

## **APPENDICES**

## **Appendix 1. Results of Laboratory Works**

## **Appendix 1-1 The Results of Whole Rock Analysis**

Appendix 1-1 The Results of Whole Rock Analysis(1)

	G004	G017	G031	G034	G042	G053	G066	G078	G087	G096	G103	G109	G113	G121	G124	G127	G145	G201	G209	I002	I004	I023	I063	I081	I085	I106	
SAMPLE LOCATION	48 5324'N 82 5102'E	48 5426'N 82 5102'E	48 4703'N 82 5052'E	48 4702'N 82 5130'E	48 4625'N 82 5341'E	48 4838'N 82 5311'E	48 4910'N 82 4930'E	48 5057'N 82 5109'E	48 5014'N 82 5158'E	48 4958'N 82 5237'E	48 5002'N 82 5140'E	48 5135'N 82 5103'E	48 5146'N 82 5059'E	48 5244'N 82 5128'E	48 5206'N 82 4846'E	48 5230'N 82 4903'E	48 5150'N 82 4934'E	48 5257'N 82 5237'E	48 5241'N 82 4946'E	48 5156'N 82 4823'E	48 4953'N 82 5602'E	48 4429'N 82 5924'E	48 5045'N 82 4958'E	48 5035'N 82 5135'E	48 5048'N 82 5229'E	48 5239'N 82 4741'E	
LITHOLOGICAL NAME	MNZGR1	MNZGR1	AGGLO- MERATE	MNZGR1	OP	QTZMNZ	MNZGR1	MNZGR1	MNZGR1	MNZGR1	MNZGR1	MNZDRT	MNZDRT	MNZGR1	MNZGR1	MNZDRT	GRNDRT	MNZGR1	MNZGR1	MNZGR1	AGGLO- MERATE	AGGLO- MERATE	MNZGR1	MNZDRT	MNZDRT	NORITE	
Magnetic Susceptibility*	0.46	1.69	35.5	4.67	0.1	0.2	11	0.09	3.66	3.57	2.38	6.32	0.4	4.86	1.98	0.71	0.38	0.06	1.3	3.42	59.3	5.9	0.24	14.8	19.8	27.7	
SiO <sub>2</sub>	69.06	70.80	54.12	72.21	76.00	60.92	63.45	71.80	71.15	66.31	71.51	57.81	56.46	70.19	71.61	52.45	58.74	75.35	64.95	71.02	54.79	51.42	69.06	49.73	52.93	46.89	
TiO <sub>2</sub>	0.33	0.24	0.84	0.15	0.067	0.69	0.53	0.15	0.23	0.43	0.24	1.83	1.75	0.30	0.29	1.28	1.14	0.073	0.49	0.22	0.9	0.73	0.25	1.93	2	1.03	
Al <sub>2</sub> O <sub>3</sub>	14.47	13.81	16.64	13.73	12.06	16.00	15.91	14.08	13.96	16.19	13.9	16.13	16.26	14.15	14.09	17.21	16.95	12.17	15.88	14.08	19.32	16.25	14.79	15.89	16.83	18.48	
Fe <sub>2</sub> O <sub>3</sub>	2.96	2.53	7.61	2.09	1.01	3.20	6.3	1.36	2.76	4.23	2.92	8.56	8.85	3.42	2.81	10.01	7.58	1.41	4.23	2.62	9.77	8.46	3.01	12.21	11.42	10.41	
FeO	0.81	1.21	3.81	0.33	<0.10	2.67	3.29	0.78	1.53	2.15	1.36	5.30	5.59	1.00	1.04	6.12	5.02	0.35	1.36	0.95	6.9	4.77	0.85	6.26	4.87	6.12	
MnO	0.048	0.044	0.11	0.015	0.006	0.13	0.11	0.031	0.041	0.070	0.045	0.12	0.13	0.050	0.04	0.14	0.095	0.017	0.071	0.039	0.15	0.11	0.046	0.14	0.15	0.13	
MgO	0.51	0.26	5.69	0.091	0.05	0.22	0.17	0.23	0.26	0.42	0.3	2.41	4.03	0.4	0.42	5.61	2.32	0.083	0.8	0.27	4.48	6.7	0.45	3.82	3.49	8.55	
CaO	1.61	1.16	9.07	0.46	0.39	2.01	1.51	1.12	0.91	1.51	0.98	5.08	6.06	1.51	1.16	7.84	4.97	0.53	1.72	1.26	4.66	10.61	1.54	7.56	7.18	9.28	
Na <sub>2</sub> O	3.38	3.37	3.17	3.44	3.09	5.00	3.86	2.99	2.54	3.87	3.41	3.64	3.15	3.11	3.19	2.98	3.24	2.75	4.04	3.34	3.17	2.62	3.34	3.22	3.45	2.87	
K <sub>2</sub> O	3.58	3.71	1.45	4.08	3.51	6.19	4.63	3.59	3.51	4.14	3.82	2.43	1.69	3.76	3.57	1.54	2.49	3.78	3.76	3.69	0.65	1.59	3.26	1.89	1.74	0.77	
P <sub>2</sub> O <sub>5</sub>	0.085	0.19	0.33	0.047	0.017	0.07	0.085	0.047	0.08	0.075	0.059	0.69	0.49	0.079	0.076	0.57	0.46	0.032	0.22	0.045	0.28	0.39	0.1	0.72	0.72	0.5	
CO <sub>2</sub>																											
H <sub>2</sub> O(+)																											
H <sub>2</sub> O(-)	0.20	0.09	0.04	0.02	0.12		0.03	0.03	0.21	0.03	<0.02	0.10	0.13	<0.02	0.19	0.11	<0.02	0.09	0.18	0.04	0.61	0.20	<0.02	0.02	0.04	0.02	
LOI	0.66	0.43	0.57	0.24	0.23	0.82	0.34	0.54	0.34	0.33	0.3	0.92	1.22	0.34	0.35	1.62	0.75	0.29	0.65	0.34	0.36	1.25	0.49	0.7	0.59	0.74	
Total	97.70	97.84	103.45	96.90	96.60	97.92	100.22	96.75	97.52	99.76	98.85	105.02	105.81	98.32	98.84	107.48	103.77	96.93	98.35	97.91	106.04	105.10	97.20	104.09	105.41	105.79	
Solidification Index	4.7	2.4	27.1	0.9	0.7	1.3	1.0	2.6	2.5	2.9	2.6	11.2	18.0	3.5	3.9	22.2	11.7	1.0	5.8	2.5	18.7	28.8	4.2	14.6	14.6	30.9	
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub>	8.1	8.7	5.5	8.9	10.7	6.5	6.8	8.7	8.7	7.0	8.7	6.1	5.9	8.4	8.6	5.2	5.9	10.5	6.9	8.6	4.8	5.4	7.9	5.3	5.3	4.3	
CaO+Na <sub>2</sub> O/K <sub>2</sub> O	1.5	1.4	3.5	1.3	1.3	1.3	1.3	1.3	1.1	1.4	1.4	2.4	2.9	1.3	1.4	3.1	2.1	1.1	1.7	1.4	7.5	2.7	1.6	2.7	3.1	5.8	
K <sub>2</sub> O/Na <sub>2</sub> O+K <sub>2</sub> O	0.4	0.4	0.2	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.3	0.3	0.5	0.4	0.4	0.1	0.3	0.4	0.3	0.2	0.2	
K <sub>2</sub> O/Na <sub>2</sub> O	0.7	0.7	0.3	0.8	0.7	0.8	0.8	0.8	0.9	0.7	0.7	0.4	0.4	0.8	0.7	0.3	0.5	0.9	0.6	0.7	0.1	0.4	0.6	0.4	0.3	0.2	
FeO/Fe <sub>2</sub> O <sub>3</sub>	0.6	1.1	1.1	0.4	0.1	1.9	1.2	1.3	1.2	1.1	1.0	1.4	1.4	0.6	0.8	1.4	1.5	0.6	0.7	0.8	1.6	1.3	0.6	1.1	0.9	1.3	
Modal opaque minerals	0.4		3.7	0.4		1.0		0.7	0.3	1.0		2.1	1.1		0.7	1.8		0.0	0.4	1.0	1.6	0.7	0.6		1.0	4.5	

