666
103188	20.0	6.85	670
110188	25.0	6.19	671
111088	25.0	4.83	680
111588	28.0	3.64	685
121288	35.0	3.75	712
122088	17.5	4.98	720
122188	30.0	4.5	721
122888	27.5	4.31	728
10389	35.0	4.38	734
10489	12.5	5.63	735
10589	17.5	5.75	736

TABLE-6.

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
1	61787	0.04	168
2	61887	0.03	169
3	61987	0.00	170
4	62087	0.00	171
5	62187	0.01	172
6	62287	0.02	173
7	62387	0.02	174
8	62487	0.00	175
9	62587	0.00	176
10	62687	0.04	177
11	62787	0.05	178
12	62887	0.00	179
13	62987	0.01	180
14	63087	0.13	181
15	70187	0.01	182
16	70287	0.01	183
17	70387	0.13	184
18	70487	0.04	185
19	70587	0.02	186
20	70687	0.05	187
21	70787	0.01	188
22	70887	0.01	189
23	70987	0.01	190
24	71087	0.00	191
25	71187	0.00	192
26	71287	0.00	193
27	71387	0.05	194
28	71487	0.02	195
29	71587	0.15	196
30	71687	0.03	197
31	71787	0.00	198
32	71887	0.00	199
33	71987	0.00	200
34	72087	0.01	201
35	72187	1.82	202
36	72287	1.25	203
37	72387	0.46	204
38	72487	0.05	205
39	72587	0.00	206
40	72687	0.02	207
41	72787	0.01	208
42	72887	0.04	209
43	72987	0.00	210
44	73087	0.01	211
45	73187	0.01	212
46	80187	0.05	213
47	80287	0.04	214
48	80387	0.01	215
49	80487	0.01	216
50	80587	0.00	217

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
51	80687	0.03	218
52	80787	0.00	219
53	80887	0.03	220
54	80987	0.00	221
55	81087	0.00	222
56	81187	0.00	223
57	81287	0.00	224
58	81387	0.00	225
59	81487	0.00	226
60	81587	0.00	227
61	81687	0.00	228
62	81787	0.01	229
63	81887	0.02	230
64	81987	0.03	231
65	82087	0.00	232
66	82187	0.00	233
67	82287	0.00	234
68	82387	0.00	235
69	82487	0.00	236
70	82587	0.00	237
71	82687	0.02	238
72	82787	0.00	239
73	82887	0.00	240
74	82987	0.00	241
75	83087	0.04	242
76	83187	0.03	243
77	90187	0.10	244
78	90287	0.92	245
79	90387	0.72	246
80	90487	0.00	247
81	90587	0.46	248
82	90687	0.00	249
83	90787	0.00	250
84	90887	0.00	251
85	90987	0.03	252
86	91087	0.00	253
87	91187	0.27	254
88	91287	0.03	255
89	91387	0.09	256
90	91487	0.10	257
91	91587	0.00	258
92	91687	0.10	259
93	91787	0.00	260
94	91887	0.05	261
95	91987	0.00	262
96	92087	0.00	263
97	92187	0.07	264
98	92287	0.23	265
99	92387	1.07	266
100	92487	7.80	267
101	92587	0.00	268

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
102	92687	0.00	269
103	92787	0.00	270
104	92887	0.01	271
105	92987	0.00	272
106	93087	0.08	273
107	100187	0.23	274
108	100287	0.10	275
109	100387	1.27	276
110	100487	0.00	277
111	100587	0.04	278
112	100687	0.00	279
113	100787	0.00	280
114	101087	0.00	283
115	101187	0.00	284
116	101287	0.00	285
117	101387	0.00	286
118	101487	1.07	287
119	101587	0.31	288
120	101687	0.00	289
121	101787	0.00	290
122	101887	0.02	291
123	101987	0.00	292
124	102087	0.00	293
125	102187	0.02	294
126	102287	0.19	295
127	102387	0.09	296
128	102487	0.03	297
129	102587	0.03	298
130	102687	0.08	299
131	102787	0.00	300
132	102887	0.03	301
133	102987	0.08	302
134	103087	0.02	303
135	103187	0.00	304
136	110187	0.00	305
137	110287	0.10	306
138	110387	0.03	307
139	110487	0.01	308
140	110587	0.00	309
141	110687	0.00	310
142	110787	0.00	311
143	110887	0.00	312
144	110987	0.00	313
145	111087	0.00	314
146	111187	0.00	315
147	111287	0.18	316
148	111387	0.00	317
149	111487	0.02	318
150	111587	0.01	319
151	111687	0.01	320
152	111787	0.00	321

