

AM-87-331

Variations in Mg/(Mg+Fe), F, and (Fe,Mg)Si=2Al in pelitic minerals in
the Ballachulish thermal aureole, Scotland

Pattison

To be deposited: Appendix III

Ammin. 72, 3-4 pp. 255-272

APPENDIX III

MICROPROBE ANALYSES

Instrument and operating conditions

Microprobe analyses were obtained using a Cambridge Instruments Microscan 5 with two crystal spectrometers and a Link Systems energy dispersive system. Take off angle was 75° and accelerating potential was 20 kV. For wavelength dispersive spectrometry (WDS), probe current (measured at a Faraday cage) was 30 nA, while for energy dispersive spectrometry (EDS), the probe current was 6 nA.

All analyses were performed with a focussed electron beam of 1-2 μm diameter, penetrating to a depth of about 3 μm . 40 second counting times on peaks of standards and unknowns were used, with 20 second counting times on the initial analysis of each new mineral.

Standards and correction procedure

The elemental standards used in this study are listed in Table AIII.1.

The vast majority of analyses were made using WDS. For WDS analysis, the raw X-ray counts are collected and run through an on-line computer program for ZAF corrections (after Sweatman & Long (1969), using the absorption co-efficients of Heinrich (1966)). The number of X-rays for an element in an unknown is related to the number of X-rays in that element's standard, which is read at least once in the same probe session to account for system variations.

For EDS analysis, an X-ray spectrum is collected in 100 livetime seconds, followed by the same on-line ZAF correction procedure described above. The abundance of each element is related to an overall element calibration by a secondary cobalt standard, which is read several times throughout a given session to account for system variations.

Table AIII.1 Element standards used in this study

Element	Z	Standard	Typical counts sec ⁻¹ wt-% ⁻¹
F	9	MgF ₂	19
Na	11	NaAlSi ₂ O ₆	120
Mg	12	MgO	230
Al	13	Al ₂ O ₃	260
Si	14	CaSiO ₃	180
K	19	KAlSi ₃ O ₈	62
Ca	20	CaSiO ₃	130
Ti	22	TiO ₂	170
Cr	24	metal	170
Mn	25	metal	165
Fe	26	metal	140
Zn	30	metal	70
Ba	56	BaSO ₄	35

All radiation is K α , except for Zn which is L α . Zn and all elements up to Si were analysed using a quartz crystal; all other elements were analysed using an RAP crystal. All mineral standards are natural; all metals are synthetic. In general, lower counts sec⁻¹ wt-%⁻¹ indicate poorer detection limits.

Precision on analyses

Listed below are the elements analysed in each mineral.

Mineral	Elements analysed
Chlorite	Si, Ti, Al, Fe, Mn, Mg, Ca, Na, K
Muscovite	Si, Ti, Al, Fe, Mn, Mg, Ca, Na, K
Biotite	Si, Ti, Al, Fe, Mn, Mg, Ca, Na, K, F
Garnet	Si, Ti, Al, Cr, Fe, Mn, Mg, Ca
Cordierite	Si, Ti, Al, Fe, Mn, Mg, Ca, Na, K
K-feldspar	Si, Al, Fe, Mg, Ca, K, Na
Plagioclase	Si, Al, Fe, Mg, Ca, K, Na
Spinel	Si, Ti, Al, Cr, Fe, Mn, Mg, Ca, Zn
Orthopyroxene	Si, Ti, Al, Cr, Fe, Mn, Mg, Ca, Na
Quartz	Si, Ti, Al, Fe, Mg, Ca, K, Na
Aluminosilicate	Si, Ti, Al, Fe, Mg, Ca, K, Na
Corundum	

Table AIII.2 lists the detection limits and two different types of precision calculation for typical analyses of each mineral for WDS analysis. The detection limit calculation and the first precision calculation measure the best possible analytical precision of the microprobe, based on the following formulae:

$$1) \text{ Detection limit} = \frac{3}{m\sqrt{T_b}} \sqrt{R_b}$$

$$2) \text{ Precision} = 2 \times \left[\frac{1}{\sqrt{T_p}} \times \frac{1}{\sqrt{R_p - R_b}} \right] \times (\text{wt}\%)$$

where m = counts (above background) sec^{-1} ($\text{wt}\% \text{-} 1$)

R_b = background count rate (counts sec^{-1})

T_b = time on background (sec)

R_p = peak count rate (counts sec^{-1})

T_p = time on peak (sec)

Table AIII.2 Precision and detection limits for typical WDS analysis. Reprod. - Reproducibility

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A. CHLORITE D182

Oxide	Mean Wt %	Theoretical precision $\pm 2\sigma$	Detection limit	Reprod. $\pm 2\sigma$ (n=5)	Oxide	Mean Wt %	Theoretical precision $\pm 2\sigma$	Detection limit	Reprod. $\pm 2\sigma$ (n=5)
SiO ₂	25.80	0.20	0.04	0.34	SiO ₂	45.15	0.27	0.04	0.79
TiO ₂	0.07	0.03	0.03	0.01	TiO ₂	0.07	0.03	0.03	0.03
Al ₂ O ₃	20.92	0.15	0.03	0.35	Al ₂ O ₃	34.53	0.17	0.02	0.72
FeO	18.11	0.15	0.03	0.30	FeO	2.16	0.07	0.03	0.37
MnO	0.22	0.02	0.03	0.02	MnO	0.01	0.03	0.03	0.01
MgO	20.47	0.14	0.02	0.20	MgO	0.73	0.03	0.02	0.29
					Na ₂ O	0.51	0.17	0.02	0.06
					K ₂ O	10.73	0.13	0.03	0.20
TOTAL	85.60			0.83	TOTAL	93.91			0.66

C. BIOTITE D63b

Oxide	Mean Wt %	Theoretical precision $\pm 2\sigma$	Detection limit	Reprod. $\pm 2\sigma$ (n=5)	Oxide	Mean Wt %	Theoretical precision $\pm 2\sigma$	Detection limit	Reprod. $\pm 2\sigma$ (n=5)
SiO ₂	37.79	0.25	0.04	0.87	SiO ₂	37.53	0.25	0.04	0.41
TiO ₂	2.34	0.07	0.03	0.12	TiO ₂	0.04	0.03	0.03	0.01
Al ₂ O ₃	19.31	0.14	0.02	0.62	Al ₂ O ₃	21.34	0.14	0.02	0.09
FeO	7.0	0.11	0.04	0.6	Cr ₂ O ₃	0.08	0.03	0.03	0.01
MnO	0.10	0.03	0.03	0.01	FeO	34.60	0.22	0.04	0.27
MgO	16.84	0.13	0.02	0.40	MnO	1.54	0.06	0.03	0.04
CaO	0.01	0.02	0.02	0.01	MgO	4.41	0.08	0.02	0.04
Na ₂ O	0.25	0.03	0.02	0.02	CaO	1.24	0.05	0.02	0.02
K ₂ O	9.95	0.13	0.02	0.20					
F	1.14	0.22	0.10	0.21					
TOTAL	95.54			0.95	TOTAL	100.81			0.67

E. CORDIERITE D568

Oxide	Mean Wt %	Theoretical precision $\pm 2\sigma$	Detection limit	Reprod. $\pm 2\sigma$ (n=5)	Oxide	Mean Wt %	Theoretical precision $\pm 2\sigma$	Detection limit	Reprod. $\pm 2\sigma$ (n=5)
SiO ₂	47.76	0.28	0.04	0.41	SiO ₂	64.65	0.30	0.04	1.07
TiO ₂	0.01	0.03	0.03	0.01	Al ₂ O ₃	18.81	0.13	0.02	0.12
Al ₂ O ₃	32.31	0.17	0.02	0.41	FeO	0.02	0.03	0.03	0.02
FeO	11.09	0.13	0.04	0.10	Ba	0.41	0.07	0.06	0.04
MnO	0.20	0.03	0.03	0.01	MgO	0.02	0.02	0.02	0.01
MgO	6.69	0.08	0.02	0.05	CaO	0.05	0.03	0.02	0.02
CaO	0.01	0.01	0.02	0.01	Na ₂ O	2.92	0.07	0.02	0.47
Na ₂ O	0.18	0.03	0.02	0.02	K ₂ O	13.05	0.14	0.02	0.79
K ₂ O	0.01	0.02	0.02	0.01					
TOTAL	98.28			0.40	TOTAL	99.95			1.09

G. PLAGIOCLASE D568

Oxide	Mean Wt %	Theoretical precision $\pm 2\sigma$	Detection limit	Reprod. $\pm 2\sigma$ (n=5)	Oxide	Mean Wt %	Theoretical precision $\pm 2\sigma$	Detection limit	Reprod. $\pm 2\sigma$ (n=5)
SiO ₂	59.44	0.30	0.04	0.95	SiO ₂	0.02	0.04	0.04	0.02
TiO ₂	0.01	0.03	0.03	0.01	TiO ₂	0.07	0.03	0.03	0.02
Al ₂ O ₃	25.51	0.15	0.02	0.51	Al ₂ O ₃	56.12	0.19	0.03	0.41
FeO	0.07	0.03	0.03	0.02	Cr ₂ O ₃	0.04	0.03	0.03	0.01
MnO	0.02	0.02	0.02	0.01	FeO	41.38	0.23	0.04	0.17
CaO	7.50	0.11	0.02	0.38	MnO	0.51	0.04	0.03	0.03
Na ₂ O	7.53	0.11	0.02	0.24	MgO	2.38	0.06	0.02	0.04
K ₂ O	0.26	0.03	0.02	0.04	CaO	0.01	0.02	0.02	0.01
					ZnO	0.27	0.07	0.05	0.03
TOTAL	100.35			0.79	TOTAL	100.82			0.51

I. ORTHOPYROXENE D568

Oxide	Mean Wt %	Theoretical precision $\pm 2\sigma$	Detection limit	Reprod. $\pm 2\sigma$ (n=5)
SiO ₂	48.72	0.27	0.04	0.65
TiO ₂	0.15	0.06	0.03	0.02
Al ₂ O ₃	2.18	0.06	0.02	0.12
Cr ₂ O ₃	0.05	0.03	0.03	0.01
FeO	37.56	0.23	0.04	0.16
MnO	0.64	0.04	0.03	0.05
MgO	11.30	0.12	0.02	0.03
CaO	0.16	0.03	0.02	0.03
Na ₂ O	0.01	0.01	0.01	0.01
TOTAL	100.77			0.58

The second precision calculation is a measure of the reproducability of several consecutive analyses within a small area ($\sim 100 \mu\text{m}^2$); in general (but not always) it gives a higher 2σ than that based on the counting statistics. In a sense, this calculation is probably a better estimate of the practical, or "user", precision of the microprobe; during the course of a probe session, slight fluctuations in the vacuum, beam current, and/or peak positions may influence the quality of analyses. These effects are impossible to quantify.

The minerals with the poorest reproducability are muscovite, biotite and K-feldspar. It is possible that these minerals may not have been homogeneous on the scale of $100 \mu\text{m}^2$.

Explanation of tables

In the following tables, mineral spot analyses are listed that are closest to the average value of the good analyses of a particular mineral in a given rock. Allowance is made for core-rim variation. The analyses are grouped together by rock, which are ordered numerically.

The following abbreviations are used:

n.d.:	not detected
CHL:	primary chlorite
CHL-2:	secondary chlorite, not specific
CHL-2(GT):	chlorite that is an alteration of garnet
MU:	primary muscovite
MU-2	secondary muscovite; not specific
BI:	primary biotite. May be regional or contact metamorphic
BI-R:	schistosity-parallel (regional) biotite, as opposed to late, cross-cutting biotite
BI-L:	late biotite. May be with respect to regional <u>or</u> contact metamorphic specimens; in both cases, the biotite texturally appears to post date the dominant texture.

