

## Appendix 1-1. Whole-rock compositions and modal compositions.

Total Fe expressed as Fe<sub>2</sub>O<sub>3</sub>. For plotting on the Harker diagrams (Fig. 5), FeO\* is calculated to be FeO + 0.8998 Fe<sub>2</sub>O<sub>3</sub>.

Mineral and groundmass (glass + microphenocryst + microlite) abundances are in vol.% (calculated on a vesicle-free basis) based on > 2000 point counts.

Loss on ignition (LOI) was measured by igniting the powdered samples at 900 °C for 2 h.

Abbreviations: Vol. Bl., volcanic block; tr, present in samples but not observed in point counts; n.d.: not detected.

Unit Sample No Location Rock Type	Hebei-ike Lava						Kagusa Lava						Shirane-higashi Lava						Mizugama Lava Dome			
	170812-1 Loc.1 Lava	170812-3 Loc.1 Lava	170902-2-1 Loc.2 Lava	160917-1 Loc.1 Lava	160917-2 Loc.1 Lava	160917-3 Loc.1 Lava	170901-5 Loc.4 Lava	170814-4 Loc.3 Lava	170901-6 Loc.4 Lava	170902-3-1 Loc.5 Lava	170902-3-2 Loc.5 Lava	160910-1 Loc.3 Lava	160910-2 Loc.3 Lava	160910-3 Loc.3 Lava	160911-1 Loc.3 Lava	170902-1-1 Loc.6 Lava	170902-1-2 Loc.6 Lava	170902-1-3(1) Loc.6 Lava	170902-1-3(2) Loc.6 Lava	131025-1 Loc.7 Lava	131025-2 Loc.7 Lava	131025-3 Loc.7 Lava
(wt.%)																						
SiO <sub>2</sub>	60.78	61.51	63.58	64.06	63.11	63.54	59.56	65.77	60.78	61.20	59.87	60.27	60.62	62.41	64.90	57.41	57.44	57.27		60.71	60.92	60.71
TiO <sub>2</sub>	0.70	0.69	0.57	0.55	0.57	0.61	0.65	0.53	0.62	0.63	0.64	0.63	0.63	0.59	0.55	0.72	0.73	0.73		0.67	0.67	0.66
Al <sub>2</sub> O <sub>3</sub>	15.90	16.05	15.63	15.41	15.28	15.27	16.07	15.11	16.01	16.09	16.00	15.94	15.88	15.68	15.12	16.84	16.88	16.92		16.23	16.05	16.10
FeO*	7.90	7.44	6.11	5.74	5.87	6.06	7.71	5.51	7.25	7.12	7.70	7.09	7.05	6.38	5.66	8.79	8.80	9.05		7.21	7.22	7.14
MnO	0.13	0.13	0.10	0.11	0.10	0.11	0.13	0.10	0.13	0.13	0.13	0.13	0.13	0.12	0.10	0.14	0.14	0.14		0.13	0.13	0.12
MgO	3.01	2.98	2.59	2.50	2.53	2.64	4.04	2.29	3.67	3.32	4.04	3.63	3.60	3.09	2.33	3.87	3.81	3.79	No data	3.06	3.10	3.09
CaO	6.21	5.89	5.38	5.17	5.25	5.20	6.92	4.68	6.52	6.07	6.98	6.69	6.67	5.98	4.86	7.11	7.07	6.97		6.29	6.17	6.20
Na <sub>2</sub> O	3.01	2.97	2.97	2.94	2.89	2.89	2.75	2.96	2.82	2.86	2.77	2.78	2.80	2.83	2.92	2.82	2.69	2.70		2.98	2.98	2.96
K <sub>2</sub> O	1.76	1.89	2.31	2.38	2.31	2.33	1.75	2.76	1.89	2.01	1.74	1.85	1.88	2.19	2.64	1.52	1.53	1.51		1.85	1.85	1.86
