

Supplementary Material  
 The control of magma crystallinity on the fluctuations in gas composition at open vent basaltic volcanoes  
*J Woitischek, M Edmonds, A.W. Woods*

**Table 1** Molar fraction of volcanic gases (excluding H<sub>2</sub>O) emitted from Yasur Volcano in 350 seconds shown in 236 measurements, Vanuatu during active and passive phases in July 2018. The sample abbreviation can be understood as sampling date and time as follows: year\_month\_day\_hour and minute\_seconds<sup>5</sup>

<i>sample</i>	<i>SO<sub>2</sub></i>	<i>HCl</i>	<i>CO<sub>2</sub></i>	<i>sample</i>	<i>SO<sub>2</sub></i>	<i>HCl</i>	<i>CO<sub>2</sub></i>
18_07_16_0641_49	0.10	0.11	0.79	18_07_16_0645_38	0.10	0.22	0.68
18_07_16_0641_51	0.06	0.07	0.87	18_07_16_0645_40	0.07	0.11	0.82
18_07_16_0641_53	0.19	0.21	0.61	18_07_16_0645_41	0.24	0.19	0.57
18_07_16_0641_54	0.07	0.10	0.83	18_07_16_0645_43	0.10	0.09	0.81
18_07_16_0641_56	0.07	0.08	0.85	18_07_16_0645_46	0.11	0.43	0.45
18_07_16_0641_57	0.07	0.14	0.79	18_07_16_0645_48	0.10	0.18	0.72
18_07_16_0641_59	0.09	0.17	0.74	18_07_16_0645_49	0.11	0.30	0.59
18_07_16_0642_00	0.15	0.30	0.55	18_07_16_0645_52	0.12	0.15	0.73
18_07_16_0642_02	0.08	0.12	0.81	18_07_16_0645_54	0.09	0.16	0.75
18_07_16_0642_04	0.09	0.15	0.76	18_07_16_0645_56	0.12	0.20	0.68
18_07_16_0642_05	0.09	0.11	0.79	18_07_16_0645_57	0.09	0.15	0.76
18_07_16_0642_07	0.07	0.14	0.79	18_07_16_0645_59	0.09	0.18	0.73
18_07_16_0642_08	0.08	0.10	0.82	18_07_16_0646_02	0.30	0.31	0.39
18_07_16_0642_10	0.10	0.14	0.77	18_07_16_0646_05	0.09	0.23	0.68
18_07_16_0642_11	0.08	0.10	0.82	18_07_16_0646_08	0.10	0.27	0.64
18_07_16_0642_13	0.06	0.08	0.85	18_07_16_0646_10	0.06	0.08	0.86
18_07_16_0642_15	0.15	0.25	0.61	18_07_16_0646_11	0.05	0.14	0.81
18_07_16_0642_16	0.06	0.08	0.87	18_07_16_0646_14	0.10	0.18	0.72
18_07_16_0642_18	0.06	0.13	0.81	18_07_16_0646_16	0.11	0.22	0.67
18_07_16_0642_21	0.23	0.46	0.31	18_07_16_0646_17	0.09	0.14	0.77