Appendix 1-1 The Results of Whole Rock Analysis(2)

	G370	G378	G396	G416	G433	G442	G449	G450	I162	I173	I178	I190	I212	I232	G423
SAMPLE LOCATION	48° 46'41"N	48° 46'34"N	48° 46'54"N	48° 46'33"N	48° 45'05"N	48° 44'51"N	48° 46'12"N	48° 42'65"N	48° 47'01"N	48° 47'15"N	48° 47'19"N	48° 46'56"N	48° 46'05"N	48° 42'26"N	48° 48'24"N
	83° 05'17"E	83° 05'42"E	83° 08'21"E	83° 08'39"E	83° 01'32"E	83° 01'41"E	83° 02'18"E	83° 09'86"E	83° 06'04"E	83° 06'46"E	83° 06'21"E	83° 06'54"E	83° 02'28"E	83° 03'10"E	82° 54'47"E
LITHOLOGICAL NAME	GRANITE	GRANITE	SYENITE	GRANITE	GRANITE	GRANITE	GRANITE	SYENITE	GRANITE	GRANITE	GRANITE	SYENITE	SYENITE	GRANITE	MNZ
Magnetic Susceptibility*	0.16	0.30	0.16	0.06	0.95	0.12	0.09	0.12	0.17	0.23	0.39	0.54	0.1	0.19	0.38
SiO <sub>2</sub>	70.26	64.08	66.44	71.96	71.88	69.12	72.66	62.94	73.93	72.61	71.32	64.08	63.84	72.42	58.46
TiO <sub>2</sub>	0.25	0.36	0.22	0.20	0.240	0.37	0.14	0.61	0.26	0.25	0.21	0.37	0.34	0.24	0.99
Al <sub>2</sub> O <sub>3</sub>	14.36	16.43	16.7	13.81	13.6	14.45	12.79	17.47	13.64	13.83	14.16	16.47	15.3	13.64	17.91
Fe <sub>2</sub> O <sub>3</sub>	2.95	4.77	3.07	1.73	1.95	3.66	3.08	3.24	1.33	2.44	1.91	4.37	1.59	0.86	7.83
FeO	0.13	2.36	1.64	0.42	0.58	1.94	0.13	2.00	0.50	0.92	0.36	2.00	0.13	0.13	5.09
MnO	0.045	0.1	0.053	0.024	0.058	0.07	0.063	0.094	0.022	0.053	0.045	0.08	0.045	0.015	0.21
MgO	0.12	0.18	0.12	0.083	0.14	0.46	0.26	0.64	0.075	0.1	0.079	0.17	0.11	0.13	0.7
CaO	0.73	1.37	1.03	0.31	0.66	1.62	0.82	1.86	0.39	0.62	0.41	1.33	1.01	0.56	3.05
Na <sub>2</sub> O	4.54	5.54	5.47	4.46	4.54	4.74	3.54	5.78	4.43	4.28	4.47	5.39	3.83	4.44	5.91
K <sub>2</sub> O	5.26	6.78	5.9	5.12	5	4.92	4.42	5.7	5.3	5.21	5.29	5.56	6.02	4.98	3.11
P <sub>2</sub> O <sub>5</sub>	0.05	0.045	0.04	0.036	0.039	0.12	0.064	0.21	0.045	0.034	0.032	0.044	0.039	0.036	0.19
CO <sub>2</sub>															
H <sub>2</sub> O(+)															
H <sub>2</sub> O(-)															
LOI		0.3		0.15	0.15			0.3		0.8	0.3	0.3			1
Total	98.69	102.32	100.68	98.30	98.84	101.47	97.96	100.84	99.92	101.15	98.59	100.16	92.25	97.45	104.45
Solidification Index	0.9	0.9	0.8	0.7	1.2	3.0	2.3	3.8	0.7	0.8	0.7	1.0	1.0	1.2	3.2
SiO <sub>2</sub> /Al <sub>2</sub> O <sub>3</sub>	8.3	6.6	6.8	8.8	9.0	8.1	9.6	6.1	9.2	8.9	8.5	6.6	7.1	9.0	5.5
CaO+Na <sub>2</sub> O/K <sub>2</sub> O	1.3	1.3	1.4	1.3	1.4	1.5	1.2	1.6	1.3	1.3	1.3	1.5	1.0	1.4	2.9
K <sub>2</sub> O/Na <sub>2</sub> O+K <sub>2</sub> O	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.3
K <sub>2</sub> O/Na <sub>2</sub> O	0.8	0.8	0.7	0.8	0.7	0.7	0.8	0.6	0.8	0.8	0.8	0.7	1.0	0.7	0.3
FeO/Fe <sub>2</sub> O <sub>3</sub>	0.1	1.1	1.2	0.5	0.7	1.2	0.1	1.4	0.8	0.8	0.4	1.0	0.2	0.3	1.4
R1 (Richard et al.(1985))	1753	522	975	1951	1935	1615	2464	655	2057	2004	1862	879	1432	2051	705
R2 (Richard et al.(1985))	366	478	444	308	344	480	352	573	313	343	326	474	414	334	712
Modal opaque minerals	0.4	0.7	0.3	0.5	0.7	1.0	0.5	1.5	0.7	1.0	0.5	0.5	0.5	0.3	3.0

