

APPENDIX

APPENDIX-1**Analytical setup for monazite analyses****Major elements**

<u>Element</u>	<u>Line</u>	<u>Xtal</u>	<u>Standard</u>
Si	K \square	TAP	Pg 721
P	K \square	PET	apatite
Ca	K \square	PET	apatite
Th	M \square	PET	ThO ₂
Y	L \square	PET	YAG
La	L \square	LIF	LaPO ₄
Ce	L \square	LIF	CePO ₄
Nd	L \square	LIF	NdPO ₄
Pr	L \square	LIF	PrPO ₄
Sm	L \square	LIF	SmPO ₄
Gd	L \square	LIF	Gd

Run at 15 kV and 15 nA.

Trace Elements

Th	M \square	PET	ThO ₂
Y	L \square	TAP	YAG
Pb	M \square	PET	pyromorphite
U	M \square	PET	UO ₂

Run at 15 kV and 200 nA

APPENDIX-2

Trace element analyses for monazite age determination. Analyses and errors (1 σ) are given in ppm

V634A									
<u>Analysis</u>	<u>Y</u>	<u>1σ</u>	<u>Th</u>	<u>1σ</u>	<u>Pb</u>	<u>1σ</u>	<u>U</u>	<u>1σ</u>	<u>Age</u>
V634b-M1	5575	18	44012	136	1413	32	11200	48	390
V634b-M1b	5520	18	41016	128	1317	32	10752	47	385
V634b-M1c	5007	17	37843	120	1152	31	8602	43	389
V634b-M1d	8323	22	52579	159	1329	32	6885	41	392
V634b-M1e	6753	19	46796	144	1322	32	9180	45	382
V634b-M6b	4057	16	12264	153	201	28	244	32	332
V634b-M6c	3970	16	31895	104	791	30	5188	38	360
V634b-M6d	4591	17	37288	118	1069	31	8501	43	366
V634b-M6e	4745	17	42219	131	1225	32	9633	45	370
V634b-M6f	4641	17	48476	148	1379	32	10750	47	368
V634b-M4a	10840	25	40450	127	952	31	3000	36	415
V634b-M4b	10557	25	40072	125	958	31	2985	36	421
V634b-M4c	10350	24	39671	125	860	30	2658	35	389
V634b-M4d	5777	18	41070	128	1092	31	6799	41	383
V634b-M4e	4643	17	45062	139	1355	32	9655	46	394
V634b-M4f	4488	16	44637	138	1292	32	9501	45	380
V634b-M4g	4494	17	42381	132	1271	32	9121	45	392
V634b-M8a	9494	23	37083	118	831	31	2882	36	392
V634b-M8b	9265	23	37216	118	892	31	2850	36	420
V634b-M8c	9982	24	39930	125	876	31	2953	36	387
V634b-M8d	5690	18	39221	124	1176	31	9414	45	374
V634b-M8e	9634	23	39329	124	1030	31	5519	39	395
V634b-M9a	9961	24	41466	129	950	31	3363	36	397
V634b-M9b	9078	23	36617	117	756	30	2297	35	375
V634b-M9c	5101	17	29178	97	542	30	870	33	372
V634b-M9d	9411	23	38185	121	848	30	2353	35	405
V634-M24a	8421	24	38767	133	782	30	1857	35	382
V634-M20a	4017	17	29087	104	464	30	538	33	331
V634-M20b	4314	17	43302	146	819	31	815	34	394
V634-M21a	5903	19	37836	130	813	31	1055	34	434
V634-M21b	10652	28	39783	136	883	31	2811	36	395
V634-M21c	4323	17	38854	133	758	30	763	33	405
V634-M22b	6449	20	48029	160	1049	31	1541	35	436
V634-M22c	8296	23	42082	143	943	31	2007	35	426
V634-M24b	8734	24	39307	134	861	31	2167	35	407
V634-M24c	6591	21	39354	135	805	31	1469	34	401
V634-M24d	10291	27	36715	127	843	31	2895	36	399
V634-M227a	4220	17	21443	82	442	29	539	32	418
V634-M27b	3150	15	25598	94	420	29	588	33	337
V634-M27c	4435	17	23315	87	466	30	549	32	408
V634-M28a	8331	23	36920	127	1234	32	11095	51	374
V634-M28b	7676	22	43864	148	1450	33	12036	53	387
V634-M28c	7376	22	48160	161	1540	32	13101	55	377
V634-M29a	6749	21	38987	133	861	31	1502	34	432