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18_07_16_0642_22	0.07	0.14	0.79	18_07_16_0646_22	0.08	0.12	0.80
18_07_16_0642_25	0.09	0.12	0.79	18_07_16_0646_24	0.08	0.13	0.80
18_07_16_0642_29	0.15	0.19	0.66	18_07_16_0646_25	0.09	0.09	0.82
18_07_16_0642_30	0.10	0.13	0.77	18_07_16_0646_27	0.08	0.13	0.78
18_07_16_0642_32	0.08	0.09	0.82	18_07_16_0646_28	0.13	0.15	0.72
18_07_16_0642_33	0.15	0.18	0.66	18_07_16_0646_30	0.08	0.15	0.77
18_07_16_0642_36	0.43	0.49	0.07	18_07_16_0646_33	0.10	0.17	0.73
18_07_16_0642_38	0.08	0.15	0.76	18_07_16_0646_36	0.09	0.14	0.77
18_07_16_0642_44	0.12	0.13	0.75	18_07_16_0646_39	0.08	0.12	0.80
18_07_16_0642_46	0.18	0.19	0.64	18_07_16_0646_41	0.07	0.14	0.79
18_07_16_0642_47	0.14	0.21	0.65	18_07_16_0646_43	0.09	0.15	0.76
18_07_16_0642_49	0.14	0.17	0.69	18_07_16_0646_44	0.08	0.14	0.79
18_07_16_0642_51	0.21	0.79	0.00	18_07_16_0646_47	0.11	0.11	0.78
18_07_16_0642_52	0.12	0.18	0.69	18_07_16_0646_49	0.12	0.13	0.76
18_07_16_0642_54	0.13	0.22	0.65	18_07_16_0646_50	0.08	0.13	0.79
18_07_16_0642_57	0.15	0.24	0.61	18_07_16_0646_52	0.13	0.24	0.63
18_07_16_0642_58	0.11	0.15	0.74	18_07_16_0646_53	0.08	0.13	0.78
18_07_16_0643_00	0.17	0.27	0.56	18_07_16_0646_55	0.10	0.15	0.75
18_07_16_0643_02	0.11	0.21	0.68	18_07_16_0646_57	0.09	0.18	0.73
18_07_16_0643_03	0.12	0.12	0.76	18_07_16_0646_58	0.18	0.32	0.50
18_07_16_0643_05	0.15	0.16	0.69	18_07_16_0647_00	0.10	0.17	0.73
18_07_16_0643_06	0.09	0.20	0.71	18_07_16_0647_01	0.13	0.13	0.75
18_07_16_0643_08	0.12	0.20	0.68	18_07_16_0647_05	0.10	0.15	0.75
18_07_16_0643_09	0.11	0.22	0.67	18_07_16_0647_06	0.12	0.10	0.78
18_07_16_0643_12	0.15	0.39	0.46	18_07_16_0647_08	0.12	0.14	0.74
18_07_16_0643_16	0.16	0.17	0.67	18_07_16_0647_09	0.14	0.11	0.75
18_07_16_0643_19	0.11	0.18	0.71	18_07_16_0647_11	0.17	0.12	0.70
18_07_16_0643_20	0.19	0.17	0.63	18_07_16_0647_12	0.16	0.15	0.69
18_07_16_0643_22	0.11	0.11	0.78	18_07_16_0647_14	0.17	0.19	0.64
18_07_16_0643_24	0.08	0.15	0.77	18_07_16_0647_15	0.15	0.21	0.64

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18_07_16_0643_25	0.10	0.11	0.79	18_07_16_0647_17	0.20	0.21	0.59
18_07_16_0643_28	0.08	0.09	0.83	18_07_16_0647_20	0.15	0.16	0.69
18_07_16_0643_30	0.14	0.18	0.68	18_07_16_0647_23	0.14	0.17	0.69
18_07_16_0643_33	0.08	0.09	0.83	18_07_16_0647_26	0.14	0.18	0.68
18_07_16_0643_36	0.09	0.12	0.79	18_07_16_0647_31	0.17	0.21	0.62
18_07_16_0643_38	0.10	0.09	0.81	18_07_16_0647_33	0.18	0.19	0.63
18_07_16_0643_39	0.09	0.16	0.75	18_07_16_0647_34	0.15	0.13	0.72
18_07_16_0643_41	0.14	0.14	0.72	18_07_16_0647_36	0.20	0.18	0.63
18_07_16_0643_42	0.13	0.22	0.65	18_07_16_0647_37	0.23	0.20	0.57
18_07_16_0643_44	0.10	0.12	0.78	18_07_16_0647_39	0.16	0.16	0.68
18_07_16_0643_47	0.10	0.10	0.80	18_07_16_0647_42	0.13	0.17	0.71
18_07_16_0643_49	0.10	0.17	0.74	18_07_16_0647_45	0.14	0.22	0.63
18_07_16_0643_50	0.15	0.22	0.62	18_07_16_0647_47	0.15	0.20	0.64
18_07_16_0643_52	0.09	0.10	0.81	18_07_16_0647_48	0.15	0.22	0.63
18_07_16_0643_53	0.14	0.17	0.69	18_07_16_0647_50	0.16	0.16	0.67
18_07_16_0643_55	0.10	0.19	0.71	18_07_16_0647_55	0.13	0.14	0.73
18_07_16_0643_56	0.18	0.17	0.65	18_07_16_0648_07	0.35	0.65	0.00
18_07_16_0643_58	0.12	0.12	0.77	18_07_16_0648_09	0.13	0.17	0.70
18_07_16_0644_00	0.10	0.16	0.73	18_07_16_0648_20	0.12	0.31	0.57
18_07_16_0644_03	0.11	0.17	0.73	18_07_16_0648_23	0.17	0.23	0.60
18_07_16_0644_06	0.11	0.19	0.70	18_07_16_0648_26	0.17	0.31	0.53
18_07_16_0644_07	0.16	0.25	0.59	18_07_16_0648_28	0.10	0.18	0.72
18_07_16_0644_09	0.14	0.22	0.64	18_07_16_0648_29	0.10	0.22	0.68
18_07_16_0644_11	0.18	0.18	0.63	18_07_16_0648_31	0.09	0.18	0.73
18_07_16_0644_12	0.13	0.14	0.72	18_07_16_0648_32	0.10	0.10	0.80
18_07_16_0644_14	0.10	0.18	0.72	18_07_16_0648_34	0.14	0.14	0.71
18_07_16_0644_15	0.10	0.18	0.72	18_07_16_0648_35	0.11	0.12	0.77
18_07_16_0644_18	0.09	0.10	0.81	18_07_16_0648_39	0.14	0.09	0.77
18_07_16_0644_20	0.14	0.20	0.66	18_07_16_0648_40	0.16	0.16	0.68
18_07_16_0644_21	0.12	0.17	0.72	18_07_16_0648_42	0.23	0.22	0.55