**Appendix 1-2 The Results of CIPW Normative  
Constituent**

Appendix 1-2 The Results of CIPW Normative Constituents(1)

SAMPLE NUMBER	G004	G017	G031	G034	G042	G053	G066	G078	G087	G096	G103	G109	G113	G121	G124	G127	G145	G201	G209	I002	I004	I023	I063	I081	I085	I106
SAMPLE LOCATION	48° 53'24"N 82° 51'02"E	48° 54'26"N 82° 51'02"E	48° 47'03"N 82° 50'52"E	48° 47'02"N 82° 51'30"E	48° 46'25"N 82° 53'41"E	48° 48'38"N 82° 53'11"E	48° 49'10"N 82° 49'30"E	48° 50'57"N 82° 51'09"E	48° 50'14"N 82° 51'58"E	48° 49'58"N 82° 52'37"E	48° 50'02"N 82° 51'40"E	48° 51'35"N 82° 51'03"E	48° 51'46"N 82° 50'59"E	48° 52'44"N 82° 51'28"E	48° 52'06"N 82° 48'46"E	48° 52'30"N 82° 49'03"E	48° 51'50"N 82° 49'34"E	48° 52'57"N 82° 52'37"E	48° 52'41"N 82° 49'46"E	48° 51'56"N 82° 48'23"E	48° 49'53"N 82° 56'02"E	48° 44'29"N 82° 59'24"E	48° 50'45"N 82° 49'58"E	48° 50'35"N 82° 51'35"E	48° 50'48"N 82° 52'29"E	48° 52'39"N 82° 47'41"E
LITHOLOGICAL NAME	MNZGRT	MNZGRT	AGGLOMERATE	MNZGRT	QP	QTZMNZ	MNZGRT	MNZGRT	MNZGRT	MNZGRT	MNZGRT	MNZDRT	MNZDRT	MNZGRT	MNZGRT	MNZDRT	GRNDRT	MNZGRT	MNZGRT	MNZGRT	AGGLOMERATE	AGGLOMERATE	MNZGRT	MNZDRT	MNZDRT	NORITE
qz	31.73	34.66	6.59	35.60	43.73	4.51	19.95	38.00	40.73	24.30	34.67	14.85	14.27	34.10	36.49	6.49	16.98	43.72	22.80	34.49	16.45	2.92	33.47	5.95	8.86	0.00
or	21.16	21.93	8.57	24.11	20.74	36.58	27.36	21.22	20.74	24.47	22.58	14.36	9.99	22.22	21.10	9.10	14.72	22.34	22.22	21.81	3.84	9.40	19.27	11.17	10.28	4.55
ab	28.60	28.52	26.82	29.11	26.15	42.31	32.66	25.30	21.49	32.75	28.85	30.80	26.65	26.32	26.99	25.22	27.42	23.27	34.19	28.26	26.82	22.17	28.26	27.25	29.19	24.29
an	7.43	4.51	26.89	1.98	1.82	2.93	6.94	5.25	3.99	7.00	4.48	20.50	25.24	6.98	5.26	29.04	21.65	2.42	7.10	5.96	21.29	27.89	6.99	23.32	25.30	35.27
lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ne	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
kal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C	2.31	2.60	0.00	2.93	2.51	0.00	2.01	3.35	4.52	2.78	2.52	0.00	0.00	2.41	3.05	0.00	0.99	2.67	2.56	2.41	5.60	0.00	3.21	0.00	0.00	0.00
di	0.00	0.00	12.41	0.00	0.00	3.74	0.00	0.00	0.00	0.00	0.00	0.15	1.27	0.00	0.00	4.82	0.00	0.00	0.00	0.00	0.00	17.37	0.00	7.38	4.37	5.87
hy	1.27	0.65	8.41	0.23	0.12	0.00	0.59	0.69	0.87	1.05	0.75	5.93	9.75	1.00	1.05	12.83	7.03	0.21	1.99	0.67	14.55	9.36	1.12	6.09	6.66	9.96
wo	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.88
ac	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
mt	1.81	3.35	10.20	0.68	0.00	4.64	9.13	1.97	4.00	5.91	3.83	12.17	12.83	2.52	2.64	14.51	10.99	0.97	3.19	2.55	14.17	12.27	2.16	15.04	10.39	15.09
il	0.63	0.46	1.60	0.28	0.12	1.31	1.01	0.28	0.44	0.82	0.46	3.48	3.32	0.57	0.55	2.43	2.17	0.14	0.93	0.42	1.71	1.39	0.47	3.67	3.80	1.96
hm	1.71	0.22	0.57	1.62	1.01	0.00	0.00	0.00	0.00	0.15	0.28	0.17	0.00	1.68	0.99	0.00	0.00	0.74	2.03	0.86	0.00	0.00	1.52	1.84	4.26	0.00
ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ap	0.20	0.44	0.76	0.11	0.04	0.16	0.20	0.11	0.19	0.17	0.14	1.60	1.14	0.18	0.18	1.32	1.07	0.07	0.51	0.10	0.65	0.90	0.23	1.67	1.67	1.16
cc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	96.85	97.34	102.82	96.65	96.24	97.10	99.85	96.17	96.97	99.40	98.56	104.01	104.46	97.98	98.30	105.76	103.02	96.55	97.52	97.53	105.08	103.67	96.70	103.38	104.78	105.03
mt+il+hm	4.15	4.03	12.37	2.58	1.13	5.95	10.14	2.25	4.44	6.88	4.57	15.82	16.15	4.77	4.18	16.94	13.16	1.85	6.15	3.83	15.88	13.66	4.15	20.55	18.45	17.05
Differenciation Index (an/an+ab) x 100	84.1	87.4	40.8	91.9	94.2	85.9	80.1	87.9	85.6	82.0	87.4	57.7	48.7	84.3	86.0	38.6	57.4	92.5	81.2	86.7	44.8	33.3	83.8	42.9	46.1	27.5
Modal opaque minerals	0.4		3.7	0.4		1.0		0.7	0.3	1.0		2.1	1.1		0.7	1.8		0.0	0.4	1.0	1.6	0.7	0.6		1.0	4.5

