TABLE A. CHEMICAL AND ISOTOPIC COMPOSITION OF FUMAROLIC VAPOR AND HOT-SPRING WATER FROM SATSUMA IWOJIMA

Feature	Date (d/mo/yr)	T (°C)	pH	Na (mg/kg)	K	Mg	Ca	Sr	Ba	Al	Fe	Mn	As	Sb
FUMAROLES														
Ohachi-oku A	24.10.90	877		12	2.1	0.08	0.19	0.001	0.003	1.33	0.62	<0.01	1.74	0.02
Ohachi-oku B	27.10.90	877		6.3	1.3	0.15	0.41	0.002	0.003	1.13	0.81	<0.01	1.81	0.025
Ohachi-fuchi 1	27.10.90	505		6.1	1.2	0.064	0.284	0.002	0.038	0.065	0.062	0.001	4.55	
Ohachi-fuchi 2	27.10.90	165		8.3	1.5	0.061	0.099	0.0004	0.008	0.397	0.238	0.0003	1.52	<0.01
Kuromoe	24.10.90	705		15	4.8	0.15	16.2	0.008	0.011	3.74	1.18	<0.01	3.27	0.03
Kamanokuchi 1	26.10.90	330		8.7	1.1	0.05	0.2	0.002	0.008	1.51	0.12	0.003	3.96	
Kamanokuchi 2	26.10.90	105		6.9	1	0.04	0.34	0.002	0.009	0.41	0.06	0.002	1.71	
Monogusa	26.10.90	102		2.8	0.2	0.05	0.07	0.0007	0.002	0.024	0.034	0.003	<0.01	<0.01
Kitabirashita	25.10.90	99.3		4.4	0.3	0.08	0.25	4	0.005	0.093	0.039	<0.01	0.04	0.02
HOT SPRINGS														
Heikenojo 1	28.10.90	58	1.31	448	209	62.9	189			815	182	7.54		
Heikenojo 2	28.10.90	68	1.18	808	270	100	243	3.1	0.08	1130	360	1.06	0.85	0.07
Ketsunohama	21.10.90	70.5	1.12	1060	296	225	315			1440	375			
Yunotaki 1	28.10.90	60.1	1.57	603	166	57.6	314	1.48	0.005	710	120		0.29	<0.05
Yunotaki 2	28.10.90	42.2	1.78	458	145	98.1	341			398	140	1.45		
Higashi 1	24.10.90	55.1	1.52	265	105	27.8	127.2	0.8	0.037	442	100		0.49	<0.05
Higashi 2	24.10.90	49	1.7	490	95	54	197	0.89	0.01	396				
Kitabirashita 1	25.10.90	53.4	1.47	1150	140	1320	250			760	16000	340		
Kitabirashita 2	25.10.90	48.7	1.62	1436	68	713	204			533	651	86.7		
Sakamoto	23.10.90	56.6	6.02	2745	135	335	183				0.0025	0.0001		
WELLS														
Shobodan	26.10.90	36	6.47	116	19									
Kaihatsu Center	28.10.90		6.1	144	16									
Tapwater	28.10.90		6.4	41	5.5									
SEAWATER				10770	380	1290	412	7.9	0.014	0.002	0.002	0.0001	0.0023	0.0002