P <sub>2</sub> O <sub>5</sub>	0.16	0.11	0.12	0.12	0.12	0.11	0.14	0.11	0.13	0.12	0.15	0.14	0.15	0.13	0.12	0.19	0.20	0.20		0.18	0.17	0.17
Total	100.43	100.48	100.04	99.60	98.68	99.44	100.59	100.42	100.63	100.34	100.87	99.94	100.18	100.12	99.83	100.38	100.28	100.28		100.10	100.07	99.81
FeO*/MgO	2.63	2.50	2.36	2.30	2.32	2.29	1.91	2.41	1.97	2.15	1.91	1.95	1.96	2.06	2.43	2.27	2.31	2.39		2.36	2.33	2.31
LOI (%)	0.11	0.60	0.45	0.36	0.42	0.48	0.44	0.38	0.32	0.88	0.17	0.14	-0.06	0.14	0.16	0.08	0.80	0.77		0.23	0.13	0.20
(ppm)																						
Rb	50	46	58	62	58	41	41	76	49	51	45	43	46	59	69	36	35	35		46	50	47
Sr	257	246	232	219	222	257	273	208	264	252	277	264	263	242	209	319	318	316		283	279	282
Ni	13	13	13	10	12	16	25	12	22	20	24	22	18	18	12	24	22	23	No data	13	15	14
Y	22	23	24	25	26	24	23	25	22	23	20	22	22	24	26	21	21	20		23	21	21
Zr	103	106	128	135	125	100	94	146	101	111	98	100	101	114	137	84	88	86		108	110	109
V	205	177	147	138	140	184	192	126	186	175	195	173	173	153	135	202	200	203		162	161	154
Ba	449	463	530	530	536	443	414	595	449	469	427	468	469	505	592	392	383	385		469	477	472
(vol.%)																						
Plagioclase	14.3	14.0	23.1	29.8	27.7	32.4	18.8	29.2	21.7	21.2	26.6	29.5	23.9	23.1	34.8	18.6	20.6	13.2	23.9	25.2	28.6	20.7
Quartz	n.d.	tr	tr	n.d.	1.0	tr	tr	1.3	tr	1.8	n.d.	1.5	tr	3.7	1.0	n.d.	tr	0.2	tr	n.d.	n.d.	n.d.
Amphibole	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.		n.d.	n.d.	n.d.
Orthopyroxene	4.5	3.4	6.6	3.2	4.0	4.6	3.8	3.0	4.9	2.7	3.0	2.7	5.8	3.4	3.7	2.9	1.7	1.3	5.3	2.7	3.7	3.8
Clinopyroxene	1.9	1.7	2.7	3.4	4.7	3.3	5.1	2.7	2.5	3.0	5.5	3.3	4.7	2.7	3.5	0.7	1.8	6.9	5.0	2.2	2.9	3.4
Olivine	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.2	n.d.	0.1	n.d.	0.1	n.d.	n.d.	n.d.	n.d.	0.2	n.d.	0.5	n.d.	n.d.	n.d.	n.d.
Biotite	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.9	tr	tr	tr	tr	tr	2.2	tr	tr	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Opaque	0.7	0.4	1.6	0.7	1.6	0.8	1.2	0.4	0.5	0.6	0.2	0.4	0.7	0.5	1.4	0.5	0.7	0.3	0.3	0.8	1.2	0.6
Groundmass	78.6	80.5	66.1	62.9	60.9	58.8	70.9	62.5	70.3	70.7	64.6	62.6	62.7	66.6	55.5	77.1	75.3	77.7	65.5	69.1	63.6	71.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Phenocryst	21.4	19.5	33.9	37.1	39.1	41.3	29.1	37.5	29.7	29.3	35.4	37.4	37.3	33.4	44.5	22.9	24.7	22.3	34.5	30.9	36.4	28.5