Appendix 1-2 The Results of CIPW Normative Constituents(2)

SAMPLE NUMBER	G370	G378	G396	G416	G433	G442	G449	G450	I162	I173	I178	I190	I212	I232	G423
SAMPLE LOCATION	48° 46'41"N	48° 46'34"N	48° 46'54"N	48° 46'33"N	48° 45'05"N	48° 44'51"N	48° 46'12"N	48° 42'65"N	48° 47'01"N	48° 47'15"N	48° 47'19"N	48° 46'56"N	48° 46'05"N	48° 42'26"N	48° 48'24"N
	83° 05'17"E	83° 05'42"E	83° 08'21"E	83° 08'39"E	83° 01'32"E	83° 01'41"E	83° 02'18"E	83° 09'86"E	83° 06'04"E	83° 06'46"E	83° 06'21"E	83° 06'54"E	83° 02'28"E	83° 03'10"E	82° 54'47"E
LITHOLOGICAL NAME	GRANITE	GRANITE	SYENITE	GRANITE	GRANITE	GRANITE	GRANITE	SYENITE	GRANITE	GRANITE	GRANITE	SYENITE	SYENITE	GRANITE	MNZ
qz	22.12	4.25	9.94	25.73	25.05	19.66	33.19	3.72	27.06	26.39	24.17	8.90	16.30	26.24	4.55
or	31.09	40.07	34.87	30.26	29.55	29.08	26.12	33.69	31.32	30.79	31.26	32.86	35.58	29.43	18.38
ab	38.42	46.77	46.29	37.74	38.42	40.11	29.95	48.91	37.49	36.22	37.82	45.61	32.41	37.57	50.01
an	3.27	0.00	3.59	1.30	1.96	3.62	3.65	4.89	1.64	2.85	1.83	4.33	4.76	2.54	13.16
lc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ne	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
kal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C	0.00	0.00	0.00	0.45	0.00	0.00	0.84	0.00	0.01	0.10	0.41	0.00	0.74	0.01	0.00
di	0.00	0.99	1.03	0.00	0.75	2.58	0.00	2.33	0.00	0.00	0.00	0.91	0.00	0.00	0.60
hy	0.30	0.00	0.01	0.21	0.00	0.00	0.65	0.66	0.19	0.25	0.20	0.00	0.27	0.32	3.08
wo	0.00	2.19	0.00	0.00	0.04	0.14	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.00
ol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ac	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
mt	0.00	6.87	4.45	0.85	1.36	5.31	0.20	4.70	0.93	2.41	0.70	5.63	0.00	0.00	11.35
il	0.36	0.68	0.42	0.38	0.46	0.70	0.27	1.16	0.49	0.47	0.40	0.70	0.36	0.30	1.88
hm	0.02	0.00	0.00	1.14	1.01	0.00	2.94	0.00	0.69	0.78	1.43	0.48	1.59	0.86	0.00
ti	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ap	0.12	0.10	0.09	0.08	0.09	0.28	0.15	0.49	0.10	0.08	0.07	0.10	0.09	0.08	0.44
ru	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.08	0.00
Total	95.77	102.02	100.69	98.14	98.69	101.48	97.96	100.55	99.92	100.34	98.29	99.86	92.25	97.43	103.45
mt+il+hm	0.38	7.55	4.87	2.37	2.83	6.01	3.41	5.86	2.11	3.66	2.53	6.81	1.95	1.16	13.23
Differenciation Index	95.7	89.3	90.5	95.5	94.3	87.6	91.1	85.8	95.9	93.1	94.9	87.5	91.4	95.7	70.5
(an/an+ab)× 100	7.8	0.0	7.2	3.3	4.9	8.3	10.9	9.1	4.2	7.3	4.6	8.7	12.8	6.3	20.8
Modal opaque minerals	0.4	0.7	0.3	0.5	0.7	1.0	0.5	1.5	0.7	1.0	0.5	0.5	0.5	0.3	3.0



## **Appendix 1-3 The Results of Minor Element Analysis**

Appendix 1-3 The Results of Minor Element Analysis(1)