BI-A:	biotite in medium and high grade rocks involved in the retrograde assemblage Mu-Chl-Bi.
BI-MZ:	biotite in the leucosome (melt zone) of heterogeneous migmatites.
BI-S:	biotite in the selvage of partially melted rocks.
BI-M:	biotite in the mesosome or in the middle of disrupted bedding fragments (i.e. well away from the selvage).
BI-MS:	biotite midway between the selvage and the unaffected mesosome.
CD:	cordierite.
CD-C:	cordierite core.
CD-R:	cordierite rim.
CD-A:	pinitized cordierite.
CD(+AS):	cordierite in a layer containing andalusite.
CD-MZ:	cordierite in the leucosome (melt zone) of heterogeneous migmatites.
CD-S:	cordierite in the selvage
CD-M:	cordierite in the mesosome or in the middle of disrupted bedding fragments (well away from the selvage).
CD-MS:	cordierite midway between the selvage and mesosome.
GT-C:	garnet core.
GT-R:	garnet rim.
KF:	K-feldspar.
KF-C:	K-feldspr core.
KF-R	K-feldspr rim.
PL-A:	plagioclase (albite)
PL-O:	plagioclase (oligoclase)
SP:	spinel
HY:	hypersthene
EP:	primary epidote (in regional rocks).
EP-2:	secondary (alteration epidote).
SIL:	sillimanite.
AND:	andalusite.
COR:	corundum.

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AUREOLE									
	F	nd	nd						
S102	34.13	47.32	22.98	4.4	5.5	35.74	33.77	47.03	8
T102	32.40	nd	0.45	nd	nd	33.82	nd	nd	nd
A1203	19.09	32.15	21.43	34.53	24.81	61.42	18.65	32.29	26.06
FeO	23.44	nd	0.03	3.09	0.13	nd	24.13	nd	37.66
MnO	0.44	9.29	0.25	0.01	nd	nd	0.11	0.22	0.04
Fe2O3	6.48	5.71	6.03	0.51	0.01	nd	5.63	5.50	20.03
CaO	0.04	0.02	0.01	nd	6.19	nd	0.22	0.54	22.03
MgO	0.30	0.47	0.01	0.69	7.96	nd	0.03	nd	11.96
K2O	9.06	nd	0.01	9.91	0.19	nd	9.58	nd	0.15
total =	95.08	97.51	87.44	94.13	99.25	98.05	95.91	97.10	nd
oxygenes	10.02	10.43	10.00	[14]	[11]	[10]	[11]	[10]	[15]
F	0.21	nd	nd	nd	nd	nd	0.28	nd	nd
S1	2.66	5.00	2.57	3.05	2.69	0.99	2.63	4.99	nd
A1	0.14	-	0.02	0.02	2.76	1.31	2.00	0.22	nd
Fe2	1.53	4.00	2.82	3.23	0.18	nd	0.02	4.04	nd
Mn	0.03	1.02	0.03	0.02	-	-	1.57	1.02	nd
Mg	0.75	0.90	1.34	0.05	0.05	-	-	0.02	nd
Ca	-	-	-	-	-	-	0.65	0.87	nd
Na	0.05	0.10	-	-	0.09	0.30	-	0.03	nd
K	0.90	-	-	-	0.86	0.01	-	0.11	nd
total =	7.79	11.05	10.00	[14]	[11]	7.02	5.01	3.01	nd
oxygenes	10.11	10.93	10.00	[14]	[11]	[10]	[15]	[11]	[15]
F	nd	nd							
5 D1-MH2	4.01	nd	nd						
2 D1-CO	5.01	nd	nd						
3 D1-CHL-2	6.01	nd	nd						
total =	86.74	97.73	94.95	99.38	96.16	94.35	96.81	96.24	nd
oxygenes	10.02	10.43	10.00	[14]	[11]	[10]	[11]	[10]	[15]
F	nd	nd							
S1	2.61	2.97	3.08	2.71	2.76	5.01	2.69	nd	nd
T1	2.75	nd	0.02	0.13	0.13	-	-	nd	nd
A1	2.73	1.04	2.73	1.29	0.16	nd	nd	nd	nd
Fe2	2.81	-	0.16	-	-	-	-	nd	nd
Mn	0.03	-	-	-	-	-	-	nd	nd
Mg	1.81	-	0.06	-	-	-	-	nd	nd
Ca	-	-	-	-	-	-	-	nd	nd
Na	-	0.18	0.08	0.08	0.01	0.02	0.04	-	nd
K	-	0.80	0.90	0.90	0.90	0.90	-	-	nd
total =	10.02	10.00	7.02	5.00	7.74	7.82	11.03	10.00	nd
oxygenes	10.02	10.43	7.02	[14]	[11]	[10]	[11]	[10]	[15]
F	nd	nd							
9 D2-CHL-2	12.02	PL-0	15.07	CD	16.07	CHL-2	14.07	BL-1	nd
10 D2-KF	13.02	nd	13.07	BL-1	14.07	CHL-2	14.07	BL-1-A	nd
11 D2-MU-2	nd	nd							
12 D2-PL-0	nd	nd							

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AUREOLE									
	F	nd	nd	nd	nd	nd	nd	nd	nd
S102	64.41	45.78	60.72	35.38	35.54	21	22	26.06	24
T102	60.05	0.18	nd	3.39	3.39	nd	nd	0.03	37.66
A1203	18.56	33.12	24.57	nd	nd	nd	nd	nd	20.03
FeO	0.28	3.53	0.02	16.36	15.38	nd	nd	nd	22.03
MnO	nd	nd	nd	nd	nd	nd	nd	nd	nd
CaO	nd	nd	nd	nd	nd	nd	nd	nd	nd
Na2O	0.11	nd	nd	nd	nd	nd	nd	nd	nd
K2O	13.64	10.60	0.15	9.86	9.98	0.06	0.06	0.05	22.72
total =	99.10	94.90	99.45	94.38	94.91	97.89	96.58	95.63	nd
oxygenes	10.02	10.43	10.00	[14]	[11]	[10]	[11]	[10]	[15]
F	nd	nd	nd	nd	nd	nd	nd	nd	nd
S1	2.98	3.10	2.71	2.70	2.68	5.00	2.74	nd	nd
T1	1.01	2.65	1.29	1.61	1.67	3.97	2.48	nd	nd
Fe2	0.01	-	-	-	-	1.04	0.49	nd	nd
Mn	-	-	-	-	-	0.11	0.02	0.03	0.52
Ca	-	-	-	-	-	0.18	0.12	0.12	0.08
Na	-	-	-	-	-	0.81	0.07	0.06	0.04
K	-	-	-	-	-	0.96	0.03	0.03	0.91
total =	5.00	7.06	4.99	[6]	[11]	7.80	7.81	11.05	16.00
oxygenes	10.02	10.43	10.00	[14]	[11]	[10]	[11]	[10]	[15]
F	nd	nd	nd	nd	nd	nd	nd	nd	nd
17 D7-KF	20.08	81	21	80	81	27	29	31	32
18 D7-MU-2	19	D7-PL-0	22	08	CO	56.92	46.35	45.6	64.52
S102	63.25	nd	nd	nd	nd	nd	nd	nd	nd
T102	0.05	nd	nd	nd	nd	nd	nd	nd	nd
A1203	18.59	33.43	26.01	nd	nd	nd	nd	nd	nd
FeO	0.09	2.93	0.12	nd	nd	nd	nd	nd	nd
MnO	nd	nd	nd	nd	nd	nd	nd	nd	nd
CaO	0.01	1.36	0.02	nd	nd	nd	nd	nd	nd
Na2O	0.23	0.47	0.03	nd	nd	nd	nd	nd	nd
K2O	13.29	10.49	0.05	nd	nd	nd	nd	nd	nd
total =	97.89	95.17	98.52	95.67	98.00	96.53	94.49	95.60	nd
oxygenes	10.02	10.43	10.00	[14]	[11]	[10]	[11]	[10]	[15]
F	nd	nd	nd	nd	nd	nd	nd	nd	nd
S1	2.97	3.12	2.59	2.64	4.99	nd	nd	nd	nd
T1	1.03	2.65	1.41	1.65	1.41	nd	nd	nd	nd
Fe2	0.16	-	-	1.31	1.31	nd	nd	nd	nd
Mn	-	-	-	-	-	0.03	0.03	0.03	nd
Ca	-	-	-	-	-	0.21	0.06	0.06	nd
Na	-	-	-	-	-	0.79	0.90	0.03	nd
K	-	-	-	-	-	0.88	0.88	0.03	nd
total =	5.01	7.03	5.02	7.72	11.02	10.01	9.01	10.01	nd
oxygenes	10.02	10.43	10.00	[14]	[11]	[10]	[11]	[10]	[15]
F	nd	nd	nd	nd	nd	nd	nd	nd	nd
25 D8-KF	26 D8-MU-2	26 D8-PL-0	27 D8-CHL-2	28 D8-KF	28 D8-MU-2	31 D148-CD	31 D148-PL-A	32 D148-PL-2	nd

ANALYSES OF PELEITIC MINERALS IN THE BALLACHULISH AUREOLE

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ANALYSES OF PELOTTIC MINERALS IN THE BANIACHIN ISH ANKOS F

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AUREOLE

S102	45.97	65	67	68	69	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	8010	8011	8012	8013	8014	8015	8016	8017	8018	8019	8020	8021	8022	8023	8024	8025	8026	8027	8028	8029	8030	8031	8032	8033	8034	8035	8036	8037	8038	8039	8040	8041	8042	8043	8044	8045	8046	8047	8048	8049	8050	8051	8052	8053	8054	8055	8056	8057	8058	8059	8060	8061	8062	8063	8064	8065	8066	8067	8068	8069	80610	80611	80612	80613	80614	80615	80616	80617	80618	80619	80620	80621	80622	80623	80624	80625	80626	80627	80628	80629	80630	80631	80632	80633	80634	80635	80636	80637	80638	80639	80640	80641	80642	80643	80644	80645	80646	80647	80648	80649	80650	80651	80652	80653	80654	80655	80656	80657	80658	80659	80660	80661	80662	80663	80664	80665	80666	80667	80668	80669	806610	806611	806612	806613	806614	806615	806616	806617	806618	806619	806620	806621	806622	806623	806624	806625	806626	806627	806628	806629	806630	806631	806632	806633	806634	806635	806636	806637	806638	806639	806640	806641	806642	806643	806644	806645	806646	806647	806648	806649	806650	806651	806652	806653	806654	806655	806656	806657	806658	806659	806660	806661	806662	806663	806664	806665	806666	806667	806668	806669	8066610	8066611	8066612	8066613	8066614	8066615	8066616	8066617	8066618	8066619	8066620	8066621	8066622	8066623	8066624	8066625	8066626	8066627	8066628	8066629	8066630	8066631	8066632	8066633	8066634	8066635	8066636	8066637	8066638	8066639	8066640	8066641	8066642	8066643	8066644	8066645	8066646	8066647	8066648	8066649	8066650	8066651	8066652	8066653	8066654	8066655	8066656	8066657	8066658	8066659	8066660	8066661	8066662	8066663	8066664	8066665	8066666	8066667	8066668	8066669	80666610	80666611	80666612	80666613	80666614	80666615	80666616	80666617	80666618	80666619	80666620	80666621	80666622	80666623	80666624	80666625	80666626	80666627	80666628	80666629	80666630	80666631	80666632	80666633	80666634	80666635	80666636	80666637	80666638	80666639	80666640	80666641	80666642	80666643	80666644	80666645	80666646	80666647	80666648	80666649	80666650	80666651	80666652	80666653	80666654	80666655	80666656	80666657	80666658	80666659	80666660	80666661	80666662	80666663	80666664	80666665	80666666	80666667	80666668	80666669	806666610	806666611	806666612	806666613	806666614	806666615	806666616	806666617	806666618	806666619	806666620	806666621	806666622	806666623	806666624	806666625	806666626	806666627	806666628	806666629	806666630	806666631	806666632	806666633	806666634	806666635	806666636	806666637	806666638	806666639	806666640	806666641	806666642	806666643	806666644	806666645	806666646	806666647	806666648	806666649	806666650	806666651	806666652	806666653	806666654	806666655	806666656	806666657	806666658	806666659	806666660	806666661	806666662	806666663	806666664	806666665	806666666	806666667	806666668	806666669	8066666610	8066666611	8066666612	8066666613	8066666614	8066666615	8066666616	8066666617	8066666618	8066666619	8066666620	8066666621	8066666622	8066666623	8066666624	8066666625	8066666626	8066666627	8066666628	8066666629	8066666630	8066666631	8066666632	8066666633	8066666634	8066666635	8066666636	8066666637	8066666638	8066666639	8066666640	8066666641	8066666642	8066666643	8066666644	8066666645	8066666646	8066666647	8066666648	8066666649	8066666650	8066666651	8066666652	8066666653	8066666654	8066666655	8066666656	8066666657	8066666658	8066666659	8066666660	8066666661	8066666662	8066666663	8066666664	8066666665	8066666666	8066666667	8066666668	8066666669	80666666610	80666666611	80666666612	80666666613	80666666614	80666666615	80666666616	80666666617	80666666618	80666666619	80666666620	80666666621	80666666622	80666666623	80666666624	80666666625	80666666626	80666666627