<u>Analysis</u>	<u>Y</u>	<u>10</u>	<u>TH</u>	<u>10</u>	<u>Pb</u>	<u>10</u>	<u>U</u>	<u>10</u>	<u>Age</u>
V634-M29b	10824	28	36106	125	946	31	3842	37	426
V634-M29c	10431	27	40124	137	992	31	3042	36	434
V634-M30b	7989	23	36945	127	841	30	2461	35	411
V634-M33a	3573	16	29460	105	510	29	782	33	352
V634-M33b	8033	23	40356	137	900	31	2265	35	414
V634-M33c	7450	22	37410	129	781	30	1627	34	401
V634-M33d	3611	16	38918	133	778	30	1008	33	408
V634-M36a	7825	22	34556	120	806	30	1958	34	432
V634-M36b	2347	14	19568	76	55	28	308	32	56
V634-M36c	8053	23	37125	128	814	30	2149	35	405
V634-M36d	10477	27	41084	140	1505	32	12475	54	407
V634-M36e	11679	29	42976	145	1559	32	14114	57	387
V634-M37a	10597	27	44715	150	1064	31	3176	36	424
V634-M37b	5294	18	23072	87	510	29	994	33	425
V634-M38a	9254	25	33232	116	819	30	3011	35	416
V634-M38b	9899	26	39890	136	938	31	2783	35	420
V634-M38c	10732	26	42697	144	1093	31	3790	37	435

653									
<u>Analysis</u>	<u>Y</u>	<u>10</u>	<u>TH</u>	<u>10</u>	<u>Pb</u>	<u>10</u>	<u>U</u>	<u>10</u>	<u>Age</u>
V653-M1a	183	13	36119	117	1084	31	9437	47	364
V653-M1b	524	13	28724	97	653	30	4851	38	329
V653-M1c	552	13	26247	91	575	29	3360	36	346
V653-M1d	656	13	29356	99	598	30	3461	36	330
V653-M1e	794	13	29320	99	655	30	3374	36	363
V653-M1f	4532	18	42302	134	985	31	4090	37	393
V653-M1g	8769	26	45615	143	967	31	4225	38	359
V653-M1h	9273	27	46399	146	1035	31	4219	38	379
V653-M7a	2120	15	45090	142	926	31	3680	37	362
V653-M7b	2053	15	44127	139	871	30	3539	37	349
V653-M7c	2011	15	43087	136	840	30	3552	37	343
V653-M7d	3397	16	50652	157	1091	31	3931	38	382
V653-M7e	3947	17	52589	162	1038	31	4027	38	351
V653-M7f	3976	17	49761	155	1028	31	3744	37	369
V653-M7g	386	13	37837	122	1116	31	9949	48	356
V653-M7h	227	13	38620	124	1179	31	11112	50	354
V653-M4a	855	14	35855	116	756	30	3504	36	357
V653-M4b	1192	14	34769	113	705	30	3400	36	344
V653-M4c	1311	14	36705	119	762	30	3549	36	353
V653-M4d	746	14	33208	110	909	30	7922	44	345
V653-M4e	1472	14	32945	109	853	30	8438	45	317
V653-M5a	8586	25	53215	164	1153	31	4704	39	371
V653-M5b	3738	17	46091	144	959	31	3741	37	366
V653-M5c	688	14	33642	110	669	30	2900	36	347
V653-M5d	490	13	36090	117	765	30	3810	37	353
V653-M21a	227	13	28478	97	570	30	3356	36	324
V653-M21b	300	13	25555	89	493	29	2988	35	313
V653-M23c	5256	19	32025	106	592	30	2982	36	313
V653-M23d	5298	19	36148	118	710	30	3471	37	331
V653-M23e	5705	20	34639	114	706	30	3685	37	334
V653-M23f	2480	15	33534	111	652	30	3226	36	330
V653-M24a	11868	32	19677	74	651	30	5926	40	363
V653-M24b	11402	30	20858	77	538	30	3959	37	344
V653-M24c	12651	33	22792	82	585	30	4913	39	326
V653-M24d	12301	33	20996	77	595	30	4657	38	355
V653-M30a	bd	bd	37547	121	959	31	7442	43	348
V653-M30b	1391	14	40388	129	980	31	6713	42	352
V653-M30c	350	134	35872	117	878	30	6359	41	348
V653-M30d	923	14	35548	116	692	30	3395	36	332
V653-M31a	1026	14	40240	128	707	30	4494	38	289
V653-M31b	10419	29	40378	129	839	31	3695	37	351
V653-M31c	4169	18	42315	135	865	31	3505	37	357
V653-M33a	781	13	24005	85	453	29	2764	35	307
V653-M33b	1178	14	25875	90	504	30	2996	36	316
V653-M33c	1361	14	26765	92	502	29	3143	36	303