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
153	111887	0.27	322
154	111987	0.01	323
155	112087	0.01	324
156	112187	3.00	325
157	112287	0.92	326
158	112387	0.09	327
159	112487	0.35	328
160	112587	0.09	329
161	112687	0.11	330
162	112787	0.01	331
163	112887	0.01	332
164	112987	0.00	333
165	113087	0.09	334
166	120187	0.03	335
167	120287	0.01	336
168	120387	0.00	337
169	120487	0.00	338
170	120587	0.00	339
171	120687	0.00	340
172	120787	0.03	341
173	120887	0.05	342
174	120987	0.01	343
175	121087	0.01	344
176	121187	0.12	345
177	121287	2.03	346
178	121387	10.70	347
179	121487	3.32	348
180	121587	0.41	349
181	121687	0.45	350
182	121787	0.31	351
183	121887	1.64	352
184	121987	5.00	353
185	122087	0.05	354
186	122187	0.02	355
187	122287	0.11	356
188	122387	0.08	357
189	122487	0.05	358
190	122587	0.02	359
191	122687	0.00	360
192	122787	0.10	361
193	122887	0.16	362
194	122987	0.11	363
195	123087	0.15	364
196	123187	0.03	365
197	10188	0.20	366
198	10288	2.11	367
199	10388	0.01	368
200	10488	0.00	369
201	10588	0.01	370
202	10688	0.00	371
203	10788	0.01	372

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
204	10888	0.00	373
205	10988	0.00	374
206	11088	0.00	375
207	11188	0.27	376
208	11288	0.01	377
209	11388	0.01	378
210	11488	0.00	379
211	11588	0.02	380
212	11688	0.06	381
213	11788	0.10	382
214	11888	0.01	383
215	11988	0.01	384
216	12088	0.00	385
217	12188	0.01	386
218	12288	0.02	387
219	12388	0.02	388
220	12488	0.03	389
221	12588	0.01	390
222	12688	0.00	391
223	12788	0.01	392
224	12888	0.02	393
225	12988	0.20	394
226	13088	0.40	395
227	13188	0.05	396
228	20188	0.02	397
229	20288	0.01	398
230	20388	0.00	399
231	20488	0.00	400
232	20588	0.04	401
233	20688	0.00	402
234	20788	0.00	403
235	20888	0.04	404
236	20988	0.15	405
237	21088	0.09	406
238	21188	0.03	407
239	21288	0.01	408
240	21388	0.12	409
241	21488	0.01	410
242	21588	0.30	411
243	21688	0.43	412
244	21788	0.01	413
245	21888	0.04	414
246	21988	0.00	415
247	22088	0.00	416
248	22188	0.02	417
249	22288	0.00	418
250	22388	0.15	419
251	22488	0.17	420
252	22588	0.01	421
253	22688	0.38	422
254	22788	0.05	423

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
255	22888	0.18	424
256	22988	0.04	425
257	30188	0.02	426
258	30288	0.01	427
259	30388	0.01	428
260	30488	0.00	429
261	30588	0.00	430
262	30688	0.05	431
263	30788	0.01	432
264	30888	0.01	433
265	30988	0.28	434
266	31088	0.02	435
267	31188	0.00	436
268	31288	0.00	437
269	31388	0.00	438
270	31488	0.00	439
271	31588	0.04	440
272	31688	0.37	441
273	31788	0.01	442
274	31888	0.05	443
275	31988	0.00	444
276	32088	0.00	445
277	32188	0.04	446
278	32288	0.07	447
279	32388	0.14	448
280	32488	0.28	449
281	32588	0.21	450
282	32688	0.48	451
283	32788	0.51	452
284	32888	0.07	453
285	32988	0.18	454
286	33088	0.06	455
287	33188	0.57	456
288	40188	0.10	457
289	40288	0.02	458
290	40388	0.05	459
291	40488	0.03	460
292	40588	0.20	461
293	40688	0.02	462
294	40788	0.07	463
295	40888	0.00	464
296	40988	0.03	465
297	41088	0.00	466
298	41188	0.46	467
299	41288	0.00	468
300	41388	0.00	469
301	41488	0.00	470
302	41588	0.00	471
303	41888	0.00	474
304	41988	0.00	475
305	42088	0.00	476