ANALYSES OF PELOMIC MINERALS IN THE BALLACHULISH AUREOLE

ANALYSES OF PELOMIC MINERALS IN THE BALLACHULISH AUREOLE													
	F	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
S102	97	98	99	100	101	102	103	104	115	116	117	118	119
T102	37.46	36.94	48.73	68.65	34.69	48.38	65.71	45.08	64.67	64.67	65.70	65.70	35.95
A102	0.14	0.09	0.25	0.03	2.36	nd	nd	nd	nd	nd	nd	nd	nd
C102	20.96	20.90	31.02	20.84	17.51	31.09	18.07	29.60	22.05	18.55	33.15	18.88	21.41
F102	0.02	0.02	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Hn102	10.03	27.46	2.71	0.34	16.06	7.67	0.11	2.99	nd	nd	nd	nd	nd
Mg102	6.71	0.71	0.01	nd	0.03	nd	nd	nd	nd	nd	nd	nd	nd
Ca102	1.00	1.74	0.08	12.17	0.05	1.59	0.05	1.59	nd	nd	nd	nd	nd
K102	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Na20	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ba20	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
total =	100.84	100.03	94.53	101.79	92.39	96.96	99.95	90.75	100.15	94.59	97.41	100.03	92.49
	F	nd	nd	nd	nd	nd	nd	nd	F	nd	nd	nd	nd
S1	3.00	2.98	3.26	2.96	2.68	5.04	3.01	3.18	S1	2.85	2.67	4.94	2.97
T1	-	-	0.02	0.45	1.06	0.14	0.91	0.38	T1	1.20	1.04	4.04	1.02
A1	1.98	1.99	2.45	1.06	1.60	3.91	0.38	2.46	A1	0.52	1.04	1.02	1.11
F2	-	0.04	1.81	0.15	0.01	1.04	0.65	-	F2	nd	nd	nd	0.02
Hn	0.68	0.46	-	-	-	-	-	0.18	Hn	nd	nd	nd	0.50
Mg	0.12	0.17	-	-	-	-	-	-	Mg	nd	nd	nd	0.83
Ca	0.64	0.60	-	-	-	-	-	-	Ca	nd	nd	nd	nd
Na	-	-	-	-	-	-	-	-	Na	0.79	0.14	0.02	0.04
K	-	-	-	-	-	-	-	-	K	nd	nd	nd	nd
total =	8.00	8.00	6.93	1.99	7.85	11.04	5.00	6.99	total =	5.01	7.84	11.06	5.02
	oxygenes =	[122]	[122]	[111]	[161]	[161]	[161]	[111]	oxygenes =	[163]	[163]	[111]	[53]
S102	100	101	101	101	101	101	101	101	S102	121	122	124	125
T102	100	101	101	101	101	101	101	101	T102	48.96	64.80	63.85	34.84
A102	100	101	101	101	101	101	101	101	A102	nd	nd	nd	nd
F2	100	101	101	101	101	101	101	101	F2	33.42	18.57	21.91	19.59
Hn102	100	101	101	101	101	101	101	101	Hn102	nd	nd	nd	nd
Mg102	100	101	101	101	101	101	101	101	Mg102	nd	nd	nd	nd
Ca102	100	101	101	101	101	101	101	101	Ca102	nd	nd	nd	nd
Na20	100	101	101	101	101	101	101	101	Na20	nd	nd	nd	nd
Ba20	100	101	101	101	101	101	101	101	Ba20	nd	nd	nd	nd
total =	96.96	93.93	93.59	94.69	98.53	86.92	100.15	95.42	total =	96.86	99.23	98.56	94.09
	F	nd	nd	nd	nd	nd	nd	nd	F	nd	nd	nd	nd
S1	0.34	0.47	0.66	0.55	nd	nd	nd	nd	S1	5.01	2.99	2.85	2.67
T1	-	-	-	-	-	-	-	-	T1	4.03	1.01	1.15	1.15
A1	-	-	-	-	-	-	-	-	A1	4.03	1.01	1.15	1.15
F2	-	-	-	-	-	-	-	-	F2	0.34	-	-	-
Hn	-	-	-	-	-	-	-	-	Hn	0.02	-	-	-
Mg	-	-	-	-	-	-	-	-	Mg	0.57	-	-	-
Ca	-	-	-	-	-	-	-	-	Ca	-	-	-	-
Na	-	-	-	-	-	-	-	-	Na	-	-	-	-
K	-	-	-	-	-	-	-	-	K	-	-	-	-
total =	105	105	105	105	105	105	105	105	total =	109	5.00	4.99	4.99
	oxygenes =	[111]	[111]	[111]	[111]	[111]	[111]	[111]	oxygenes =	[163]	[163]	[111]	[111]
105	105	105	105	105	105	105	105	105	121	124	125	126	126
106	106	106	106	106	106	106	106	106	122	122	122	122	122
107	107	107	107	107	107	107	107	107	123	123	123	123	123
	oxygenes =	[111]	[111]	[111]	[111]	[111]	[111]	[111]	oxygenes =	[163]	[163]	[111]	[111]
105	105	105	105	105	105	105	105	105	124	124	124	124	124
106	106	106	106	106	106	106	106	106	125	125	125	125	125
107	107	107	107	107	107	107	107	107	126	126	126	126	126
	oxygenes =	[111]	[111]	[111]	[111]	[111]	[111]	[111]	oxygenes =	[163]	[163]	[111]	[111]
105	105	105	105	105	105	105	105	105	127	127	127	127	127
106	106	106	106	106	106	106	106	106	128	128	128	128	128
107	107	107	107	107	107	107	107	107	129	129	129	129	129

ANALYSES OF PELOITIC MINERALS IN THE BALLACHILISH AUREOLE											
	ANALYSES OF PELOITIC MINERALS IN THE BALLACHILISH AUREOLE										
S102	64.29	130	131	132	67.83	66.01	134	135	65.24	149	145
T102	65.32	nd	45.31	0.36	0.02	35.64	48.17	nd	56.03	47.01	61.59
A1203	18.04	18.83	34.51	19.84	21.81	17.09	18.98	nd	0.03	36.29	66.61
FeO	0.49	0.17	3.04	0.17	0.17	0.30	0.04	nd	0.25	33.56	0.03
MnO	nd	nd	nd	nd	nd	nd	nd	nd	nd	23.41	nd
MgO	0.09	0.01	0.58	0.58	0.01	0.23	0.55	nd	0.25	18.20	0.25
K20	0.05	0.04	0.04	nd	nd	nd	nd	nd	nd	11.44	nd
CaO	1.63	2.67	0.68	11.48	10.26	0.19	0.44	nd	nd	0.12	0.21
Na2O	13.97	12.54	9.99	0.20	0.27	9.49	nd	nd	nd	0.02	0.17
BaO	nd	0.27	nd	nd	nd	nd	nd	nd	nd	0.18	0.11
total=	99.48	100.15	94.47	99.78	100.84	93.61	97.40	100.52	total=	100.45	100.02
F	nd	nd	nd	nd	nd	nd	nd	nd	F	nd	nd
S1	2.97	2.99	3.07	2.97	2.88	2.71	4.99	2.98	S1	2.91	2.78
T1	1.03	1.01	2.75	1.03	1.12	0.25	1.00	1.02	T1	1.10	1.22
Fe2	0.02	-	0.17	-	0.01	0.05	0.61	-	Fe2	-	1.14
Mn	-	-	-	-	-	-	0.05	-	Mn	-	-
Mg	-	-	0.06	-	0.01	0.10	1.30	-	Mg	-	-
Ca	-	-	-	-	-	-	1.31	-	Ca	0.08	0.21
Na	0.62	0.73	0.09	0.98	0.87	0.03	0.09	0.01	Na	0.86	0.76
K	0.82	0.73	0.86	0.91	0.02	0.93	0.77	0.01	K	-	1.13
total=	5.00	4.98	7.02	5.01	5.00	7.79	11.05	5.01	total=	4.97	4.99
oxygene=	[16]	[16]	[11]	[16]	[16]	[11]	[16]	[16]	oxygene=	[16]	[16]
129 068-KF-C	132 065-KF-C	133 065-KF-C	134 065-KF-C	135 068-KF-C	136 068-KF-C	137 068-KF-C	138 068-KF-C	139 068-KF-C	145 078-Pt-A	146 081-A-CO	150 081-A-PL-0
130 065-KF-H	131 065-Mn-2	132 065-KF-H	133 065-Mn-2	134 065-Mn-2	135 068-KF-C	136 068-KF-C	137 068-KF-C	138 068-KF-C	145 078-Pt-B	146 081-A-Mn-2	152 083(A-2)-PL-1-A
S102	64.37	130	130	130	145	145	144	144	S102	46.83	153
T102	64.60	nd	45.79	60.39	20.07	33.51	47.13	64.49	T102	nd	153
A1203	18.60	nd	34.75	25.36	20.78	22.68	32.64	18.67	A1203	nd	153
FeO	0.06	0.06	1.49	0.12	0.12	22.69	22.29	1.20	FeO	nd	153
MnO	nd	nd	nd	nd	nd	nd	nd	nd	MnO	nd	nd
CaO	0.05	1.57	nd	6.13	16.13	6.46	0.53	0.02	CaO	nd	5.99
Na2O	0.31	nd	nd	nd	nd	nd	nd	nd	Na2O	nd	nd
K20	1.72	9.93	7.33	nd	nd	nd	nd	nd	K20	nd	nd
BaO	0.15	nd	nd	nd	nd	nd	nd	nd	BaO	nd	nd
total=	99.76	93.85	99.78	84.98	96.51	98.03	99.84	95.11	total=	96.18	97.30
F	nd	nd	nd	0.03	0.21	nd	nd	nd	F	nd	nd
S1	2.98	3.09	2.69	2.69	2.61	4.95	2.98	3.03	S1	5.00	5.00
T1	1.01	2.76	1.33	2.63	1.87	4.04	0.98	2.85	T1	nd	nd
Fe2	0.08	-	-	2.04	1.45	0.98	0.07	0.07	Fe2	4.00	4.00
Mn	0.02	0.16	-	0.02	0.25	0.75	0.05	0.05	Mn	0.94	0.94
Na	0.12	0.87	0.85	0.30	0.64	0.02	0.05	0.05	Na	0.95	0.95
K	0.87	0.87	0.85	0.64	0.27	0.89	0.05	0.05	K	-	-
total=	5.01	6.98	4.97	9.98	7.76	11.05	4.99	6.99	total=	11.06	11.03
oxygene=	[16]	[11]	[16]	[14]	[16]	[11]	[16]	[16]	oxygene=	[16]	[16]
137 068-KF-H	140 068-CHL-2	141 068-KF	142 068-Mn-2	143 078-KF	144 068-CHL-2	145 068-A(2)-CO-H	146 068-A(2)-PL-0	147 068-A(2)-CHL-2	152 083(A-2)-PL-1-A	153 068-A(2)-CO-H	154 068-A(2)-CO-S
138 068-KF-H	139 068-Mn-2	140 068-KF	141 068-Mn-2	142 068-Mn-2	143 078-KF	144 068-CHL-2	145 068-A(2)-PL-0	146 068-A(2)-CHL-2	152 083(A-2)-PL-1-A	153 068-A(2)-CO-H	154 068-A(2)-CO-S