## Appendix 1-2. continued

Unit	Shirane Pyroclastic Deposit 1			Shirane Pyroclastic Deposit 2			Shirane Pyroclastic Deposit 3			Shirane Pyroclastic Deposit 4			Ainomine Pyroclastic Deposit			Yumi-ike Pyroclastic Deposit			
Sample No	151020-1-2	151020-1-3	151020-1-4	151020-2-1	151020-2-2	151020-2-3	151020-3-1	151020-3-2	151020-3-3	151020-4-1	151020-4-2	151020-4-3	151022-1	151022-2	151022-3	180913-2-2	180913-2-3	180913-1-1	180913-1-2
Location	Loc.8	Loc.8	Loc.8	Loc.8	Loc.8	Loc.8	Loc.8	Loc.8	Loc.8	Loc.8	Loc.8	Loc.8	Loc.9	Loc.9	Loc.9	Loc.10	Loc.10	Loc.11	Loc.11
Rock Type	Vol. Bl.	Vol. Bl.	Vol. Bl.	Vol. Bl.	Vol. Bl.	Vol. Bl.	Vol. Bl.	Vol. Bl.	Vol. Bl.	Vol. Bl.	Vol. Bl.	Vol. Bl.	block	block	block	block	block	block	block
(wt.%)																			
SiO <sub>2</sub>	59.20	59.71	60.77	62.01	59.95	60.58	59.05	58.67	62.71	60.14	59.68	59.95	58.81	59.69	59.26	60.60	59.83	59.01	58.62
TiO <sub>2</sub>	0.71	0.69	0.67	0.63	0.66	0.64	0.67	0.67	0.62	0.65	0.67	0.67	0.69	0.69	0.71	0.65	0.67	0.69	0.72
Al <sub>2</sub> O <sub>3</sub>	16.51	16.49	16.34	15.96	16.51	16.18	16.66	16.47	15.79	16.17	16.10	16.21	16.16	16.23	16.41	16.14	16.24	16.26	16.44
FeO*	7.91	7.73	7.29	7.04	7.72	7.36	8.02	8.18	6.74	7.56	7.90	7.60	7.83	7.83	7.89	7.29	7.72	8.12	8.29
MnO	0.14	0.13	0.13	0.12	0.13	0.13	0.14	0.14	0.12	0.13	0.14	0.13	0.13	0.13	0.14	0.13	0.13	0.14	0.14
MgO	3.62	3.65	3.37	3.12	3.46	3.45	3.97	4.13	3.11	3.92	4.00	3.85	3.74	3.67	3.79	3.28	3.47	3.75	3.62
CaO	6.89	6.89	6.53	6.11	6.70	6.67	6.96	7.19	5.75	6.77	6.77	6.77	6.91	6.78	6.95	6.48	6.67	6.92	6.96
Na <sub>2</sub> O	2.86	2.87	2.90	2.86	2.78	2.80	2.75	2.70	2.82	2.58	2.53	2.54	2.70	2.83	2.68	2.92	2.86	2.81	2.86
K <sub>2</sub> O	1.58	1.62	1.75	2.03	1.75	1.86	1.42	1.39	2.08	1.82	1.75	1.80	1.67	1.64	1.64	1.81	1.71	1.60	1.56
P <sub>2</sub> O <sub>5</sub>	0.15	0.15	0.15	0.14	0.15	0.15	0.16	0.16	0.14	0.15	0.15	0.15	0.13	0.15	0.14	0.14	0.15	0.16	0.16
Total	100.44	100.78	100.72	100.80	100.66	100.64	100.69	100.61	100.62	100.74	100.58	100.52	99.64	100.54	100.49	100.26	100.31	100.36	100.28
FeO*/MgO	2.19	2.12	2.16	2.26	2.23	2.13	2.02	1.98	2.16	1.93	1.98	1.97	2.09	2.13	2.08	2.22	2.22	2.17	2.29
LOI (%)	1.21	1.12	1.42	-0.08	0.04	-0.12	0.06	-0.06	-0.02	-0.04	0.00	0.19	0.81	0.00	0.97	-0.03	-0.11	-0.20	-0.17
(ppm)																			
Rb	38	39	42	53	45	48	33	34	56	41	43	42	41	42	40	45	40	37	36
Sr	273	271	263	253	271	3	277	277	243	278	277	280	269	265	273	262	265	271	277
Ni	18	19	14	13	15	19	24	25	18	30	29	27	21	16	17	18	20	22	21
Y	22	22	22	21	22	22	21	21	23	23	22	23	21	22	22	22	21	21	20
Zr	92	93	99	111	96	100	90	88	117	97	96	96	93	95	93	107	104	96	93
V	198	185	183	170	195	185	181	190	157	181	171	175	184	192	194	181	198	209	214
Ba	419	414	447	484	432	466	398	387	501	424	418	416	395	426	402	448	433	409	416
(vol.%)																			
Plagioclase	23.7	22.0	16.7	27.5	24.6	25.7	21.6	23.7	27.6	28.3	24.7	21.8	30.3	23.6	26.8	22.6	23.7	22.1	20.3
Quartz	0.1	n.d.	n.d.	0.7	0.4	0.9	n.d.	n.d.	0.2	n.d.	n.d.	n.d.	tr	0.1	n.d.	tr	tr	0.1	n.d.
Amphibole	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Orthopyroxene	2.7	1.9	1.6	3.1	2.8	3.1	1.7	1.9	3.2	3.2	4.0	8.2	2.4	2.8	3.6	3.8	2.5	2.3	4.2
Clinopyroxene	3.8	4.2	2.3	3.3	2.5	4.6	2.0	2.3	3.5	4.1	3.7	3.7	2.8	4.0	4.0	3.9	3.0	2.4	1.7
Olivine	0.6	0.9	0.2	0.9	0.3	1.1	0.3	0.1	0.1	1.3	n.d.	0.1	0.2	0.9	0.2	0.6	0.3	0.6	0.9
Biotite	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	0.1	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Opaque	0.9	1.1	0.7	0.8	0.5	1.0	0.2	0.2	1.3	0.6	0.4	1.3	0.8	1.2	0.6	1.0	0.5	0.8	0.8
Groundmass	68.3	70.1	78.5	63.7	69.1	63.7	74.2	71.8	64.2	62.6	67.2	65.0	63.4	67.4	64.8	68.1	70.1	71.9	72.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Phenocryst	31.7	29.9	21.5	36.3	30.9	36.3	25.8	28.2	35.8	37.4	32.8	35.0	36.6	32.6	35.2	31.9	30.0	28.1	27.7