V436A									
<u>Analysis</u>	<u>Y</u>	<u>10</u>	<u>TH</u>	<u>10</u>	<u>Pb</u>	<u>10</u>	<u>U</u>	<u>10</u>	<u>Age</u>
V436A-12a	2564	15	36307	116	1530	33	17426	59	368
V436A-12b	2098	14	33041	107	1411	32	15700	56	375
V436A-12c	657	13	33023	107	1713	33	17987	60	418
V436A-12d	4584	17	31279	102	841	30	5607	39	377
V436A-12e	5196	17	49608	151	1304	32	7341	42	394
V436A-12f	5121	17	52628	159	1395	32	7374	42	404
V436A-12g	5273	18	53395	161	1374	32	7468	42	393
V436A-4a	bd	bd	32497	106	1381	32	14395	54	390
V436A-4b	1113	13	28355	94	666	30	3392	36	377
V436A-4c	1253	13	31054	102	740	30	3531	36	388
V436A-4d	1102	13	27120	91	632	29	3257	35	374
V436A-5a	1673	14	54053	163	1203	32	4606	38	388
V436A-5b	1853	14	48613	149	1105	31	4195	37	395
V436A-5c	1587	14	45168	139	976	31	3906	37	376
V436A-5c	1463	13	41892	130	921	31	3831	37	378
V436A-1a	5971	18	36954	117	879	30	3572	36	399
V436A-1b	7275	20	42259	132	971	31	4096	37	385
V436A-1c	7529	20	43673	135	981	31	4049	37	381
V436A-1d	7793	21	45114	139	1058	31	4218	37	397
V436A-1e	6952	20	41097	128	972	31	3875	37	399
V436A-6a	934	13	32592	106	706	30	3278	36	364
V436A-6b	554	13	27642	93	397	29	2676	35	245
V436A-10a	6120	18	30257	100	700	30	3621	36	367
V436A-10b	7830	21	31193	102	691	30	3612	36	353
V436A-10c	11309	26	39001	123	879	31	4139	37	366
V436A-10d	11677	26	43221	134	961	31	4116	37	371
V436A-10e	11749	27	44006	136	1051	31	4206	38	399
V436A-10f	10688	25	42699	133	1013	31	4112	37	396
V436A-10g	11125	26	43109	134	986	31	4184	37	381
V436A-10h	9843	24	31962	104	773	30	3695	36	384
V436A-11a	11771	27	48799	149	1106	32	4305	38	386
V436A-11b	11811	27	52215	158	1156	32	4260	38	384
V436A-11c	10730	25	42330	132	1005	31	3910	37	400
V436A-M20	5018	18	39857	136	925	30	4416	38	378
V436A-M22a	4327	17	32578	114	756	30	3427	36	383
V436A-M22b	5011	18	35468	123	864	30	3664	36	403
V436A-M25a	5411	18	31075	110	755	30	4171	37	374
V436A-M25b	6621	20	39349	134	932	30	4204	37	388
V436A-M25c	7176	21	50177	166	1184	31	4621	39	401
V436A-M25d	4690	18	35313	123	1089	31	8761	45	379
V436A-M11h	7208	21	34171	119	883	30	4074	37	410
V436A-M11i	7466	22	30647	109	796	30	3822	36	406
V436A-M11j	8673	24	32750	115	915	30	4152	37	434
V436A-M11d	4683	17	30341	108	802	30	3934	36	411
V436A-M11f	9076	24	33244	116	848	30	4032	37	401
V436A-M11g	10564	27	32273	113	814	30	3913	37	395