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AUREOLE

ANALYSES OF PEELING MINERALS IN THE DULUTH ISLAND AREA

ANALYSES IN THE CELLULOSE-ASSIMILATING BACTERIA										
S102	61.03	170	178	35.92	36.95	35.73	47.82	47.90	48.40	184
T102	61.03	170	178	34.82	34.45	34.32	40.02	40.02	40.06	24.50
A1203	26.55	16.52	17.02	17.02	16.82	16.82	32.68	33.16	nd	0.06
Feo	0.11	nd	nd	0.10	0.10	0.12	8.49	7.23	6.39	27.64
Hg0	0.01	10.12	10.12	10.65	11.12	11.94	0.09	0.17	0.20	0.19
C20	6.04	nd	nd	0.18	0.16	0.16	7.90	8.76	9.35	13.03
M20	0.26	9.44	9.44	8.89	9.54	9.54	0.20	0.22	0.03	0.01
K20	0.26	9.44	9.44	8.89	9.54	9.54	nd	nd	nd	0.01
total =	100.12	94.94	94.94	94.55	95.67	96.91	96.96	97.83	96.64	
F	nd	0.28	0.31	0.42	nd	nd	nd	nd	nd	
S1	2.71	2.73	2.67	2.66	2.69	5.00	4.98	4.98	2.65	
T1	2.73	2.73	2.68	2.53	1.53	1.49	3.99	4.00	4.01	
A1	1.29	1.48	1.13	1.09	1.13	1.07	0.74	0.63	0.55	
F2	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Hg	-	nd	nd	nd	nd	nd	nd	nd	nd	
K	0.28	nd	nd	nd	nd	nd	nd	nd	nd	
Ma	0.01	0.03	0.03	0.02	0.02	0.02	0.04	0.04	0.04	
Na	0.01	0.91	0.91	0.87	0.87	0.87	nd	nd	nd	
total =	5.00	7.73	7.75	7.75	7.79	11.02	11.04	11.04	9.99	
organisms:	(6)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	
S102	177	0830-BI-0	180	0830-CI-S	180	0830-CD-M	180	0830-CD-S	180	
T102	178	0830-BI-4	181	0830-CD-M	181	0830-CD-M	184	0830-CD-M	182	
A1203	179	0830-BI-1S	182	0830-CD-M	182	0830-CD-M	184	0830-CD-M	182	
F	nd	nd	nd	nd	nd	nd	nd	nd	nd	
S1	165	165	165	165	187	188	189	190	191	182
T1	64.05	45.04	59.43	39.36	31.39	27.56	48.90	47.75	36.77	
A1	110.32	88.45	50.04	50.04	29.91	20.52	60.69	60.12	67.74	
F2	0.02	0.02	0.02	0.02	0.07	0.07	28.99	32.54	20.54	
Hg	nd	nd	nd	nd	nd	nd	nd	nd	nd	
K	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Ma	0.01	0.40	0.01	0.01	0.05	0.05	0.01	0.01	0.01	
Na	0.06	nd	0.06	0.06	0.59	0.59	2.75	1.59	12.85	
Na2	2.14	10.45	10.45	7.84	0.06	0.04	0.04	0.02	0.02	
K20	13.56	nd	0.17	0.17	9.52	0.06	0.18	0.02	0.24	
Bal	0.44	nd	nd	nd	nd	nd	10.07	10.15	8.52	
total =	99.74	93.42	99.06	95.08	95.31	95.06	96.14	94.17		
F	nd	nd	nd	nd	nd	nd	nd	nd	nd	
S1	2.98	3.09	2.67	2.69	2.80	3.29	3.17	2.71		
T1	1.02	2.66	1.32	1.37	2.46	3.03	2.55	2.04		
A1	-	0.15	-	0.74	3.15	6.20	0.19	1.81		
F2	-	0.14	-	1.03	3.53	6.28	0.16	1.43		
Hg	-	nd	-	-	-	-	-	-		
K	0.19	0.91	0.91	0.68	0.89	-	0.02	0.07		
Na	0.80	nd	nd	nd	nd	nd	0.86	0.86	0.81	
Na2	nd	nd	nd	nd	nd	nd	nd	nd		
total =	5.00	7.04	5.01	7.80	9.97	6.97	7.01	7.77		
organisms:	(6)	(11)	(11)	(11)	(11)	(11)	(11)	(11)		
S102	185	0830-CI-KF	188	0830-CHI-2	188	0830-CHI-2	188	0830-CHI-1	187	
T102	186	0830-CHI-2	189	0830-CHI-1	189	0830-CHI-1	190	0830-CHI-1	192	

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AUREOLE

S102	193	194	195	196	197	198	199	200
T102	47.92	34.85	37.26	47.52	68.20	36.19	47.62	68.20
A1203	0.30	0.41	1.62	0.03	0.41	nd	0.60	0.60
F102	33.50	20.95	18.15	32.84	29.83	19.56	31.09	22.35
F20	17.19	11.09	17.51	7.98	2.12	18.58	15.17	0.05
MgO	1.68	1.05	1.07	0.15	0.30	nd	0.25	0.21
CaO	nd	nd	nd	nd	nd	nd	nd	nd
MnO	0.58	0.24	0.22	0.28	0.18	0.16	0.39	0.21
K20	9.45	6.53	6.35	0.10	9.77	0.07	8.62	10.06
total =	94.62	93.32	94.85	97.38	92.60	99.80	92.24	94.25
F	nd	0.30	0.25	nd	nd	0.36	nd	nd
S1	3.18	2.66	2.79	4.94	3.26	2.99	2.77	3.21
T1	0.01	0.02	0.09	0.02	0.03	0.09	0.03	0.02
A1	2.62	1.89	1.60	2.41	2.12	1.68	2.47	2.12
F2	0.07	1.09	1.10	0.69	0.12	0.01	0.97	0.13
Mg	nd	nd	nd	nd	nd	nd	nd	nd
Mg%	0.17	1.27	1.31	0.32	0.25	nd	1.36	0.21
Na	0.07	0.04	0.03	0.06	0.05	0.02	0.05	0.02
K	0.80	0.83	0.80	0.01	0.85	0.84	0.87	0.01
total =	6.93	7.81	7.73	11.08	6.98	5.01	7.73	6.98
oxygen =	[111]	[111]	[111]	[101]	[111]	[101]	[111]	[111]
193	194	195	196	197	198	199	200	200
194	0.126-B1	- contact metamorphic	197	0.126-CD	198	0.126-MU	199	0.126-B1
195	0.126-B1-R	- recrystall.	196	0.126-PL-A	197	0.126-PL-B1	198	0.126-PL-C

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AUREOLE

S102	218	219	220	221	222	223	224
T102	48.01	23.78	46.07	69.36	24.23	23.24	37.24
A1203	0.57	0.10	0.24	0.24	0.08	0.08	0.12
F20	27.99	20.29	23.93	19.73	20.21	20.09	20.73
MgO	4.67	5.56	10.89	3.67	20.35	25.96	5.56
Mg%	nd	nd	nd	nd	nd	nd	nd
Na20	0.03	1.22	0.29	0.01	0.14	5.57	0.27
K20	nd	nd	nd	2.05	nd	nd	0.59
total =	94.57	87.17	93.46	92.71	101.01	98.30	100.09
F	nd	2.60	6.07	3.9	3.01	2.72	2.59
S1	3.28	2.60	6.07	3.9	3.02	2.76	3.00
T1	0.03	0.02	0.02	0.02	0.02	0.02	0.02
A1	2.26	2.75	4.50	2.51	0.98	2.76	1.97
F2	0.27	2.80	1.52	0.21	0.01	3.27	1.82
Mg	0.25	1.83	0.04	0.14	0.99	0.02	0.38
Na	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd
total =	7.04	10.02	16.00	7.02	4.98	9.99	10.02
oxygen =	[111]	[141]	[125]	[111]	[103]	[141]	[121]
217	0.15-B1	220	0.157-MU	223	0.157-PL-A	224	0.160-CH-2(1)
218	0.157-CHL	219	0.157-EP	220	0.157-CHL-2(1)	221	0.160-CHL-2(1)
S102	225	226	227	228	229	230	232
T102	37.22	47.09	34.27	23.91	37.53	46.75	67.72
A1203	0.08	0.28	2.05	0.14	0.10	0.38	nd
F20	31.49	33.04	17.44	21.16	20.94	32.67	19.53
MgO	2.88	2.70	22.72	28.98	25.63	22.40	nd
Mg%	nd	nd	nd	nd	nd	nd	nd
Na20	0.93	nd	nd	nd	nd	nd	nd
K20	nd	nd	nd	nd	nd	nd	nd
total =	10.02	16.00	7.02	4.98	9.99	10.02	8.00
oxygen =	[111]	[141]	[125]	[111]	[103]	[141]	[121]
217	0.15-B1	218	0.157-MU	219	0.157-PL-A	220	0.160-CH-2(1)
218	0.157-CHL	219	0.157-EP	220	0.157-CHL-2(1)	221	0.160-CHL-2(1)
S102	225	226	227	228	229	230	232
T102	37.22	47.09	34.27	23.91	37.53	46.75	67.72
A1203	0.08	0.28	2.05	0.14	0.10	0.38	nd
F20	31.49	33.04	17.44	21.16	20.94	32.67	19.53
MgO	2.88	2.70	22.72	28.98	25.63	22.40	nd
Mg%	nd	nd	nd	nd	nd	nd	nd
Na20	0.93	nd	nd	nd	nd	nd	nd
K20	nd	nd	nd	nd	nd	nd	nd
total =	10.02	16.00	7.02	4.98	9.99	10.02	8.00
oxygen =	[111]	[141]	[125]	[111]	[103]	[141]	[121]
217	0.15-B1	218	0.157-MU	219	0.157-PL-A	220	0.160-CH-2(1)
218	0.157-CHL	219	0.157-EP	220	0.157-CHL-2(1)	221	0.160-CHL-2(1)
S1	2.99	3.16	2.72	2.63	3.00	3.02	2.99
T1	0.01	0.61	0.61	0.61	0.61	0.61	0.61
A1	1.98	2.61	2.61	2.78	1.99	2.61	2.61
F2	0.03	0.15	0.15	1.51	1.51	1.51	0.14
Mg	0.20	0.20	0.20	0.91	0.91	0.91	0.14
Na	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd
total =	8.00	6.98	7.77	9.99	8.00	8.00	5.00
oxygen =	[123]	[111]	[111]	[111]	[111]	[111]	[111]
225	0.160-GT-R	226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A
226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A	229	0.161-GT-R
S1	2.99	3.16	2.72	2.63	3.00	3.02	2.99
T1	0.01	0.61	0.61	0.61	0.61	0.61	0.61
A1	1.98	2.61	2.61	2.78	1.99	2.61	2.61
F2	0.03	0.15	0.15	1.51	1.51	1.51	0.14
Mg	0.20	0.20	0.20	0.91	0.91	0.91	0.14
Na	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd
total =	8.00	6.98	7.77	9.99	8.00	8.00	5.00
oxygen =	[123]	[111]	[111]	[111]	[111]	[111]	[111]
225	0.160-GT-R	226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A
226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A	229	0.161-GT-R
S1	2.99	3.16	2.72	2.63	3.00	3.02	2.99
T1	0.01	0.61	0.61	0.61	0.61	0.61	0.61
A1	1.98	2.61	2.61	2.78	1.99	2.61	2.61
F2	0.03	0.15	0.15	1.51	1.51	1.51	0.14
Mg	0.20	0.20	0.20	0.91	0.91	0.91	0.14
Na	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd
total =	8.00	6.98	7.77	9.99	8.00	8.00	5.00
oxygen =	[123]	[111]	[111]	[111]	[111]	[111]	[111]
225	0.160-GT-R	226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A
226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A	229	0.161-GT-R
S1	2.99	3.16	2.72	2.63	3.00	3.02	2.99
T1	0.01	0.61	0.61	0.61	0.61	0.61	0.61
A1	1.98	2.61	2.61	2.78	1.99	2.61	2.61
F2	0.03	0.15	0.15	1.51	1.51	1.51	0.14
Mg	0.20	0.20	0.20	0.91	0.91	0.91	0.14
Na	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd
total =	8.00	6.98	7.77	9.99	8.00	8.00	5.00
oxygen =	[123]	[111]	[111]	[111]	[111]	[111]	[111]
225	0.160-GT-R	226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A
226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A	229	0.161-GT-R
S1	2.99	3.16	2.72	2.63	3.00	3.02	2.99
T1	0.01	0.61	0.61	0.61	0.61	0.61	0.61
A1	1.98	2.61	2.61	2.78	1.99	2.61	2.61
F2	0.03	0.15	0.15	1.51	1.51	1.51	0.14
Mg	0.20	0.20	0.20	0.91	0.91	0.91	0.14
Na	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd
total =	8.00	6.98	7.77	9.99	8.00	8.00	5.00
oxygen =	[123]	[111]	[111]	[111]	[111]	[111]	[111]
225	0.160-GT-R	226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A
226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A	229	0.161-GT-R
S1	2.99	3.16	2.72	2.63	3.00	3.02	2.99
T1	0.01	0.61	0.61	0.61	0.61	0.61	0.61
A1	1.98	2.61	2.61	2.78	1.99	2.61	2.61
F2	0.03	0.15	0.15	1.51	1.51	1.51	0.14
Mg	0.20	0.20	0.20	0.91	0.91	0.91	0.14
Na	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd
total =	8.00	6.98	7.77	9.99	8.00	8.00	5.00
oxygen =	[123]	[111]	[111]	[111]	[111]	[111]	[111]
225	0.160-GT-R	226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A
226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A	229	0.161-GT-R
S1	2.99	3.16	2.72	2.63	3.00	3.02	2.99
T1	0.01	0.61	0.61	0.61	0.61	0.61	0.61
A1	1.98	2.61	2.61	2.78	1.99	2.61	2.61
F2	0.03	0.15	0.15	1.51	1.51	1.51	0.14
Mg	0.20	0.20	0.20	0.91	0.91	0.91	0.14
Na	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd
total =	8.00	6.98	7.77	9.99	8.00	8.00	5.00
oxygen =	[123]	[111]	[111]	[111]	[111]	[111]	[111]
225	0.160-GT-R	226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT-A
226	0.160-GT-U	227	0.161-GT-C	228	0.161-GT		