(continued) Feature	Pb (mg/kg)	Zn	Cu	Mo	Sn	Aux10^6	B	SiO_2	SO_4	Cl	F	$\delta^{18}O$ (‰)	δD (‰)
FUMAROLES													
Ohachi-oku A	1.04	0.15	0.03	0.43	0.48	1.51	10.7		53820	13670	355	6.3	-23
Ohachi-oku B	1.43	0.17	0.009	1.07	0.57	6.5	18.07		56650	10480	368	6.8	-26
Ohachi-fuchi 1	1.27	0.064	0.064	0.03	0.66	2.77	13.7		77210	34220	255	7.7	-23
Ohachi-fuchi 2	<0.01	0.012	0.013	0.005	0.2	32.3	7.43		58420	5670	456	7.6	-19
Kuromoe	1.77	0.24	0.036	0.16	0.78	2.18	29		61260	11800	488	6.7	-25
Kamanokuchi 1	0.24	0.027	0.006	<0.01	0.33	1.93	28.1		63400	20720	154	9.1	-17
Kamanokuchi 2	0.038	0.06	0.02	0.01	0.08	0.8	0.84		72170	12140	410	7.7	-17
Monogusa	0.014	0.027	0.003	<0.01	<0.01	4.27	0.09	4.16	82530	38	0.38	-1	-29
Kitabirashita	<0.01	0.03	0.007	<0.01	0.03	2.54	0.01	11.1	85230	4	2.18	-7.7	-56
HOT SPRINGS													
Heikenojo 1	0.13	0.66	0.002	<0.02			1.2		5060	1185		-2.7	-23
Heikenojo 2	0.07	0.74	0.014	0.133		56	3.23	205	11920	2640	11.0	-2.3	-21
Ketsunohama								274	14600	2960			
Yunotaki 1	0.24	0.72	0.019	0.17			3.29	315	7430	1847	10.0	-0.2	-19
Yunotaki 2		0.34	0.4	0.018	0.12		2.62	268	4390	1650		-1.8	-22
Higashi 1		0.15	<0.01	0.113			2.22	230	4710	1020	11.0	-4.2	-30
Higashi 2				0.142			0.84	290	4770	735		-1.9	-21
Kitabirashita 1	0.15	12.9		0.74			1.11	194	18680	2740	5.0	1.3	-20
Kitabirashita 2	0.08	5.6	0.013			182	0.86		13540	347		-3	-26
Sakamoto	0.0045						1.45		840	5430	0.3	-3.6	-22
WELLS													
Shobodan									87.3	206	0.4	-5.1	-28
Kaihatsu Center									105	256		-5.3	-32
Tapwater									24.1	78.2		-5	-28
SEAWATER	<0.001	<0.004	<0.002	0.01	<0.001	4.0	4.6	2	2710	18950	1.3	0	0

Note: Fumarolic vapors collected through silica glass tubes (with a tube-in-tube design to reduce entrainment of rock particles) and silicon rubber tubing into a pyrex condensor (sitting in an ice-water bath). Condensates and hot-spring waters were analyzed by wet chemistry and inductively coupled plasma spectrometry; Au was analyzed by neutron activation. Some missing values due to interference from Fe and Al. The Kitabirashita seeps have low flows, with local precipitation and dissolution of efflorescent salts. Ketsunohama analysis from Nogami et al. (1993). Cl, SO_4 and isotopic data from Shinohara et al. (1993). Ohachi-oku A and B are duplicate samples from the same vent. Concentrations in mg/kg, except Au (ng/kg) and δ (‰).

TABLE B. AVERAGE COMPOSITION AND COMPONENT FLUX FOR FUMAROLES AND ACIDIC SPRINGS

	Acidic springs (pH 1.2-1.6, 55-68 °C)		Fumaroles (>700 °C)	
	(mg/kg)	(t/yr)	(mg/kg)	(t/yr)
H_2O		20×10^6		5.2×10^6
S_T	2470	5.0×10^4	17,400	9.4×10^4
Cl	1800	3.6×10^4	11,400	6.2×10^4
B	2.2	4.4×10^1	20	1.1×10^2
Al	600	1.2×10^4	2.5	1.4×10^1
Fe	300	6.0×10^3	0.95	5.1×10^0
As	0.5	1.0×10^1	2.5	1.4×10^1
Sb	0.05	1.0×10^0	0.025	1.3×10^{-1}
Pb	0.15	3.0×10^0	1.5	8.1×10^0
Zn	0.7	1.4×10^1	0.16	8.7×10^{-1}
Cu	0.015	3.0×10^{-1}	0.03	1.6×10^{-1}
Mo	0.14	2.8×10^0	0.5	2.7×10^0
Sn	0.1	2.0×10^0	0.6	3.2×10^0
Au	5.6×10^{-5}	1.1×10^{-3}	3×10^{-6}	1.6×10^{-5}
Molal ratios				
S/Cl	1.5		1.7	
Na/S	0.34		1.0×10^{-3}	

Note: Average chemical composition of springs based on pH <1.6 samples from Heikenojo, Yunotaki and Higashi, whereas high-temperature vapor composition was based on Ohachi-oku and Kuromoe fumaroles. Data from Kamada (1964; spring flow), Kazahaya et al., (1992; SO_2 flux), Shinohara et al. (1993; fumarole gas composition) and this study (Table A). For comparison, the S/Cl and Na/S ratios of aerosols erupted from White Island are 1.8 and 3.3×10^{-2}, respectively.