<u>Analysis</u>	<u>Y</u>	<u>1σ</u>	<u>Th</u>	<u>1σ</u>	<u>Pb</u>	<u>1σ</u>	<u>U</u>	<u>1σ</u>	<u>Age</u>
V436A-M20b	3397	16	31030	104	598	30	3386	36	316
V436A-M20c	3185	16	28275	96	568	30	3077	36	329
V436A-M20d	3809	17	28065	96	514	30	3010	36	301
V436A-M20e	5174	19	36527	119	748	30	3485	37	346
V436A-M20f	4862	19	35656	116	728	30	3249	36	348
V436A-M20g	4770	19	38656	125	823	31	3580	37	362
V436A-M21a	2942	16	36148	118	1449	32	16642	63	359
V436A-M21c	3600	17	33335	111	1948	33	26342	87	366
V436A-M24b	3130	16	28654	98	563	30	3281	36	318
V436A-M24c	3232	16	31307	105	705	30	4248	38	347

V436B									
<u>Analysis</u>	<u>Y</u>	<u>I□</u>	<u>TH</u>	<u>I□</u>	<u>Pb</u>	<u>I□</u>	<u>U</u>	<u>I□</u>	<u>Age</u>
V436B-M3a	818	13	36884	124	765	29	3841	36	346
V436B-M3b	927	13	33878	115	678	29	3555	36	334
V436B-M3c	978	13	38162	128	826	30	4287	37	354
V436B-M3d	937	13	37941	127	790	30	4198	37	342
V436B-M3e	766	13	36983	124	814	30	3896	37	366
V436B-M3f	850	13	36326	122	734	30	3574	36	342
V436B-M9a	845	13	33737	115	713	30	3632	36	350
V436B-M9b	739	13	34271	116	785	30	3961	37	372
V436B-M9c	567	13	33619	114	695	30	3932	37	335
V436B-M9d	435	13	36367	123	742	30	4126	37	334
V436B-M8a	241	13	44089	145	867	30	3666	37	346
V436B-M8b	1772	14	52810	170	1102	31	5313	40	351
V436B-M4a	915	13	33946	116	696	30	3558	36	342
V436B-M4b	858	13	32579	112	656	30	3564	36	332
V436B-M6a	830	13	42570	140	855	30	4100	37	342
V436B-M6b	1050	13	40174	139	787	30	3914	37	333
V436B-M6c	985	13	39642	132	787	30	3966	37	335
V436B-M6d	bd	bd	54135	175	1036	31	4009	38	345
V436B-M1b	505	13	32945	113	820	30	3710	36	407
V436B-M1c	564	13	33400	114	876	30	3707	37	430
V436B-M1d	376	13	33524	115	837	30	3712	37	410
V436B-M1e	171	13	34560	118	776	30	3625	36	374
V436B-M2b	bd	bd	34838	119	728	30	3294	36	358
V436B-M2c	231	113	31510	109	607	30	3252	36	323
V436B-M2d	243	13	31909	110	691	30	3214	36	365
V436B-M2e	bd	bd	30778	107	456	29	2956	36	254
V436B-M2f	bd	bd	36177	123	673	30	3812	37	311
V436B-M3i	660	13	36547	124	860	30	3728	37	394
V436B-M3j	523	13	39951	133	873	30	3911	37	370
V436B-M3k	636	13	41535	138	894	30	4134	38	363
V436B-M3l	bd	bd	38615	130	846	30	3721	37	373
V436B-M3m	bd	bd	42959	142	916	30	4258	38	361
V436B-M3n	190	13	37500	126	824	30	3457	37	378
V436B-M3o	bd	bd	42554	141	889	30	4087	38	356
V436B-M3p	bd	bd	40366	138	790	30	3878	37	334