ANALYSES OF PELITIC MINERALS IN THE BALLACHULISH AUREOLE

S102	34.57	233	234	235	236	237	238	239	240	241	242	243
T102	1.06	-	47.44	24.59	48.15	38.63	27.86	46.75	36.57	45.47	64.08	33.09
A103	20.08	37.68	0.03	21.69	33.13	15.30	18.44	27.75	1.15	0.93	0.52	26.75
Fe2	1.50	-	7.39	22.70	1.19	11.61	15.23	4.46	15.96	16.55	22.52	1.51
Mn	0.11	0.34	0.54	0.54	nd	0.10	0.20	0.08	0.08	0.06	0.03	0.14
K	1.85	7.87	15.92	1.08	17.67	24.01	3.39	12.36	nd	nd	0.11	32.80
Ca20	0.23	0.02	0.66	0.01	nd	0.09	nd	0.02	nd	nd	0.01	0.14
K20	0.07	0.05	0.02	0.07	0.07	0.40	0.08	0.33	0.27	nd	0.01	9.10
total =	92.47	95.57	85.16	93.57	93.06	85.88	93.16	94.21	nd	nd	0.02	0.03
F	0.38	nd	nd	nd	nd	0.70	nd	0.46	nd	nd	0.10	nd
S1	2.67	5.03	2.63	3.22	2.88	2.84	3.24	2.73	nd	nd	nd	nd
T1	0.05	-	0.51	2.76	2.61	1.34	2.22	0.06	0.02	0.01	0.01	0.04
A1	1.83	3.95	2.04	2.04	0.06	0.72	1.30	2.27	1.00	2.46	1.00	2.36
Fe2	1.13	0.03	0.03	0.01	-	0.02	0.26	0.26	nd	nd	nd	nd
Mn	1.25	0.18	1.24	2.55	0.11	1.96	3.65	0.35	1.38	nd	nd	nd
K	0.03	0.18	-	-	0.10	0.01	0.04	0.04	0.04	nd	nd	0.01
total =	7.77	11.09	9.99	11.43	11.11	11.11	10.79	10.04	7.72	nd	nd	1.48
oxgenes =	[113]	[163]	[236]	[236]	[163]	[163]	[111]	[111]	[111]	nd	nd	-
233 D163-BI	237 D163-CHL	238 D168-BI	239 D163-MU	240 D168-BI	241 D168-CHL	242 D168-BI	243 D168-BI	244 D168-BI	245 D168-BI	246 D168-BI	247 D168-BI	248 D168-BI
234 D163-CHL-2	235 D163-CHL-2	236 D168-BI	237 D168-BI	238 D168-BI	239 D168-BI	240 D168-BI	241 D168-BI	242 D168-BI	243 D168-BI	244 D168-BI	245 D168-BI	246 D168-BI
S102	47.99	241	242	243	244	245	246	247	248	249	250	251
T102	0.02	46.50	36.68	39.95	25.57	48.92	25.88	37.13	34.05	37.55	37.55	37.55
A103	32.75	32.04	32.04	1.20	0.05	0.10	0.26	0.05	0.10	0.09	0.09	0.09
Fe2	6.91	6.82	19.77	34.58	14.82	5.05	19.05	33.24	20.63	34.05	34.05	34.05
Mn	0.31	0.32	0.32	0.12	0.12	0.18	0.22	nd	0.22	0.04	0.04	0.04
K	8.75	2.39	12.73	4.68	18.43	0.08	0.02	20.09	0.03	32.42	32.42	32.42
Ca20	0.02	0.01	0.01	0.04	0.02	0.02	0.02	0.01	0.01	0.16	0.16	0.16
K20	0.41	1.11	0.56	0.56	0.56	0.61	0.61	0.63	0.63	0.62	0.62	0.62
total =	97.19	93.95	93.46	85.24	85.40	95.35	84.88	95.32	nd	nd	nd	nd
S1	4.98	3.14	0.03	2.75	4.70	2.68	3.22	2.71	6.00	nd	nd	nd
T1	4.01	2.55	1.75	0.07	0.03	0.01	0.01	0.01	nd	nd	nd	nd
Fe2	0.60	-	0.16	-	4.79	2.70	2.55	4.35	nd	nd	nd	nd
Mn	0.03	-	0.24	1.42	0.93	0.50	1.67	0.07	1.59	1.59	1.59	1.59
K	0.08	-	0.15	0.04	0.02	0.01	0.02	0.04	0.04	nd	nd	nd
Ca20	0.74	0.75	0.75	0.09	0.01	0.01	0.01	0.01	0.01	nd	nd	nd
K20	7.00	7.71	10.95	9.97	6.91	10.01	16.00	12.53	nd	nd	nd	nd
total =	11.06	[113]	[111]	[111]	[111]	[111]	[111]	[111]	nd	nd	nd	nd
oxgenes =	[113]	[163]	[236]	[236]	[163]	[163]	[111]	[111]	nd	nd	nd	nd
241 D176-CO	244 D176-CO-A	245 D176-CO-L	246 D176-CO-L	247 D176-CO-L	248 D176-CO-L	249 D176-CO-L	250 D176-CO-L	251 D176-CO-L	252 D176-CO-L	253 D176-CO-L	254 D176-CO-L	255 D176-CO-L
242 D176-MU	243 D176-BI	244 D176-BI	245 D176-BI	246 D176-BI	247 D176-BI	248 D176-BI	249 D176-BI	250 D176-BI	251 D176-BI	252 D176-BI	253 D176-BI	254 D176-BI

ANALYSES OF PELITIC MINERALS IN THE BALLACHULISH AUREOLE

S102	49.27	250	251	252	253	254	255	256	257	258	259	260	261
T102	49.49	19.01	0.93	19.84	20.05	18.95	18.75	19.55	19.59	19.52	19.51	18.72	18.75
A103	28.44	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30	11.30
Fe2	4.03	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Mn	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ca20	2.16	nd											
K20	10.57	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
total =	94.88	102.22	94.74	100.84	94.61	101.06	94.17	88.70	nd	nd	nd	nd	nd
F	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
S1	3.23	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01	3.01
T1	3.23	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
A1	2.46	nd											
Fe2	0.23	nd											
Mn	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ca20	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
K20	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
total =	6.98	4.97	7.05	4.95	7.01	6.98	4.97	7.01	4.97	7.01	6.98	4.97	7.01
oxgenes =	[113]	[163]	[236]	[236]	[163]	[163]	[111]	[111]	[111]	[111]	[111]	[111]	[111]
S102	250 D184-KF	251 D244-CHL	252 D244-CHL	253 D244-CHL	254 D244-CHL	255 D244-CHL	256 D244-CHL	257 D244-CHL	258 D244-CHL	259 D244-CHL	260 D244-CHL	261 D244-CHL	262 D244-CHL