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18_07_16_0644_23	0.18	0.25	0.57	18_07_16_0648_45	0.12	0.17	0.71
18_07_16_0644_26	0.12	0.16	0.72	18_07_16_0648_48	0.09	0.15	0.76
18_07_16_0644_29	0.12	0.15	0.72	18_07_16_0648_51	0.15	0.16	0.69
18_07_16_0644_31	0.16	0.18	0.66	18_07_16_0648_54	0.17	0.17	0.67
18_07_16_0644_32	0.18	0.20	0.63	18_07_16_0648_57	0.11	0.15	0.74
18_07_16_0644_34	0.17	0.22	0.62	18_07_16_0648_59	0.10	0.18	0.72
18_07_16_0644_36	0.18	0.18	0.64	18_07_16_0649_00	0.09	0.13	0.78
18_07_16_0644_37	0.17	0.19	0.64	18_07_16_0649_04	0.12	0.13	0.74
18_07_16_0644_39	0.16	0.18	0.66	18_07_16_0649_05	0.15	0.12	0.73
18_07_16_0644_40	0.16	0.21	0.63	18_07_16_0649_08	0.15	0.28	0.57
18_07_16_0644_42	0.22	0.23	0.55	18_07_16_0649_11	0.33	0.26	0.41
18_07_16_0644_43	0.17	0.17	0.66	18_07_16_0649_15	0.15	0.21	0.63
18_07_16_0644_45	0.17	0.20	0.63	18_07_16_0649_18	0.13	0.27	0.60
18_07_16_0644_47	0.16	0.19	0.65	18_07_16_0649_21	0.09	0.08	0.83
18_07_16_0644_48	0.20	0.27	0.53	18_07_16_0649_22	0.09	0.08	0.83
18_07_16_0644_50	0.16	0.19	0.65	18_07_16_0649_26	0.09	0.18	0.73
18_07_16_0644_51	0.20	0.27	0.53	18_07_16_0649_35	0.14	0.19	0.67
18_07_16_0644_53	0.15	0.20	0.64	18_07_16_0649_36	0.10	0.11	0.79
18_07_16_0644_54	0.19	0.18	0.64	18_07_16_0649_40	0.07	0.15	0.78
18_07_16_0644_56	0.18	0.25	0.57	18_07_16_0649_43	0.08	0.17	0.75
18_07_16_0644_58	0.13	0.17	0.69	18_07_16_0649_44	0.08	0.20	0.71
18_07_16_0644_59	0.14	0.18	0.68	18_07_16_0649_48	0.08	0.12	0.80
18_07_16_0645_01	0.12	0.16	0.73	18_07_16_0649_5	0.11	0.13	0.76
18_07_16_0645_02	0.11	0.14	0.75	18_07_16_0649_52	0.11	0.12	0.77
18_07_16_0645_04	0.12	0.11	0.77	18_07_16_0649_54	0.13	0.20	0.67
18_07_16_0645_05	0.11	0.15	0.74	18_07_16_0649_55	0.12	0.16	0.72
18_07_16_0645_07	0.26	0.32	0.42	18_07_16_0649_57	0.12	0.13	0.75
18_07_16_0645_08	0.09	0.15	0.76	18_07_16_0650_00	0.15	0.14	0.71
18_07_16_0645_12	0.10	0.15	0.75	18_07_16_0650_02	0.14	0.21	0.65
18_07_16_0645_15	0.06	0.07	0.87	18_07_16_0650_05	0.15	0.14	0.71