V240									
<u>Analysis</u>	<u>Y</u>	<u>10</u>	<u>TH</u>	<u>10</u>	<u>Pb</u>	<u>10</u>	<u>U</u>	<u>10</u>	<u>Age</u>
V240-M1a	2280	15	19112	89	533	30	3910	38	375
V240-M1b	2284	15	18150	82	504	29	3757	37	372
V240-M1c	2249	15	17994	74	510	29	3689	36	381
V240-M1d	2311	15	17512	82	488	29	3626	37	373
V240-M1e	2613	15	20692	82	578	30	4206	37	377
V240-M1f	3760	15	17388	83	472	30	3560	37	365
V240-M1g	2728	15	26854	69	746	29	4905	36	390
V240-M2a	2796	15	24672	102	710	30	5154	40	384
V240-M2b	2805	15	29191	85	830	30	5622	38	391
V240-M2c	2848	15	29779	88	786	30	5547	38	368
V240-M2d	2757	15	28994	94	800	30	5438	39	384
V240-M2e	2905	15	21915	80	611	30	4632	37	370
V240-M2f	2679	15	23507	85	697	30	5014	38	392
V240-M2g	2468	15	26934	93	842	30	5262	39	427
V240-M3a	12547	25	18726	77	614	30	4083	38	428
V240-M3b	9760	40	22681	73	749	30	5675	46	407
V240-M3c	11800	29	18059	89	651	30	4745	47	434
V240-M7a	1591	14	25672	77	668	29	4660	37	367
V240-M7b	1589	14	25779	106	710	30	4729	40	386
V240-M7c	1690	14	30856	80	899	29	6433	37	389
V240-M7d	1491	14	19716	94	547	30	4074	38	372
V240-M7e	1702	14	27075	73	726	29	5188	37	370

APPENDIX-3**V240 microprobe data****V240 GARNET**

analysis #	1-3	4-6	garn 7-9	10-12	15-18	19-21	1-3a	4-6a	7-9a
SiO ₂	38.64	39.01	38.69	37.91	38.10	38.32	37.49	37.97	38.37
Al ₂ O ₃	20.01	20.05	19.99	19.81	19.42	20.27	18.96	19.42	19.81
TiO ₂	0.01	0.16	0.04	0.12	0.12	0.05	0.05	0.07	0.01
FeO	34.00	32.84	33.13	32.33	29.89	33.37	30.27	30.39	31.49
MnO	0.19	0.94	1.62	2.68	4.19	0.09	3.84	3.69	4.18
MgO	4.96	4.48	3.39	2.52	2.13	5.14	1.71	1.95	2.25
CaO	1.99	2.27	3.13	3.97	4.46	1.85	5.46	5.72	4.64
Total	99.8	99.8	100.0	99.3	98.3	99.1	97.8	99.2	100.7
Almandine	74.60	73.48	73.91	72.47	68.49	74.16	68.49	67.65	68.95
Grossular	5.59	6.52	8.94	11.39	13.09	5.26	15.82	16.31	13.02
Pyrope	19.39	17.87	13.49	10.06	8.69	20.38	6.88	7.73	8.77
Spessartine	0.41	2.14	3.66	6.08	9.73	0.21	8.80	8.32	9.26
Fe/(Fe+Mg)	0.79	0.80	0.85	0.88	0.89	0.78	0.91	0.90	0.89

V 240 GARNET

analysis #	11-13a	14-16a	17-19a	20-22a	23-25a	26-28a	1b	2b	3b
SiO ₂	38.18	38.14	38.38	39.05	37.87	39.12	38.79	38.01	37.42
Al ₂ O ₃	19.94	19.32	19.71	19.96	19.50	19.62	21.56	20.89	20.86
TiO ₂	0.05	0.10	0.04	0.04	0.11	0.02	0.34	0	0
FeO	31.32	31.36	33.65	34.29	33.61	34.72	35.54	33.63	32.89
MnO	2.94	4.34	2.15	0.92	1.91	0.30	0.59	0.97	0.95
MgO	2.24	2.04	3.43	4.03	3.19	4.27	3.79	3.43	3.84
CaO	5.65	4.52	2.85	2.23	3.43	1.86	2.2	2.42	2.39
Total	100.3	99.8	100.2	100.5	99.6		102.81	99.35	98.35
Almandine	68.80	69.40	73.79	75.77	73.68	77.12	77.75	76.73	75.16
Grossular	15.89	12.82	8.01	6.31	9.62	5.30	6.17	7.07	7.00
Pyrope	8.77	8.06	13.42	15.87	12.45	16.91	14.78	13.95	15.64
Spessartine	6.54	9.72	4.78	2.05	4.24	0.67	1.31	2.24	2.20
Fe/(Fe+Mg)	0.89	0.90	0.85	0.83	0.86	0.82	0.84	0.85	0.83