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AUREOLE									
S102	265	266	267	268	269	270	271	272	273
T102	47.15	46.95	46.95	47.44	47.48	45.93	68.19	68.19	48.39
A103	33.16	32.96	34.44	32.03	32.09	30.48	nd	nd	nd
F103	11.63	10.93	11.05	19.95	19.25	32.13	19.43	18.59	18.59
M103	0.03	0.03	0.03	1.05	1.05	8.33	0.13	0.13	0.13
C103	6.92	7.19	1.08	9.40	9.40	0.26	0.01	0.01	0.01
K103	0.25	0.22	0.05	10.19	9.24	7.39	7.74	7.74	7.74
M20	0.05	0.05	0.05	10.11	7.12	0.51	0.29	0.29	0.29
total =	98.25	98.57	94.10	93.44	97.05	97.73	96.64	99.65	98.33
F	nd	nd	nd	0.50	nd	nd	nd	nd	nd
S1	4.92	4.96	3.12	2.69	4.97	4.97	3.08	2.99	0.40
Al	4.08	4.03	0.02	0.12	0.05	0.05	0.02	-	nd
Fe2	0.93	0.90	0.96	1.24	0.73	3.96	2.68	1.00	nd
Mg	1.08	1.11	0.11	1.08	1.02	0.82	0.17	-	nd
Ca	0.07	0.04	0.06	0.04	0.01	0.15	0.17	-	nd
N	K	-	-	0.87	0.96	0.10	0.06	0.14	0.01
total =	11.08	11.05	6.96	7.70	11.07	11.09	6.99	5.00	0.04
oxygen =	(118)	(118)	(111)	(111)	(118)	(118)	(111)	(111)	(111)
265 D266-CO-A	268 D269-CO-C	270 D269-CO-A	271 D269-MU	272 D269-PL	273	274	275	276	277
265 D266-CO-C	268 D269-CO-C	270 D269-CO-A	271 D269-MU	272 D269-PL	273	274	275	276	277
265 D266-AL-A	268	270	271	272	273	274	275	276	277
265 D266-AL-C	268	270	271	272	273	274	275	276	277
total =	94.23	98.25	93.59	94.12	98.44	99.75	95.31	99.91	98.61
F	0.19	nd	nd	0.04	nd	nd	nd	nd	nd
S1	2.73	5.05	3.20	2.66	4.99	2.99	3.06	2.81	0.31
Al	0.14	0.03	0.03	0.15	0.02	0.02	0.04	0.04	2.63
Fe2	1.12	3.96	2.52	1.75	4.00	1.01	2.71	1.20	0.69
Mg	1.17	0.79	0.13	1.29	0.86	0.02	0.17	-	1.60
Ca	1.09	0.02	-	0.16	0.02	1.12	-	0.06	1.55
N	K	0.02	-	-	-	-	0.06	-	0.65
total =	7.72	11.00	6.99	7.76	11.03	5.00	7.01	5.00	9.92
oxygen =	(112)	(118)	(111)	(111)	(118)	(111)	(111)	(111)	(111)
273 D272-BI	277 D279-BI	280 D279-PL-2	276 D279-BI	278 D279-BI	279 D279-MU-2	277 D279-BI	278 D279-BI	279 D279-BI	280 D279-BI
273 D272-CO	277 D279-CO	280 D279-MU	276 D279-CO	278 D279-CO	279 D279-KF	277 D279-CO	278 D279-CO	279 D279-KF	280 D279-PL-0

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AUREOLE									
S102	261	262	263	264	265	266	267	268	269
T102	34.65	47.23	64.02	45.67	65.08	63.67	36.11	26.67	48.39
A103	33.23	32.11	18.70	35.24	20.13	22.59	18.59	nd	nd
F103	20.56	1.18	0.19	0.91	0.08	0.08	15.71	33.43	33.43
M103	0.03	0.01	nd	nd	nd	nd	0.05	0.08	0.08
H103	6.60	6.02	0.02	0.61	0.34	0.02	11.83	9.82	9.82
C103	0.03	0.01	nd	nd	nd	nd	3.71	nd	nd
N103	0.15	0.16	0.16	0.16	0.16	0.16	9.11	0.16	0.16
K103	0.50	0.50	0.50	0.50	0.50	0.50	9.65	9.65	9.65
total =	95.41	97.23	99.03	94.70	98.36	99.84	95.08	97.83	97.83
F	0.45	nd							
S1	2.67	4.99	2.96	3.06	2.32	2.81	2.71	4.96	4.96
Al	0.19	0.02	0.01	0.01	0.01	0.01	0.15	0.15	0.15
Fe2	1.39	0.93	0.93	1.02	1.02	1.02	1.20	1.20	1.20
Mg	0.76	1.01	0.03	0.03	0.03	0.03	0.98	0.98	0.98
Ca	0.02	0.04	0.04	0.04	0.04	0.04	1.32	1.32	1.32
N	K	0.94	0.04	0.04	0.04	0.04	0.18	0.18	0.18
total =	95.41	97.23	99.03	94.70	98.36	99.84	95.08	97.83	97.83
F	0.45	nd							
S1	2.67	4.99	2.96	3.06	2.32	2.81	2.71	4.96	4.96
Al	0.19	0.02	0.01	0.01	0.01	0.01	0.15	0.15	0.15
Fe2	1.39	0.93	0.93	1.02	1.02	1.02	1.20	1.20	1.20
Mg	0.76	1.01	0.03	0.03	0.03	0.03	0.98	0.98	0.98
Ca	0.02	0.04	0.04	0.04	0.04	0.04	1.32	1.32	1.32
N	K	0.94	0.04	0.04	0.04	0.04	0.18	0.18	0.18
total =	95.41	97.23	99.03	94.70	98.36	99.84	95.08	97.83	97.83
F	0.45	nd							
S1	2.67	4.99	2.96	3.06	2.32	2.81	2.71	4.96	4.96
Al	0.19	0.02	0.01	0.01	0.01	0.01	0.15	0.15	0.15
Fe2	1.39	0.93	0.93	1.02	1.02	1.02	1.20	1.20	1.20
Mg	0.76	1.01	0.03	0.03	0.03	0.03	0.98	0.98	0.98
Ca	0.02	0.04	0.04	0.04	0.04	0.04	1.32	1.32	1.32
N	K	0.94	0.04	0.04	0.04	0.04	0.18	0.18	0.18
total =	95.41	97.23	99.03	94.70	98.36	99.84	95.08	97.83	97.83
F	0.45	nd							
S1	2.67	4.99	2.96	3.06	2.32	2.81	2.71	4.96	4.96
Al	0.19	0.02	0.01	0.01	0.01	0.01	0.15	0.15	0.15
Fe2	1.39	0.93	0.93	1.02	1.02	1.02	1.20	1.20	1.20
Mg	0.76	1.01	0.03	0.03	0.03	0.03	0.98	0.98	0.98
Ca	0.02	0.04	0.04	0.04	0.04	0.04	1.32	1.32	1.32
N	K	0.94	0.04	0.04	0.04	0.04	0.18	0.18	0.18
total =	95.41	97.23	99.03	94.70	98.36	99.84	95.08	97.83	97.83
F	0.45	nd							
S1	2.67	4.99	2.96	3.06	2.32	2.81	2.71	4.96	4.96
Al	0.19	0.02	0.01	0.01	0.01	0.01	0.15	0.15	0.15
Fe2	1.39	0.93	0.93	1.02	1.02	1.02	1.20	1.20	1.20
Mg	0.76	1.01	0.03	0.03	0.03	0.03	0.98	0.98	0.98
Ca	0.02	0.04	0.04	0.04	0.04	0.04	1.32	1.32	1.32
N	K	0.94	0.04	0.04	0.04	0.04	0.18	0.18	0.18
total =	95.41	97.23	99.03	94.70	98.36	99.84	95.08	97.83	97.83
F	0.45	nd							
S1	2.67	4.99	2.96	3.06	2.32	2.81	2.71	4.96	4.96
Al	0.19	0.02	0.01	0.01	0.01	0.01	0.15	0.15	0.15
Fe2	1.39	0.93	0.93	1.02	1.02	1.02	1.20	1.20	1.20
Mg	0.76	1.01	0.03	0.03	0.03	0.03	0.98	0.98	0.98
Ca	0.02	0.04	0.04	0.04	0.04	0.04	1.32	1.32	1.32
N	K	0.94	0.04	0.04	0.04	0.04	0.18	0.18	0.18
total =	95.41	97.23	99.03	94.70	98.36	99.84	95.08	97.83	97.83
F	0.45	nd							
S1	2.67	4.99	2.96	3.06	2.32	2.81	2.71	4.96	4.96
Al	0.19	0.02	0.01	0.01	0.01	0.01	0.15	0.15	0.15
Fe2	1.39	0.93	0.93	1.02	1.02	1.02	1.20	1.20	1.20
Mg	0.76	1.01	0.03	0.03	0.03	0.03	0.98	0.98	0.98
Ca	0.02	0.04	0.04	0.04	0.04	0.04	1.32	1.32	1.32
N	K	0.94	0.04	0.04	0.04	0.04	0.18	0.18	0.18
total =	95.41	97.23	99.03	94.70	98.36	99.84	95.08	97.83	97.83
F	0.45	nd							
S1	2.67	4.99	2.96	3.06	2.32	2.81	2.71	4.96	4.96
Al	0.19	0.02	0.01	0.01	0.01	0.01	0.15	0.15	0.15
Fe2	1.39	0.93	0.93	1.02	1.02	1.02	1.20	1.20	1.20
Mg	0.76	1.01	0.03	0.03	0.03	0.03	0.98	0.98	0.98
Ca	0.02	0.04	0.04	0.04	0.04	0.04	1.32	1.32	1.32
N	K	0.94	0.04	0.04	0.04	0.04	0.18	0.18	0.18
total =	95.41	97.23	99.03	94.70	98.36	99.84	95.08	97.83	97.83
F	0.45	nd							
S1	2.67	4.99	2.96	3.06	2.32	2.81	2.71	4.96	4.96
Al	0.19	0.02	0.01	0.01	0.01	0.01	0.15	0.15	0.15
Fe2	1.39	0.93	0.93	1.02	1.02	1.02	1		

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AUREOLE

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ESTIMATED IN THE DOLLAR VALUE OF AGRICULTURE										
S102	313	33.98	314	47.64	315	45.72	317	68.14	318	66.69
T102	68	nd	11	20.71	11	34.39	nd	2.36	nd	0.03
A103	19	4.3	21	32.89	21	10.80	1.36	0.13	20	10
F103	0.02	nd	23	6.1	nd	nd	nd	nd	32	18.56
H103	nd	nd	23	5.9	0.58	nd	nd	0.03	nd	0.04
C103	nd	nd	7	7.81	5.36	nd	0.18	nd	11.93	9.13
M20	0.18	nd	7	7.77	0.48	nd	11.54	nd	0.01	0.02
K20	0.12	nd	7	7.77	0.48	nd	9.55	nd	0.03	0.04
B20	nd	nd	7	7.77	0.48	nd	nd	nd	2.32	13.36
total=	99.73	95.20	97.97	92.47	99.34	93.63	97.49	98.74	nd	0.27
F	nd	nd	nd	nd	nd	nd	0.48	nd	nd	nd
S1	3.00	2.62	5.00	3.12	3.00	2.63	4.99	2.98	nd	nd
T1	nd	nd	4.93	2.76	1.00	0.13	nd	nd	nd	nd
F2	1.00	1.52	0.96	0.96	1.00	0.94	0.59	1.02	nd	nd
H2	-	0.91	0.94	0.94	-	nd	nd	nd	nd	nd
M2	0.97	0.90	0.93	0.97	-	nd	1.35	1.40	nd	nd
K2	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
B2	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
total=	4.99	7.76	11.04	6.94	4.99	7.61	11.05	5.01	nd	nd
oxygens	(18)	(11)	(18)	(11)	(18)	(11)	(18)	(18)	nd	nd
313 0372 PL-A	316	0377 MU	319	0391-D	320	0391-KF	321	0391-CD	322	0391-K
314 0377 BL	316	0391-81	315	0391-81	315	0391-81	315	0391-81	315	0391-81
315 0377-D	321	nd	322	nd	323	nd	325	nd	327	nd
S102	45.93	64.11	35.07	47.34	66.67	44.73	66.27	61.99	nd	nd
T102	11.13	nd	22.71	nd	18.60	nd	20.78	nd	20.56	nd
A103	34.74	21.26	19.36	32.28	34.89	31.02	30.59	21.91	nd	nd
F103	0.74	0.08	21.29	11.30	0.32	nd	0.02	0.06	0.06	nd
H103	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
C103	nd	nd	0.05	0.21	nd	nd	0.02	nd	nd	nd
M20	0.82	nd	7.45	6.31	0.06	nd	0.72	0.15	0.01	nd
K20	10.56	2.28	10.16	0.17	nd	nd	0.04	1.24	2.90	nd
B20	10.56	10.16	8.79	nd	nd	nd	nd	10.56	9.80	nd
total=	93.90	98.13	94.86	97.61	101.30	92.55	99.49	96.96	nd	nd
F	nd	nd	0.61	nd	nd	nd	nd	nd	nd	nd
S1	3.09	2.88	2.70	4.98	3.01	3.05	2.92	2.82	nd	nd
T1	nd	nd	1.75	4.01	0.99	0.04	nd	nd	nd	nd
F2	2.73	1.12	1.37	0.02	0.01	0.06	0.06	1.07	1.18	nd
H2	0.04	nd	nd	nd	nd	nd	nd	nd	nd	nd
M2	0.08	-	0.85	0.93	-	nd	0.07	-	-	nd
K2	-	0.88	0.02	nd	nd	nd	nd	nd	nd	nd
B2	0.07	0.88	0.86	0.03	0.18	0.07	0.06	0.14	0.07	nd
total=	6.97	5.01	7.71	11.03	4.98	6.99	5.01	5.03	nd	nd
oxygens	(11)	(8)	(11)	(11)	(11)	(11)	(11)	(11)	nd	nd
321 0391-D	322 0391-KF	323 0427-BI	324 0427-CO	325 0427-KF	326 0427-KH	327 0427-PL-A	328 0427-PL-A	329 0427-PL-O	330 0427-PL-P	331 0427-PL-Q