SAMPLE NUMBER	G004	G017	G031	G034	G042	G053	G066	G078	G087	G096	G103	G109	G113	G121	G124	G127	G145	G201	G209	I002	I004	I023	I063	I081	I085	I106	
SAMPLE LOCATION	48 5324'N	48 5426'N	48 4703'N	48 4702'N	48 4625'N	48 4838'N	48 4910'N	48 5057'N	48 5014'N	48 4958'N	48 5002'N	48 5135'N	48 5146'N	48 5244'N	48 5206'N	48 5230'N	48 5150'N	48 5257'N	48 5241'N	48 5156'N	48 4953'N	48 4429'N	48 5045'N	48 5035'N	48 5048'N	48 5239'N	
	82 5102'E	82 5102'E	82 5052'E	82 5130'E	82 5341'E	82 5311'E	82 4930'E	82 5109'E	82 5158'E	82 5237'E	82 5140'E	82 5103'E	82 5059'E	82 5128'E	82 4846'E	82 4903'E	82 4934'E	82 5237'E	82 4946'E	82 4823'E	82 5602'E	82 5924'E	82 4958'E	82 5135'E	82 5229'E	82 4741'E	
LITHOLOGICAL NAME	MNZGRT	MNZGRT	AGGLO-MERITE	MNZGRT	OP	QTZMNZ	MNZGRT	MNZGRT	MNZGRT	MNZGRT	MNZGRT	MNZDRT	MNZDRT	MNZGRT	MNZGRT	MNZDRT	GRNDRT	MNZGRT	MNZGRT	MNZGRT	AGGLO-MERITE	AGGLO-MERITE	MNZGRT	MNZDRT	MNZDRT	NORITE	
Magnetic Susceptibility*	0.46	1.69	35.5	4.67	0.1	0.2	11	0.09	3.66	3.57	2.38	6.32	0.4	4.86	1.98	0.71	0.38	0.06	1.3	3.42	59.3	5.9	0.24	14.8	19.8	27.7	
Ag(ppm)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ba(ppm)	503	350	508	68.5	33	3680	1260	324	272	844	261	607	299	414	412	358	567	112.5	668	295	402	1010	469	439	424	250	
Ce(ppm)	78	90	51	177	8.5	27.5	39	41	111.5	69	87	79.5	59.5	74	72.5	60	68	74.5	95	89.5	55.5	91.5	61.5	67.5	68	36.5	
Co(ppm)	3.5	1.5	23.5	0.5	0.5	1.5	1	1	1.5	2	1.5	13.5	22.5	2.5	2.5	30.5	13.5	<0.5	5	2	27	27.5	2.5	26.5	22	42	
Cs(ppm)	5.5	3.4	1.6	1.5	1	0.6	1	10.1	3.9	2.3	2.2	3.2	2.3	6.1	6.3	2.6	7.2	3	1.5	2.3	0.4	0.4	4.2	1.7	1.3	0.3	
Cu(ppm)	70	5	90	15	35	5	15	10	5	10	5	25	30	10	10	30	30	15	25	10	10	110	10	30	25	45	
Dy(ppm)	5.2	6.5	3.4	8.3	3.8	2.7	5.3	2.2	8.5	6.3	7.6	7.5	6.5	5.1	5	6.9	5.2	4.4	5.9	6.5	4.5	4	3	7.7	6.8	4	
Er(ppm)	3.3	4	1.9	4.9	3.7	1.7	3.8	1.2	5.9	4.1	5.1	4.6	3.8	3.6	3.3	4	3.1	3.1	3.6	4.7	2.8	1.8	1.8	4.2	4.3	2.6	
Eu(ppm)	1	0.5	1.4	0.2	<0.10	2.9	1.6	0.4	0.6	1.3	0.5	2.1	1.7	0.9	0.7	2.1	1.7	0.2	1.4	0.5	1.6	1.9	0.8	2.4	2.4	1.6	
Ga(ppm)	22	24	20	26	26	19	22	18	22	22	22	22	20	22	21	20	22	18	22	21	24	20	21	22	21	19	
Gd(ppm)	6	7.1	4.7	10.9	1.6	3.2	6.1	3	9.4	7.2	7.8	8.7	7.1	5.6	5.8	7.8	6.4	5	7.4	6.8	5.6	6.8	3.8	9.2	8.7	4.7	
Hf(ppm)	6	8	4	9	6	1	18	3	9	14	9	7	6	6	7	5	6	3	9	7	4	3	5	5	6	3	
Ho(ppm)	1.1	1.4	0.6	1.5	0.9	0.5	1.1	0.4	1.8	1.3	1.5	1.5	1.2	1.1	1	1.4	1.1	0.9	1.2	1.3	0.9	0.7	0.6	1.5	1.4	0.8	
La(ppm)	39	36	22.5	81	2.5	13	16.5	19.5	56	29.5	37.5	32.5	25.5	31	34.5	25	28	32.5	45	39.5	25	37.5	29.5	27	28	15	
Lu(ppm)	0.5	0.6	0.2	0.6	0.7	0.3	0.6	0.1	0.7	0.6	0.7	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.6	0.4	0.2	0.2	0.5	0.5	0.3	
Nb(ppm)	11	12	4	10	15	9	11	8	13	13	14	12	11	11	11	11	10	9	12	13	7	6	9	12	13	6	
Nd(ppm)	32	36.5	27	75.5	3.5	15.5	24.5	17.5	51	33.5	38	41.5	32	31	31.5	34	33	31.5	41	37.5	27.5	45	24	38.5	38	22.5	
Ni(ppm)	5	<5	45	<5	<5	<5	5	<5	<5	<5	<5	<5	20	<5	<5	40	10	<5	5	<5	45	55	<5	5	<5	85	
Pb(ppm)	15	20	20	30	35	10	30	45	25	20	30	140	45	35	30	20	30	30	40	15	15	20	45	20	15	20	
Pr(ppm)	8.8	9.2	6.4	20.1	0.8	3.5	5.5	4.5	13.5	8.2	10	9.8	7.4	7.7	8.3	7.5	8.1	8.4	10.6	9.8	6.4	10.6	6.5	8.8	8.7	4.9	
Rb(ppm)	104.5	101	24.8	86.4	162.5	39.6	46.8	130	102	66.6	90.2	59	46.4	104	124	38.2	89.8	115	84	86.2	11.2	28.4	97.8	43.4	35.8	10	
Sm(ppm)	6.3	7.5	5.4	12.4	1.1	3.2	5.6	3.5	9.8	7.1	8.1	8	7	5.7	6.3	7.4	6.5	5.9	7.4	7	5.4	7.6	4.1	8.7	8.2	5	
Sn(ppm)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Sr(ppm)	194	98.7	1290	39.9	17.2	153.5	68.7	135	75.9	114.5	74.3	502	533	154.5	147.5	610	512	34.1	239	96.9	664	1390	186	579	542	785	
Ta(ppm)	0.5	0.5	<0.5	<0.5	1.5	<0.5	<0.5	0.5	0.5	<0.5	0.5	0.5	0.5	0.5	0.5	<0.5	0.5	<0.5	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Tb(ppm)	0.9	1.1	0.6	1.6	0.4	0.5	0.9	0.4	1.5	1.1	1.3	1.3	1.1	1	1	1.2	1	0.8	1.1	1.1	0.8	0.8	0.5	1.3	1.2	0.7	
Th(ppm)	15	9	4	10	9	1	2	12	10	5	12	7	5	21	13	3	8	11	13	10	4	8	11	3	4	<1	
Tl(ppm)	<0.5	<0.5	4.0	0.5	<0.5	<0.5	0.5	1.5	3.0	<0.5	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Tm(ppm)	0.4	0.6	0.2	0.6	0.6	0.2	0.5	0.1	0.8	0.6	0.7	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.6	0.4	0.2	0.2	0.5	0.6	0.3	
U(ppm)	3.0	3.0	1.5	2.0	3.5	<0.5	0.5	2.5	2.0	1.5	1.5	5.0	3.0	3.0	2.5	1.0	2.5	2.0	3.0	2.5	<0.5	2.5	3.0	2.0	1.5	<0.5	
V(ppm)	20	10	175	5	5	30	15	5	5	10	10	105	135	15	15	160	85	5	25	10	175	185	15	200	170	145	
W(ppm)	1	<1	<1	1	1	<1	<1	1	1	1	1	1	1	1	3	1	1	<1	1	1	<1	<1	3	1	<1	<1	
Y(ppm)	31	35	17	40	24.5	13	27.5	11.5	46.5	33.5	43	38.5	33.5	30	29	35.5	28	22	30.5	36.5	23	18	16	38	37.5	21	
Yb(ppm)	3.1	3.7	1.5	4.3	4.6	1.5	3.7	1.1	5.1	4	4.7	3.5	3.5	3.1	3.3	3.4	2.9	2.8	3.4	4	2.3	1.4	1.5	3.7	3.3	1.9	
Zn(ppm)	55	65	90	70	25	50	70	30	65	80	65	275	115	55	60	100	85	25	80	55	105	130	45	125	110	165	
Zr(ppm)	261	346	170.5	323	145	141.5	1240	106.5	328	738	355	361	287	268	267	257	313	113	375	262	180	155.5	200	235	314	156	