V240 CHLORITOID

analysis #	1-3	4-6	7-9	10-12	14-16	1-3a	4-6a	7-9a	11-13a
SiO ₂	25.31	24.81	25.38	27.71	24.99	24.62	24.37	25.38	25.20
Al ₂ O ₃	38.19	36.95	38.27	48.71	37.40	36.83	36.66	38.24	37.75
TiO ₂	0.17	0.03	0.00	0.37	0.03	0.01	0.11	0.06	0.00
FeO	21.90	21.97	21.64	15.02	22.31	22.95	22.30	26.60	23.06
MnO	0.05	0.13	0.19	0.03	0.19	0.55	0.28	0.46	0.38
MgO	5.68	4.40	4.24	2.34	4.34	3.21	4.06	3.98	3.95
CaO	0.05	0.10	0.00	0.01	0.03	0.02	0.04	0.00	0.05
Cl	0.01	0.03	0.00	0.08	0.03	0.00	0.00	0.00	0.01
Total	91.3475	88.41	89.73	94.26	89.33	88.2	87.82	94.72	90.37
cat Si	2.091	2.125	2.130	2.103	2.120	2.128	2.109	2.071	2.120
cat Al	3.718	3.729	3.785	4.355	3.738	3.752	3.738	3.679	3.742
cat Ti	0.010	0.002	0.000	0.021	0.002	0.001	0.007	0.003	0.000
cat Fe	1.513	1.573	1.519	0.953	1.583	1.659	1.614	1.816	1.622
cat Mn	0.004	0.009	0.014	0.002	0.014	0.040	0.021	0.032	0.027
cat Mg	0.700	0.562	0.531	0.264	0.549	0.414	0.524	0.484	0.495
cat Ca	0.004	0.009	0.000	0.001	0.003	0.002	0.003	0.000	0.005
Total cations	8.040	8.009	7.978	7.699	8.009	7.995	8.015	8.086	8.010
Fe/(Fe+Mg)	0.684	0.737	0.741	0.783	0.742	0.800	0.755	0.789	0.766

V240 CHLORITOID

analysis #	14-16a	18-20a	20-22a	2b	3b	4b
SiO ₂	25.10	24.81	25.38	25.48	25.76	25.99
Al ₂ O ₃	37.36	36.95	38.27	39.84	40.73	39.86
TiO ₂	0.00	0.03	0.00	0.13	0.11	0.13
FeO	23.09	21.97	21.64	24.94	24.54	25.2
MnO	0.31	0.13	0.19	0.15	0.18	0
MgO	3.68	4.40	4.24	4.84	4.25	3.99
CaO	0.08	0.10	0.00	0.00	0.00	0.00
Cl	0.03	0.03	0.00	0.00	0.00	0.00
Total	89.6425	88.41	89.73	95.38	95.57	95.17
cat Si	2.131	2.125	2.130	2.041	2.051	2.084
cat Al	3.737	3.729	3.785	3.762	3.822	3.767
cat Ti	0.000	0.002	0.000	0.008	0.007	0.008
cat Fe	1.639	1.573	1.519	1.671	1.634	1.690
cat Mn	0.022	0.009	0.014	0.010	0.012	0.000
cat Mg	0.466	0.562	0.531	0.578	0.505	0.477
cat Ca	0.007	0.009	0.000	0.000	0.000	0.000
Total cations	8.001	8.009	7.978	8.070	8.031	8.025
Fe/(Fe+Mg)	0.779	0.737	0.741	0.743	0.764	0.780