ANALYSES OF PELOMIC MINERALS IN THE BALLACHULISH AUREOLE									
	ANALYSES OF PELOMIC MINERALS IN THE BALLACHULISH AUREOLE								
S102	32.9	33.0	33.1	33.2	59.77	33.6	33.5	33.6	33.6
T102	35.48	35.17	47.72	65.44	nd	0.07	34.52	24.65	33.52
A1203	2.95	4.10	nd	nd	0.01	0.17	33.63	33.52	46.88
F102	19.73	17.99	32.18	11.53	0.07	24.84	58.81	18.93	nd
Mn	20.39	20.56	nd	nd	0.04	nd	21.35	nd	20.37
Hg	0.07	0.09	nd	nd	0.02	0.02	nd	nd	nd
Hg	6.58	7.64	6.15	0.22	0.02	0.25	0.39	0.35	31.82
Ca	0.07	0.11	nd	nd	0.04	nd	nd	nd	nd
Ca	0.11	0.13	0.01	0.01	0.04	nd	nd	nd	13.14
Ka20	0.33	0.19	9.29	0.01	12.02	0.24	nd	0.59	22.62
Ba20	nd	nd	nd	nd	nd	nd	nd	nd	0.02
Zn	nd	nd	nd	nd	nd	nd	nd	nd	nd
total =	94.74	94.97	97.96	100.49	98.81	100.44	95.44	86.93	nd
F	0.33	0.50	nd	nd	nd	nd	nd	nd	nd
Si	2.72	2.71	5.01	2.98	2.69	-	2.66	2.67	nd
T1	0.17	0.24	1.63	3.98	1.01	1.32	1.98	1.12	nd
F2	1.78	1.32	1.01	nd	nd	0.77	1.38	2.66	nd
Mn	0.75	0.88	0.96	-	-	0.10	0.85	2.54	nd
Ca	0.05	0.02	0.03	0.23	0.20	-	0.03	0.05	nd
K	0.89	0.91	-	0.70	0.01	0.13	0.95	-	nd
Zn	-	-	-	-	-	-	-	-	nd
total =	7.69	7.71	11.02	5.03	5.00	3.00	7.79	9.99	nd
oxygen =	11.11	11.03	11.03	10.91	10.91	14.3	11.11	11.11	nd
329 D433-BI	332 D433-KF	335 D440-BI	336 D440-CHL						
330 D433-BI-M2	334 D433-SP								
331 D433-CO									
S102	45.57	34.08	47.39	64.49	34.1	64.32	34.3	34.4	351 D451-BI
T102	45.57	34.06	47.37	64.49	nd	0.03	nd	nd	352 D451-CD
A1203	35.45	17.92	31.95	18.81	19.12	22.09	58.79	21.47	
F102	1.56	22.39	11.87	0.13	nd	nd	0.09	nd	
Hg	0.65	6.39	5.97	nd	nd	0.18	37.89	13.53	
Ca	0.62	0.56	0.52	0.03	0.02	0.04	0.25	nd	
Ka20	0.68	0.45	0.2	0.11	0.29	0.24	2.43	12.75	
Ba20	10.48	9.35	0.02	13.99	11.38	9.82	0.06	nd	
Ba	nd	nd	nd	0.62	0.62	0.30	nd	9.90	
total =	96.39	94.56	98.05	99.81	99.86	100.32	99.64	94.44	
F	nd	0.35	nd	nd	nd	nd	nd	nd	
Si	3.07	2.67	5.03	2.98	2.99	2.85	-	2.64	nd
T1	2.81	0.59	3.96	1.02	1.00	1.14	1.98	1.89	nd
F2	0.09	1.47	1.04	-	-	-	0.02	nd	nd
Mn	0.07	0.75	0.93	0.02	-	-	0.89	0.86	nd
Ca	0.09	0.02	-	-	-	-	0.10	0.01	nd
K	0.90	0.93	-	0.02	-	0.18	0.14	0.12	nd
Ba	-	-	-	0.80	0.80	0.01	0.02	-	nd
total =	7.02	7.73	11.01	5.00	5.00	3.00	7.82	9.97	nd
oxygen =	11.11	11.03	10.91	10.91	10.91	14.3	11.11	11.11	nd
337 D440-NU-2	340 D441-KF	343 D441-SP	344 D450a-BI						
338 D441-BI-CO	341 D441-PL-A	342 D441-PL-0							

ANALYSES OF PELOITIC MINERALS IN THE DALIACHIN ISH ANDREEV

ANALYSES OF PETITIC MINERALS IN THE DALLAS AREA

ESTIMATED MATERIALS IN THE BALLAST/MAUL/SCREW										
S102	47.94	6.377	65.93	3600	23.98	46.44	58.60	384		
T102	10.05	19.14	21.02	nd	0.03	0.05	2.45	nd	35.75	
A103	11.29	nd	nd	nd	nd	nd	nd	nd	17.08	
F00	8.67	0.03	0.34	nd	0.25	21.16	32.19	25.30		
M00	8.01	nd	nd	nd	nd	19.88	1.56	0.13	20.64	
C00	8.09	nd	nd	nd	nd	nd	nd	nd	0.06	
B00	12.04	0.03	1.51	nd	0.04	0.17	0.01	nd	7.03	
K00	0.08	12.97	10.16	nd	0.44	0.01	nd	nd	nd	
N00	nd	0.12	nd	nd	nd	nd	0.03	nd	0.18	
K20	nd	nd	nd	nd	nd	nd	nd	nd	9.34	
Total =	98.48	99.93	100.20	99.32	82.61	94.21	99.88	95.48		
F	nd	nd	nd	nd	nd	nd	nd	nd	0.14	
S1	4.94	2.97	2.90	2.73	2.62	3.12	2.64	2.74		
T1	nd	1.04	1.10	1.28	2.73	0.15	1.34	1.54		
A1	4.05	nd	0.01	nd	nd	0.09	nd	nd		
F2	0.77	nd	nd	nd	nd	nd	nd	nd	1.32	
M2	1.24	nd	nd	nd	nd	nd	nd	nd	nd	
C2	nd	nd	nd	nd	nd	nd	nd	nd	nd	
B2	nd	nd	nd	nd	nd	nd	nd	nd	nd	
K2	nd	nd	nd	nd	nd	nd	nd	nd	nd	
N2	0.04	0.18	0.92	0.73	nd	nd	nd	nd	nd	
Total =	11.05	5.01	5.02	5.01	10.01	6.92	5.37	7.65		
Oxygen =	[18]	[18]	[18]	[18]	[14]	[11]	[10]	[11]		
377 0516-CD	380	556-PL-0	380	556-PL-0	380	556-PL-A	380	556-PL-B1		
378 0516-PL-A	381	0564-CHL	382	0564-CHL	384	0567-B1	386	0567-B1		
S102	34.85	35.02	36.76	3086	37.18	37.00	46.91	392		
T102	11.57	nd	10.14	nd	nd	nd	0.18	nd	58.73	
A103	19.86	nd	16.18	nd	nd	nd	nd	nd	0.01	
C200	19.72	nd	nd	nd	nd	nd	nd	nd	27.06	
F00	19.70	nd	19.55	nd	nd	nd	nd	nd	nd	
M00	10.09	nd	9.06	nd	nd	nd	nd	nd	nd	
B00	8.70	nd	8.25	nd	nd	nd	nd	nd	nd	
K00	nd	nd	nd	nd	nd	nd	nd	nd	nd	
N00	8.77	8.91	8.47	nd	0.02	0.05	nd	nd	6.46	
K20	nd	nd	nd	nd	nd	nd	nd	nd	0.17	
Total =	93.71	95.88	99.36	85.93	100.24	99.84	94.81	100.90		
Oxygen =	[11]	[11]	[11]	[11]	[14]	[11]	[11]	[11]	[10]	
F	0.15	0.17	nd	nd	nd	nd	nd	nd	nd	
S1	2.69	2.66	4.45	2.75	2.97	3.05	3.11	2.60		
T1	0.09	1.81	1.45	3.02	2.72	2.03	2.03	2.81	1.41	
A1	nd	nd	nd	nd	nd	nd	nd	nd	nd	
F2	1.27	1.24	3.51	2.35	2.31	2.57	2.57	0.06	-	
M2	nd	nd	nd	nd	nd	nd	nd	nd	nd	
B2	1.00	1.05	0.74	2.06	0.49	0.08	0.08	-	-	
K2	nd	nd	0.07	0.16	nd	0.09	0.11	0.07	-0.40	
N2	0.02	0.86	0.86	nd	nd	nd	nd	nd	0.55	
K00	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Total =	7.76	7.17	12.03	9.90	8.00	8.00	8.91	8.91	4.90	
Oxygen =	[11]	[11]	[11]	[11]	[14]	[12]	[11]	[11]	[10]	

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AMMOLITE

S102	393	394	395	396	397	398	399	400
T102	35.00	47.44	37.78	37.99	48.07	59.24	34.93	34.78
A1203	15.11	32.26	21.04	20.06	20.18	24.01	5.35	15.56
C1203	15.83	32.45	21.67	21.67	24.41	24.91	16.30	15.49
F102	22.11	34.59	34.67	nd	nd	nd	nd	nd
H102	20.07	10.98	14.69	35.62	0.06	1.89	37.91	22.25
M102	7.59	6.68	4.39	35.93	35.93	nd	20.94	20.94
C102	0.79	0.78	1.26	1.68	1.16	1.16	0.03	0.03
K102	0.78	0.77	nd	nd	0.02	0.02	0.02	0.02
total=	95.78	101.13	102.03	100.69	99.69	96.15	95.30	95.30
F	0.06	nd	nd	nd	nd	0.06	0.27	
S1	2.71	4.99	2.99	1.92	2.66	2.69	2.68	
A1	1.44	4.00	2.00	2.01	0.11	1.32	1.48	
Fe2	1.49	0.97	2.27	0.02	0.04	0.22	0.07	
Mn	0.87	1.03	0.50	0.51	0.13	0.02	0.42	
Ca	0.04	0.03	0.11	0.10	0.10	0.02	0.07	
K	0.87	-	-	-	-	0.57	0.93	
total=	7.73	11.03	8.00	8.00	4.00	4.00	4.98	4.98
oxygene-	(111)	(111)	(112)	(112)	(112)	(112)	(113)	(113)
393 0568-B1	396	0568-GT-R	399 0568-B1	400 0568-B1-INCL(61)				
394 0568-C0	397	0568-HY	398 0568-PL-0					
395 0568-G1-C	398	0568-PL-0						
S102	401	402	403	404	405	406	407	408
T102	42.9	37.51	37.71	35.35	34.93	46.78	47.47	47.47
A1203	0.04	0.09	0.01	0.01	0.01	0.02	0.03	0.03
C1203	27.57	21.49	21.58	19.25	18.76	17.78	32.79	32.79
F102	11.55	34.69	35.12	nd	nd	nd	nd	nd
H102	0.11	1.71	1.84	20.24	26.79	21.67	12.16	10.97
M102	5.06	4.15	3.50	7.39	6.74	6.19	6.35	6.35
Ca20	0.13	1.26	1.10	nd	nd	nd	nd	nd
K20	5.13	nd	nd	9.60	9.56	9.56	0.04	0.04
total=	92.22	100.94	100.31	95.76	96.37	96.16	98.04	98.54
F	nd	nd	nd	0.35	0.38	0.42	nd	nd
S1	4.95	2.97	2.97	2.69	2.67	4.93	4.35	
A1	3.78	2.01	2.04	1.19	1.73	1.60	4.07	
Fe2	1.12	0.03	0.02	1.29	1.29	1.39	-	
Mn	0.01	0.11	0.42	0.02	0.01	0.02	0.03	
Ca	0.88	0.49	0.42	0.84	0.77	0.78	1.03	
Na	0.03	0.11	0.09	0.04	0.03	0.02	0.05	
K	0.76	-	-	0.93	0.94	0.92	-	
total=	11.56	8.00	8.00	7.74	7.76	7.70	11.06	11.06
oxygene-	(113)	(112)	(112)	(113)	(113)	(113)	(113)	(113)
401 0568-C0-A	402 0568-C0-A	403 0568-G1-C	404 0608-1-B1-A	405 0608-1-B1-A	406 0608-1-B1-M2	407 0608-1-CD-MS	408 0608-1-CD-M2	409 0608-1-CD-M2
						420 0611-PL-0	421 0620-B1	422 0620-MU
						423 0620-KF	424 0620-MU	