Appendix 1-3 The Results of Minor Element Analysis(3)

SAMPLE NUMBER	G370	G378	G396	G416	G433	G442	G449	G450	I162	I173	I178	I190	I212	I232	G423
SAMPLE LOCATION	48° 46'41"N	48° 46'34"N	48° 46'54"N	48° 46'33"N	48° 45'05"N	48° 44'51"N	48° 46'12"N	48° 42'65"N	48° 47'01"N	48° 47'15"N	48° 47'19"N	48° 46'56"N	48° 46'05"N	48° 42'26"N	48° 48'24"N
	83° 05'17"E	83° 05'42"E	83° 08'21"E	83° 08'39"E	83° 01'32"E	83° 01'41"E	83° 02'18"E	83° 09'86"E	83° 06'04"E	83° 06'46"E	83° 06'21"E	83° 06'54"E	83° 02'28"E	83° 03'10"E	82° 54'47"E
LITHOLOGICAL NAME	GRANITE	GRANITE	SYENITE	GRANITE	GRANITE	GRANITE	GRANITE	SYENITE	GRANITE	GRANITE	GRANITE	SYENITE	SYENITE	GRANITE	MNZ
Magnetic Susceptibility*	0.46	1.69	35.5	4.67	0.1	0.2	11	0.09	3.66	3.57	2.38	6.32	0.4	4.86	1.98
Ag(ppm)	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ba(ppm)	148.5	97.7	84.8	46.3	223	365	185	867	92.9	66.1	66.6	82.8	54.5	333	8180
Ce(ppm)	204	85.2	38.6	126.5	145	118	99.7	61.6	135.5	207	144.5	59.5	81.4	131	45.1
Co(ppm)	1	1.1	1.2	1.5	1.2	3.8	2.6	4.9	0.9	0.9	0.9	1.2	0.8	2.2	4
Cr(ppm)	30	30	40	80	40	120	110	20	20	20	20	20	30	20	20
Cs(ppm)	1.1	1	1.5	1	2.1	2	3.6	1.2	1.6	0.7	0.8	1.8	1.2	1.2	0.7
Cu(ppm)	10	12	8	107	24	73	154	13	10	13	19	18	15	13	18
Dy(ppm)	6.4	7.3	4.5	6.8	10.2	8.8	10.1	5.4	4.7	7.7	5.3	6.6	4.9	9	4.1
Er(ppm)	3.6	4.3	2.9	3.8	5.8	5.4	7.6	3.3	2.5	4.2	2.9	4	2.8	4.4	2.3
Eu(ppm)	0.4	0.3	0.3	0.2	0.50	0.8	0.4	2.1	0.2	0.2	0.2	0.2	0.2	1.4	6.3
Ga(ppm)	28	29	28	27	31	28	31	24	27	27	27	28	28	27	22
Gd(ppm)	10.1	8.4	4.7	9.9	11.6	10	9	6.2	7.9	12.5	8.5	7.2	7.5	12.2	5.2
Hf(ppm)	13	31	25	12	14	12	12	14	14	15	14	29	29	9	4
Ho(ppm)	1.3	1.5	1	1.4	2	1.9	2.3	1.1	0.9	1.5	1	1.4	1	1.7	0.8
La(ppm)	96.2	35.4	19.1	75	66.5	53.4	44.8	28.4	60.4	102	62.3	23.6	49.8	52.8	19.9
Lu(ppm)	0.6	0.8	0.5	0.6	0.8	0.8	1.2	0.5	0.4	0.7	0.5	0.8	0.5	0.5	0.4
Mo(ppm)	1	2	3	2	1	11	3	2	1	2	1	1	1	1	1
Nb(ppm)	16	19	15	15	25	21	23	14	18	18	15	24	21	15	15
Nd(ppm)	79.4	46.3	23.1	66.9	64.1	53.2	42.7	31.6	58.3	92.1	57.9	33.6	52.5	61.9	25.1
Ni(ppm)	6	6	19	14	7	51	17	7	7	7	7	7	7	9	5
Pb(ppm)	69	107	39	269	221	407	822	102	42	60	121	97	121	95	95
Pr(ppm)	22.7	11.3	5.7	17.5	17.3	14.2	11.7	7.8	16	25.1	15.8	7.8	13.8	15.5	5.8
Rb(ppm)	82.1	56.1	75.8	72.8	128	105	173.5	52.1	81.4	72.2	72.2	70	86.4	78.2	28.3
Sm(ppm)	11.8	9.6	5.1	11.2	12.4	10.5	8.7	6.5	9.7	14.6	9.5	7.8	9.5	13.1	5.5
Sn(ppm)	4.0	4.0	4.0	17.0	9.0	10.0	30.0	4.0	3.0	3.0	3.0	4.0	4.0	5.0	3.0
Sr(ppm)	32.7	35.1	21.9	12.1	53.5	132	52.8	244	24.7	16.1	15.5	24	21.1	108.5	344
Ta(ppm)	0.8	0.8	0.7	0.7	1.5	1.3	1.7	0.7	0.8	0.7	0.6	1.0	0.9	0.8	0.8
Tb(ppm)	1.3	1.3	0.8	1.4	1.9	1.6	1.6	1	1	1.6	1.1	1.2	1	1.8	0.8
Th(ppm)	7	4	2	5	10	9	23	3	7	7	6	4	5	5	2
Tl(ppm)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tm(ppm)	0.5	0.6	0.25	0.5	0.8	0.8	1.2	0.5	0.25	0.6	0.25	0.6	0.25	0.6	0.25
U(ppm)	1.0	2.0	0.8	1.0	2.7	2.4	5.3	1.2	1.0	1.0	1.1	1.3	1.6	2.3	0.7
V(ppm)	15	12	15	11	12	26	12	32	16	13	12	16	16	19	92
W(ppm)	2	2	2	3	3	4	4	3	2	3	2	3	3	3	2
Y(ppm)	31.6	36.3	24.2	34.3	54.9	50.3	68.7	28.5	20.5	33.9	22.6	34.3	22.6	37.7	21.2
Yb(ppm)	3.5	4.7	3.3	3.4	5.2	5.1	8.1	3	2.2	3.9	2.9	4.4	2.8	3.7	2.2
Zn(ppm)	386	562	198	1310	1125	1125	2880	351	202	292	542	462	711	416	439
Zr(ppm)	554	1355	1050	526	468	413	260	636	599	657	609	1245	1260	332	167.5
Y+Nb(ppm)	47.6	55.3	39.2	49.3	79.9	71.3	91.7	42.5	38.5	51.9	37.6	58.3	43.6	52.7	36.2
Yb+Ta(ppm)	4.3	5.5	4.0	4.1	6.7	6.4	9.8	3.7	3.0	4.6	3.5	5.4	3.7	4.5	3.0