18_07_16_0645_16	0.06	0.06	0.88	18_07_16_0650_06	0.17	0.22	0.61
18_07_16_0645_18	0.07	0.08	0.86	18_07_16_0650_08	0.16	0.13	0.70
18_07_16_0645_19	0.06	0.17	0.78	18_07_16_0650_09	0.15	0.21	0.64
18_07_16_0645_23	0.05	0.06	0.88	18_07_16_0650_11	0.14	0.23	0.63
18_07_16_0645_26	0.37	0.52	0.11	18_07_16_0650_13	0.19	0.15	0.66
18_07_16_0645_29	0.10	0.20	0.70	18_07_16_0650_14	0.15	0.13	0.72
18_07_16_0645_30	0.05	0.09	0.86	18_07_16_0656_03	0.14	0.12	0.74
18_07_16_0645_32	0.05	0.09	0.86	18_07_16_0656_47	0.07	0.10	0.83
18_07_16_0645_35	0.07	0.21	0.72				

*data for figure 1a and b in main paper*

**Table 2** Mean molar ratios of active and passive phases measured at Erebus<sup>4,17</sup>, Stromboli<sup>2</sup> and Yasur<sup>1,5</sup>. Some mean ratios are given with the standard deviation. n represents the approximate number of all measurements including active and passive degassing phases

Volcano	n	Active		Passive	
		CO <sub>2</sub> /SO <sub>2</sub>	SO <sub>2</sub> /HCl	CO <sub>2</sub> /SO <sub>2</sub>	SO <sub>2</sub> /HCl
<i>Erebus</i>	546	169 ± 83	1.18 ± 0.24	1.30	2.68
<i>Stromboli</i>	28880	10.4 ± 1.04	9.40 ± 1.6	3.90	2.00
<i>Yasur*</i>	477	2.85 ± 0.25	1.5 ± 0.20	1.96 ± 0.20	0.5 ± 0.30
<i>Yasur</i>	2800	2	30	2	1

*Data for figure 1c in the main text*

*Erebus*: Passive gas data from <sup>4</sup> were measured by OP-FTIR during 4200 seconds in December 2004 and a spectra was collected every 8 seconds. Active data were measured by <sup>17</sup> and we used the average gas composition of 21 explosive events of type bubble I and II in 2005, 2006 and 2013.

*Stromboli*: Active and passive data measured by <sup>2</sup> with OP-FTIR during 11,520 seconds in 2002 with a time temporal resolution of 4 seconds.

*Yasur\**: S/Cl ratios from table 1 measured during 241 seconds in 2018; CO<sub>2</sub>/S ratios for active and passive were measured during 222 seconds and 477 seconds, respectively in 2018 (Woitischek et al., in review).

*Yasur*: Passive and active phases was measured in 2006 by <sup>1</sup> with OP-FTIR over 2480 seconds.

Table 3 Melt inclusion composition of Stromboli and Yasur in wt. %.

<b>Volcano</b>	<i>SiO<sub>2</sub></i>	<i>Al<sub>2</sub>O<sub>3</sub></i>	<i>CaO</i>	<i>K<sub>2</sub>O</i>	<i>Na<sub>2</sub>O</i>	<i>MgO</i>	<i>FeO</i>	<i>H<sub>2</sub>O</i>	<i>CO<sub>2</sub></i>	<i>S</i>	<i>Cl</i>
<i>Stromboli</i>	48.24	15.43	15.19	1.71	2.46	4.28	6.97	3.0	2.0	0.25	0.22
<i>Yasur</i>	49.53	16.94	10.04	1.09	3.22	4.85	9.03	1.0	0.30	0.09	0.05

*Data used in <sup>20</sup> for figure 1d in the main text*

*Stromboli* was measured by <sup>9</sup>, the CO<sub>2</sub> composition is from <sup>36</sup>

*Stromboli* was measured by <sup>8</sup>, the CO<sub>2</sub> composition is from <sup>5</sup>

### **Additional Reference**

36 Aiuppa, S. et al. A model of degassing for Stromboli volcano. *Earth Planet. Sci. Lett.* **295**, 195-204 (2010).