ANALYSES OF PELOITIC MINERALS IN THE BALLACHULISH AMMOLITE

S102	403	404	405	406	407	408	409	410
T102	46.96	10.0	41.3	46.32	64.55	60.98	nd	35.82
A1203	32.72	nd	nd	nd	nd	nd	nd	nd
C1203	32.72	20.30	19.47	35.51	nd	nd	nd	nd
F102	nd	nd	nd	nd	nd	nd	nd	nd
H102	11.99	30.91	nd	nd	nd	nd	nd	nd
Mn	0.30	0.20	0.20	0.18	0.11	0.11	0.01	0.01
Ca	nd	nd	nd	nd	nd	nd	nd	nd
Na	nd	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd	nd
total=	98.11	87.30	99.71	94.83	99.46	101.53	94.26	94.78
F	nd	nd	nd	nd	nd	nd	nd	nd
S1	4.94	2.80	2.95	3.09	2.72	-	-	-
T1	0.02	0.61	1.05	2.79	1.27	1.90	1.22	2.61
A1	4.06	2.61	-	0.08	-	0.08	1.68	1.73
Fe3	-	-	-	-	-	-	0.08	-
Fe2	1.06	2.82	-	-	-	-	0.08	-
Mn	0.03	0.02	0.02	0.07	0.07	0.07	0.07	0.07
Ca	nd	nd	nd	nd	nd	nd	nd	nd
Na	nd	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd	nd
total=	11.06	9.89	5.02	7.00	5.02	7.00	7.74	7.76
oxygene-	(111)	(111)	(111)	(111)	(111)	(111)	(111)	(111)
409 0608-1-CHL-2	410 0608-1-CHL-2	411 0608-1-CHL-2	412 0608-1-MI-2	413 0608-1-MI-2	414 0608-1-SI-2	415 0608-1-SI-2	416 0608-1-SI-2	417 0608-1-SI-2
S102	41.7	41.0	41.0	41.0	41.0	42.1	42.2	42.4
T102	nd	nd	nd	nd	nd	nd	nd	nd
A1203	nd	nd	nd	nd	nd	nd	nd	nd
C1203	nd	nd	nd	nd	nd	nd	nd	nd
F102	4.35	33.03	33.03	33.03	33.03	18.64	18.65	18.65
H102	0.21	0.21	0.21	0.21	0.21	0.03	0.03	0.03
Ca20	nd	nd	nd	nd	nd	nd	nd	nd
K20	0.57	0.57	0.57	0.57	0.57	0.21	0.21	0.21
BaO	nd	nd	nd	nd	nd	0.21	0.21	0.21
total=	97.58	97.46	99.91	99.32	99.98	97.36	97.36	97.36
F	nd	nd	nd	nd	nd	nd	nd	nd
S1	5.01	4.99	3.00	2.81	2.63	4.93	2.97	3.17
T1	-	-	-	1.01	0.17	4.93	-	0.05
A1	3.97	4.01	-	1.20	1.20	4.02	4.02	2.52
Fe2	0.37	0.52	-	-	1.23	0.65	0.65	0.15
Mn	0.92	1.57	1.42	-	-	-	-	-
Ca	nd	nd	nd	nd	nd	nd	nd	nd
Na	nd	nd	nd	nd	nd	nd	nd	nd
K	nd	nd	nd	nd	nd	nd	nd	nd
total=	11.06	11.07	4.98	7.84	11.09	5.03	5.03	5.03
oxygene-	(111)	(111)	(111)	(111)	(111)	(111)	(111)	(111)
417 0611-PL-0	418 0611-CHL-2	419 0611-CHL-2	420 0611-PL-0	421 0620-B1	422 0620-MU	423 0620-KF	424 0620-MU	

ANALYSES OF PELITIC MINERALS IN THE BALLACHULISH AMPHIBOLE

S102	4.25	4.25	427	428	429	431	432	
T102	34.69	47.47	64.36	45.08	65.66	47.53	44.21	
A1203	1.67	nd	0.29	0.47	nd	2.75	44.21	
F1203	19.83	32.04	18.98	35.12	2.91	20.74	32.36	
FeO	20.90	11.53	0.27	1.56	0.09	14.98	34.59	
MnO	0.05	0.20	nd	nd	0.05	0.01	1.36	
MgO	8.18	6.15	0.06	0.94	nd	1.05	0.01	
CaO	0.02	nd	nd	nd	nd	nd	nd	
Na2O	0.10	0.17	2.27	0.58	10.15	0.21	0.78	
K2O	8.60	0.01	12.94	9.99	0.33	9.58	0.11	10.06
total =	94.04	97.57	99.17	93.74	100.19	96.58	92.54	
F	0.61	nd	nd	nd	0.67	nd	nd	
Si	2.68	5.00	2.97	3.05	2.88	2.62	4.97	
Ti	0.10	-	0.01	0.02	0.13	0.12	0.92	
Al	1.81	3.98	1.03	2.80	1.13	1.84	3.89	
Fe2	1.02	0.02	0.01	0.09	nd	0.02	0.08	
Mn	0.94	0.97	-	-	0.09	1.33	1.43	
Ca	0.01	0.03	-	0.20	0.10	0.08	0.14	
Na	0.85	-	0.76	0.86	0.65	0.93	0.95	
K	11.02	11.02	4.99	7.00	4.99	0.92	0.96	
total =	111	111	61	111	61	111	111	
oxygen =	425	426	427-BI	428	429-BI	430-BI	431-BI	
425 0527-CO	426 0527-CO	427 0527-KF	428 0527-MU	429 0527-MU	430 0527-MU	431 0527-MU	432 0527-MU	
427	429	0527-KF	430	0527-KF	0527-KF	0527-KF	0527-KF	

ANALYSES OF PELITIC MINERALS IN THE BALLACHULISH AMPHIBOLE

S102	37.43	43.6	425	426	427	438	439	
T102	37.83	25.20	47.76	34.16	47.57	24.32	37.39	
A1203	1.83	0.06	0.48	0.18	0.07	0.13	0.06	
Cr203	16.56	20.68	28.75	18.12	32.15	21.68	21.31	
FeO	nd	nd	nd	nd	nd	nd	nd	
MnO	19.91	25.36	5.70	24.24	11.95	30.39	35.10	
CaO	0.21	0.21	0.01	0.11	0.11	0.15	0.09	
Na2O	10.38	15.24	2.04	6.37	6.32	10.60	3.54	
K2O	0.01	nd	nd	nd	nd	0.01	0.93	
total =	96.24	86.86	95.41	96.46	98.17	87.33	100.80	100.71
F	nd	nd	nd	nd	nd	nd	nd	
Si	2.85	2.70	3.24	2.65	4.98	2.65	2.98	
Ti	0.10	2.60	0.92	0.21	0.21	0.01	2.99	
Al	1.47	2.60	2.30	1.65	4.00	2.78	2.00	
Fe2	1.25	2.26	0.30	-	-	0.01	2.00	
Mn	1.16	0.62	2.42	0.30	1.57	0.97	2.77	
Ca	0.03	-	-	-	0.04	0.04	0.16	
K	0.90	-	-	0.89	0.95	0.04	-	
total =	111	111	111	111	111	111	111	111
oxygen =	433	434	435	436	437	438	439	
433 D670-01	434 D670-MU	435 D670-MU	436 SW2A-01	437 SW2A-CO	438 SW2A-CHL-2	439 SW2A-G1-C	440 SW2A-G1-R	

ANALYSES OF PELITIC MINERALS IN THE BALLACHULISH AMPHIBOLE

S102	64.51	442	442	444	445	446	447	
T102	64.51	45.63	66.97	60.78	34.72	47.42	25.37	
A1203	18.03	0.11	20.86	24.01	18.79	32.15	0.35	
Cr203	18.58	35.12	nd	nd	nd	20.86	21.30	
FeO	nd	nd	nd	nd	nd	nd	nd	
MnO	nd	nd	nd	nd	nd	nd	nd	
CaO	nd	nd	nd	nd	nd	nd	nd	
Na2O	nd	nd	nd	nd	nd	nd	nd	
K2O	14.45	9.97	0.23	0.31	0.31	0.66	0.02	
total =	99.63	94.83	100.65	99.04	96.08	97.40	66.69	101.37
F	nd	nd	nd	nd	nd	nd	nd	
Si	2.98	3.06	2.92	2.73	2.68	4.99	2.74	
Ti	1.01	2.78	1.07	1.27	1.65	3.99	2.65	
Al	-	0.13	-	-	-	1.49	0.94	
Fe2	-	-	-	-	-	-	-	
Mn	-	-	-	-	-	-	-	
Ca	-	-	-	-	-	-	-	
Na	-	-	-	-	-	-	-	
K	0.85	0.85	0.85	0.01	0.74	0.03	0.04	
total =	101	101	101	101	101	101	101	101
oxygen =	111	111	111	111	111	111	111	111
441	SW2A-KF	442	SW2A-MU-2	443	SW2A-PL-A	444	SW2A-PL-0	445
446	SW2B-67-C	447	SW2B-67-C	448	SW2B-67-C	449	SW2B-67-C	450
total =	101.39	99.81	95.02	100.01				
Si	37.49	449	450	451	452	453	454	
Ti	37.67	65.15	nd	nd	nd	nd	nd	
Al	20.10	16.52	nd	nd	nd	nd	nd	
Cr203	20.98	nd	nd	nd	nd	nd	nd	
FeO	35.04	nd	nd	nd	nd	nd	nd	
MnO	35.03	0.05	nd	nd	nd	nd	nd	
CaO	2.73	0.02	nd	nd	nd	nd	nd	
Na2O	0.93	0.01	nd	nd	nd	nd	nd	
K2O	nd	nd	nd	nd	nd	nd	nd	
total =	101.39	99.81	95.02	100.01				
Si	3.09	2.73	2.76	2.77	2.77	2.77	2.77	
Al	1.00	nd	nd	nd	nd	nd	nd	
Fe2	2.35	-	-	-	-	-	-	
Mn	0.32	-	-	-	-	-	-	
Ca	0.08	-	-	-	-	-	-	
Na	-	-	-	-	-	-	-	
K	-	-	-	-	-	-	-	
total =	9.00	5.01	7.03	5.00				
oxygen =	112	101	111	101				
449	SW2B-G1-R	450	SW2B-KF	451	SW2B-MU-2	452	SW2B-PL-0	453