**Appendix 1-4 Microscopic Observation of the Thin  
Sections**

Appendix 1-4 Microscopic Observations of the thin Sections(1)

SAMPLE NUMBER	PETROGRPHIC NAME	Quartz(Qz)	K-feldspar(Kf)	Plagioclase(Pl)	Biotite(Bi)	Hornblende(Hb)	Augite(Px)	Olivine(Ol)	Zircon(Zr)	Apatite(Ap)	Ilmenite(Il)	Magnetite/Ti-magnetite(Ti-Mt)	Actinolite(Ac)	Chlorite(Chl)	Sericite(Ser)	Clay minerals (Kaoline,Smectite,illite)
1	G004	Hornblende-biotite monazogranite	○	○	◎	○	△		·	·	·	·				
2	G029	Hornblende-biotite monazogranite	○	○	◎	○	△				·					
3	G031	Andesitic agglomerate	·		◎	△	○	○				·		△	·	
4	G034	Hornblende-biotite monazogranite	◎	◎	○	△	·		·		·	·		·		
5	G053	Pyroxene-hornblende quartzmonzonite	○	◎	○		△	·	·		·			·		
6	G078	Biotite monzogranite	○	◎	◎	·					·	·		△		
7	G087	Hornblende-biotite monazogranite	◎	◎	○	△	△		·			·		·		
8	G096	Hornblende monzogranite	○	◎	○		○		·							
9	G109	Biotite-hornblende monzogranite	·	○	◎	△	◎				·					
10	G113	Biotite monzodiorite	·	○	◎	△			·	·				·	·	
11	G124	Hornblende-biotite monazogranite	◎	◎	△	·	·		·		·	·				
12	G127	Hornblende-biotite monzodiorite	·		◎	○	○		·					○	·	
13	G201	Biotite monzogranite	◎	◎	△	△								·	·	
14	G209	Biotite monzogranite	◎	○	◎	△					·	·		△	·	
15	I002	Biotite-hornblende monzogranite	○	◎	△	·	△		·			·		·	·	
16	I004	Andesitic -tuff	◎		◎	△	△	○			△					
17	I023	Andesitic agglomerate	·		◎	·		△				·	·	△	·	
18	I063	Biotite monzogranite	·	○	◎	○						·				
19	I085	Biotite monzogranite	◎	◎	○	△			·		·	·		·		
20	I106	Gabbro	·	○	◎	○	◎	△			·			·	·	
21	MJBK-29 48.0m	Ilmenite-bearing clayey sand	◎	·	·							○				△
22	MJBK-21 41.0m	Ilmenite-bearing clayey sand	◎	·	·							○				

[Abundance]

◎:Abundant, ○:Common, △:Poor, ·:Rare

Appendix 1-4 Microscopic Observations of the thin Sections(2)