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
306	42188	0.00	477
307	42288	0.13	478
308	42388	0.03	479
309	42488	0.03	480
310	42588	0.00	481
311	42688	0.00	482
312	42788	0.03	483
313	42888	0.01	484
314	42988	0.08	485
315	43088	0.00	486
316	50188	0.12	487
317	50288	0.05	488
318	50388	0.12	489
319	50488	0.08	490
320	50588	0.11	491
321	50688	0.03	492
322	50788	0.08	493
323	50888	0.04	494
324	50988	0.00	495
325	51088	0.01	496
326	51188	0.14	497
327	51288	0.01	498
328	51388	0.01	499
329	51488	0.00	500
330	51588	0.00	501
331	51688	0.00	502
332	51788	0.00	503
333	51888	0.01	504
334	51988	0.00	505
335	52088	0.00	506
336	52188	0.00	507
337	52288	0.00	508
338	52388	0.00	509
339	52488	0.00	510
340	52588	0.00	511
341	52688	0.00	512
342	52788	0.00	513
343	52888	0.00	514
344	52988	0.30	515
345	53088	0.01	516
346	53188	0.00	517
347	60188	0.01	518
348	60288	0.00	519
349	60388	0.00	520
350	60488	0.00	521
351	60588	0.02	522
352	60688	0.03	523
353	60788	0.04	524
354	60888	0.07	525
355	60988	0.02	526
356	61088	0.05	527

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
357	61188	0.05	528
358	61288	0.01	529
359	61388	0.00	530
360	61488	0.00	531
361	61588	0.00	532
362	61688	0.00	533
363	61788	0.00	534
364	61888	0.01	535
365	61988	0.00	536
366	62088	0.00	537
367	62188	0.00	538
368	62288	0.00	539
369	62388	0.00	540
370	62488	0.00	541
371	62588	0.00	542
372	62688	0.00	543
373	62788	0.00	544
374	62888	0.00	545
375	62988	0.00	546
376	63088	0.00	547
377	70188	0.00	548
378	70288	0.00	549
379	70388	0.00	550
380	70488	0.00	551
381	70588	0.10	552
382	70688	0.00	553
383	70788	0.02	554
384	70888	0.00	555
385	70988	0.26	556
386	71088	0.13	557
387	71188	0.01	558
388	71288	0.00	559
389	71388	0.00	560
390	71488	0.00	561
391	71588	0.00	562
392	71688	0.00	563
393	71788	0.00	564
394	71888	0.00	565
395	71988	0.00	566
396	72088	0.00	567
397	72188	0.07	568
398	72288	0.00	569
399	72388	0.00	570
400	72488	0.01	571
401	72588	0.05	572
402	72688	0.00	573
403	72788	0.00	574
404	72888	0.00	575
405	72988	0.00	576
406	73088	0.00	577
407	73188	0.00	578

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
408	80188	0.00	579
409	80288	0.00	580
410	80388	0.17	581
411	80488	0.01	582
412	80588	0.00	583
413	80688	0.25	584
414	80788	2.20	585
415	80888	0.85	586
416	80988	0.00	587
417	81088	0.00	588
418	81188	0.05	589
419	81288	0.95	590
420	81388	0.03	591
421	81488	0.00	592
422	81588	0.00	593
423	81688	0.00	594
424	81788	0.05	595
425	81888	0.00	596
426	81988	0.00	597
427	82088	0.02	598
428	82188	0.00	599
429	82288	0.02	600
430	82388	0.00	601
431	82488	0.00	602
432	82588	0.00	603
433	82688	0.00	604
434	82788	0.00	605
435	82888	0.00	606
436	82988	0.01	607
437	83088	0.00	608
438	83188	0.00	609
439	90188	0.00	610
440	90288	0.00	611
441	90388	0.00	612
442	90488	0.00	613
443	90588	0.00	614
444	90688	0.72	615
445	90788	0.01	616
446	90888	0.07	617
447	90988	0.00	618
448	91088	0.00	619
449	91188	0.00	620
450	91288	0.20	621
451	91388	0.01	622
452	91488	0.00	623
453	91588	0.00	624
454	91688	0.00	625
455	91788	0.00	626
456	91888	0.00	627
457	91988	0.00	628
458	92088	0.04	629