SAMPLE NUMBER	PETROGRAPHIC NAME	Quartz (Qz)	K-feldspar (Kfi)	Plagioclase (Pl)	Biotite (Bio)	Hornblende (Hb)	Augite (Px)	Olivine (Ol)	Zircon (Zr)	Apatite (Ap)	Allanite (All)	Tourmaline	Chlorite (Chl)	Calcite (Cal)	Sericite (Ser)	Clay minerals (Kaolinite, Smectite, Illite)	Ilmenite (Il), Alterilmenite	Pseudorutile (Psr)	Magnetite (Mt)/Ti-magnetite (Ti-Mt)	Rutile, Anatase (Ana), Sphene (Sp)	Hematite (Hm), Goethite (Geo)	Opaque mineral mode (%)
		1	G365 Siliceous tuff hornfels	○	○	⊙	·	△			·	·							·			
2	G370 Hornblende-augite granite	⊙	⊙	○		△	·		·	·	·						·		·			0.4
3	G378 Augite-hornblende syenite	△	⊙	○	·	△	·		·								·				·	
4	G387 Augite porphyrite hornfels	△		⊙	△		○		·								△			·	·	
5	G395 Siltstone hornfels	⊙			○							·					△					
6	G396 Hornblende quartz syenite	○	⊙	⊙		△		·									·					0.3
7	G416 Hornblende granite	⊙	⊙	△		·		·									·					
8	G423 Hornblende-olivine monzonite	△	⊙	△		△	○	·									△		·		·	
9	G433 Hornblende granite	○	⊙		·			·									·		·		·	0.7
10	G442 Hornblende-augite granite porphyry	⊙	⊙		·	△	·		·								△					
11	G445 Sandstone hornfels	⊙		△	○												△		△			
12	G449 Biotite granite porphyry	⊙	⊙	○	△			·				·			·		·					
13	G450 Augite quartz syenite	△	⊙	⊙	△		○		·	·					·		△				·	1.5
14	I 162 Augite-biotite granite	⊙	⊙	△	·		·		·	·			·		·		·				·	
15	I 173 Biotite-hornblende granite	⊙	⊙	△	·	·	△		·				·				·		·		·	1.0
16	I 178 Biotite-augite granite	⊙	⊙	△	·	·	△		·								·		·		·	
17	I 190 Hornblende-biotite quartz syenite	○	⊙	○	·	△	·										·		·		·	
18	I 212 Biotite quartz syenite	⊙	⊙	△	·				·								·			·	·	
19	I 232 Biotite granite	⊙	⊙	△	△				·						·		·		·		·	0.3
20	MJBKE-12 29.0m Porphyritic diorite	△														⊙						
21	MJBKE-25 24.5m clayey sand	⊙	△					·									△		·	·	·	
22	MJBKE-36 17.8m clayey sand	⊙			·	·		·						△			△	·	·	·	·	
23	MJBKE-38 6.0m Conglomerate	○											⊙				·				·	
24	KARAOTKEL PIT2 Ilmenite concentrate	○	·	·				○									△	⊙		·		
25	MJBKE-33 13.3m Ilmenite-bearing clayey sand	⊙	·	·				·								○	△	△			△	
26	MJBKE-29 14.18m Ilmenite-bearing clayey sand	⊙						·						·	○	○	·		·		·	
27	MJBK-54 54.7m Ilmenite-bearing clayey sand	⊙						·						△	○	○	·				△	
28	MJBK-54 57.5m Ilmenite-bearing clayey sand	⊙	△					·							○	○	○			·		
29	MJBK-44 50.2m Ilmenite concentrate	○						△									⊙	△		·		
30	MJBK-54 56.5m Ilmenite-bearing clayey sand	⊙	△	△				△						△	○	○	⊙		·			

[Abundance]

⊙: Abundant, ○: Common, △: Poor, ·: Rare

## **Appendix 1-5 Results of X-ray Diffraction**

Appendix 1-5 Results of X-Ray Diffraction Analysis(1)

	Sample no.	Locality	Rock description	Qz	Kol	Ill	Smc	Ilm	Pl	K-f	Cpx	Amp	Tor
1	U70/50		ilmenite-bearing clayey sand	⊙	○		○				.		
2	MJBK-21	41.0m	ilmenite-bearing clayey sand	⊙	△		○	.	△		△		
3	MJBK-34	43.0m	ilmenite-bearing clayey sand	⊙	△		○		.	△			
4	MJBK-29	20.0m	clayey sand	⊙	○		⊙						
5	MJBK-29	30.0m	clayey sand	⊙	○		⊙						
6	MJBK-29	40.0m	clayey sand	⊙	△	○	○		⊙				.
7	MJBK-29	43.5m	ilmenite-bearing clayey sand	○	△				⊙	.			
8	MJBK-29	48.0m	ilmenite-bearing clayey sand	⊙	⊙	△							
9	MJBK-29	50.0m	clayey sand	⊙	⊙		○			△			
10	MJBK-29	55.5m	shale (bed rock)	⊙	⊙		○						
11	MJBKS-1	20.0m	clayey sand	⊙	△			.	○				
12	MJBKS-1	25.0m	clayey sand	⊙	△	△	○		△				
13	MJBKS-1	28.0m	clayey sand	⊙	△			.				.	
14	MJBKS-4	31.0m	clayey sand	⊙	○			.					
15	MJBK-24	58.0m	shale (bed rock)	⊙	○	○			△	△			
16	MJBK-36	51.0m	shale (bed rock)	⊙	△		⊙		.	.			
17	MJBK-37	48.0m	shale (bed rock)	⊙	⊙	⊙	○		.	.			
18	MJBKS-8	30.5m	shale (bed rock)	⊙	○	○			○	.			
19	MJBKS-13	33.0m	shale (bed rock)	⊙	○	△					.		
20	MJBKS-25	34.0m	shale (bed rock)	⊙	△		△		⊙	△			

[Abundance]

⊙: Abundant, ○: Common, △: Poor, .: Rare

[Abbreviations]

Qz=Quartz

Kol=Kaolinite

Ill=Illite

Smc=Smectite

Ilm=Ilmenite

Pl=Plagioclase

K-f=K-Feldspar

Cpx=Clinopyroxene

Amp=Amphibole

Tor=Tourmaline



Appendix 1-5 Results of X-Ray Diffraction Analysis(2)

	Sample no.	Locality	Rock description	Qz	Pl	K-f	Smc	Ill	Kol	Chl	Cal	Goth	Hm	Ilm	Psr	Ant	Rut	Zr
1	KARAOTKEL	Pit 1	clay	○	△	⊙			⊙									
2	KARAOTKEL	Pit 2	Ilmenite concentrate	⊙	▪								△	△	⊙		△	⊙
3	MJBKE-8	41.4m	clay	⊙			○	○	⊙									
4	MJBKE-8	50.4m	clay	⊙			△	△	⊙									
5	MJBKE-8	57.8m	clay	⊙	○		○	○	⊙									
6	MJBKE-25	23.7m	Ilmenite concentrate	⊙									▪	⊙				⊙
7	MJBKE-26	21.2m	clay	⊙	○		⊙		⊙									
8	MJBKS-32	10.0m	clay	⊙	△	▪	○	△		▪	△					▪		
9	MJBKS-32	20.0m	clay	⊙			⊙		△							▪		
10	MJBKS-32	32.5m	clay	⊙		△	△		△							▪	▪	
11	MJBKS-32	35.6m	clay	⊙					▪					▪			△	
12	MJBKS-32	38.0m	clay	⊙			⊙	○	△			▪				△		
13	MJBKE-33	13.7m	Ilmenite concentrate	⊙										⊙				⊙

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[Abundance]

⊙: Abundant, ○: Common, △: Poor, ▪: Rare

[Abbreviations]

Qz=Quartz

Pl=Plagioclase

K-f=K-Feldspar

Smc=Smectite

Ill=Illite

Kol=Kaolinite

Chl=Chlorite

Cal=Calcite

Goth=Goethite

Hm=Hematite

Il=Ilmenite

Psr=Pseudorutile

Ant=Anatase

Rut=Rutile

Zr=Zircon