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
459	92188	0.01	630
460	92288	0.00	631
461	92388	0.00	632
462	92488	0.00	633
463	92588	0.00	634
464	92688	0.00	635
465	92788	0.14	636
466	92888	0.01	637
467	92988	0.03	638
468	93088	0.12	639
469	100188	0.00	640
470	100288	0.00	641
471	100388	0.00	642
472	100488	0.00	643
473	100588	0.00	644
474	100688	0.03	645
475	100788	0.02	646
476	100888	0.00	647
477	100988	0.00	648
478	101088	0.00	649
479	101188	0.00	650
480	101288	0.00	651
481	101388	0.14	652
482	101488	0.00	653
483	101588	0.00	654
484	101788	0.95	656
485	101888	1.65	657
486	101988	0.11	658
487	102088	0.19	659
488	102188	0.01	660
489	102288	0.58	661
490	102388	0.48	662
491	102488	0.15	663
492	102588	0.02	664
493	102688	0.00	665
494	102788	0.00	666
495	102888	0.01	667
496	102988	0.00	668
497	103088	0.00	669
498	103188	0.00	670
499	110188	0.00	671
500	110288	0.00	672
501	110388	0.03	673
502	110488	0.24	674
503	110588	6.10	675
504	110688	0.75	676
505	110788	0.03	677
506	110888	0.00	678
507	110988	0.00	679
508	111088	0.21	680
509	111188	0.55	681

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
510	111288	0.02	682
511	111388	0.02	683
512	111488	0.04	684
513	111588	1.10	685
514	111688	0.01	686
515	111788	0.00	687
516	111888	0.17	688
517	111988	0.00	689
518	112088	0.02	690
519	112188	0.05	691
520	112288	0.03	692
521	112388	0.66	693
522	112488	0.31	694
523	112588	0.00	695
524	112688	0.30	696
525	112788	0.00	697
526	112888	0.02	698
527	112988	0.00	699
528	113088	0.05	700
529	120188	0.02	701
530	120288	0.00	702
531	120388	0.00	703
532	120488	0.07	704
533	120588	0.00	705
534	120688	0.07	706
535	120788	0.11	707
536	120888	0.01	708
537	120988	0.00	709
538	121088	0.00	710
539	121188	0.05	711
540	121288	0.00	712
541	121388	0.00	713
542	121488	0.00	714
543	121588	0.00	715
544	121688	0.00	716
545	121788	0.61	717
546	121888	0.12	718
547	121988	0.65	719
548	122088	0.09	720
549	122188	0.15	721
550	122288	0.08	722
551	122388	0.01	723
552	122488	0.03	724
553	122688	1.24	726
554	122788	0.00	727
555	122888	0.03	728
556	122988	0.80	729
557	123088	1.10	730
558	123188	3.00	731
559	10189	0.90	732
560	10289	0.20	733

Rainfall at the Uwekahuna Vault

Sample	Date	Rain(in)	Day
561	10389	0.11	734
562	10489	0.12	735
563	10589	0.00	736
564	10689	0.00	737
565	10789	0.00	738
566	10889	1.83	739
567	10989	0.88	740
568	11089	0.91	741
569	11189	2.61	742
570	11289	0.24	743
571	11389	1.30	744
572	11489	1.64	745
573	11589	1.33	746
574	11689	1.58	747
575	11789	0.09	748
576	11889	0.03	749
577	11989	0.01	750
578	12089	0.01	751
579	12189	0.12	752
580	12389	0.03	754
581	12489	0.10	755
582	12589	0.54	756
583	12689	0.00	757
584	12789	0.00	758
585	12889	0.17	759
586	12989	0.01	760
587	13089	0.00	761
588	13189	0.20	762
589	20189	0.00	763
590	20289	0.00	764
591	20389	0.60	765
592	20489	0.50	766
593	20589	0.15	767
594	20689	1.29	768
595	20789	0.63	769
596	20889	0.12	770
597	20989	0.02	771
598	21089	1.36	772
599	21189	1.10	773
600	21289	1.08	774
601	21389	0.01	775
602	21489	0.00	776
603	21589	0.18	777
604	21689	0.00	778
605	21789	0.00	779