V240 STAUROLITE

analysis #	1-3	1-3	4-6	7-9	11-13	14-16	17-19	20-22
SiO ₂	28.05	27.18	27.24	27.66	27.74	27.28	27.48	27.763
Al ₂ O ₃	49.96	51.06	51.62	51.19	51.88	51.41	50.89	50.260
TiO ₂	0.72	0.42	0.25	0.25	0.33	0.39	0.37	0.683
FeO	14.56	14.14	14.69	14.04	14.43	14.26	14.62	14.830
MnO	0.04	0.19	0.17	0.23	0.18	0.24	0.07	0.023
MgO	2.62	1.98	2.13	2.30	1.98	2.20	2.48	2.120
ZnO	0.15	0.60	0.05	0.24	0.70	0.91	0.16	0.393
CaO	0.05	0.09	0.06	0.03	0.00	0.07	0.03	0.007
Total	96.16	95.65	96.21	95.94	97.24	96.76	96.09	96.080
cat Si	3.99	3.89	3.87	3.93	3.90	3.87	3.91	3.959
cat Al	8.37	8.61	8.65	8.58	8.61	8.59	8.54	8.446
cat Ti	0.08	0.05	0.03	0.03	0.03	0.04	0.04	0.073
cat Fe	1.73	1.69	1.75	1.67	1.70	1.69	1.74	1.768
cat Mn	0.01	0.02	0.02	0.03	0.02	0.03	0.01	0.003
cat Mg	0.56	0.42	0.45	0.49	0.42	0.46	0.53	0.451
cat Zn	0.02	0.07	0.01	0.03	0.08	0.10	0.02	0.044
cat Ca	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.001
Total cations	14.75	14.76	14.78	14.75	14.76	14.80	14.78	14.745
Fe/(Fe+Mg)	0.76	0.80	0.79	0.77	0.80	0.78	0.77	0.80

V240 STAUROLITE

analysis #	1a	3a	3a	4a	7a	8a	9a
SiO ₂	29.75	29.38	29.05	29.63	31.05	30.12	30.18
Al ₂ O ₃	52.19	52.74	52	51.94	52.8	52.39	52.5
TiO ₂	0.00	0.38	0.14	0.2	0.24	0.19	0.02
FeO	15.81	15.2	15.73	15.14	15.16	15.21	15.14
MnO	0.07	0.04	0.09	0.02	0	0.07	0
MgO	2.57	2.4	2.33	2.3	2.66	2.27	2.39
ZnO	0.23	0.34	0.01	0.26	0.43	0.01	0.44
CaO	0.00	0	0	0	0	0	0
Total	100.62	100.48	99.35	99.49	102.34	100.26	100.67
cat Si	4.05	3.99	4.00	4.06	4.13	4.09	4.09
cat Al	8.37	8.45	8.44	8.40	8.28	8.39	8.38
cat Ti	0.00	0.04	0.01	0.02	0.02	0.02	0.00
cat Fe	1.80	1.73	1.81	1.74	1.69	1.73	1.72
cat Mn	0.01	0.00	0.01	0.00	0.00	0.01	0.00
cat Mg	0.52	0.49	0.48	0.47	0.53	0.46	0.48
cat Zn	0.02	0.04	0.00	0.03	0.05	0.00	0.05
cat Ca	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total cations	14.77	14.74	14.76	14.72	14.70	14.70	14.72
Fe/(Fe+Mg)	0.78	0.78	0.79	0.79	0.76	0.79	0.78

V240										
CHLORITE										
analysis #	matrix	1	2	3	4	5	6	7	8	9
SiO ₂	25.01	25.07	25.24	25.06	24.72	24.64	25.53	24.45	24.35	25.68
Al ₂ O ₃	20.71	22.36	22.39	23.05	22.81	22.52	22.21	22.21	21.92	22.46
TiO ₂	0.02	0.12	0.06	0.00	0.14	0.05	0.00	0.00	0.09	0.00
FeO	20.09	22.79	22.04	23.07	21.64	21.87	22.44	22.47	22.57	22.79
MnO	0.07	0.08	0.08	0.00	0.23	0.00	0.05	0.11	0.00	0.00
MgO	17.93	16.92	17.22	16.99	16.20	16.31	16.50	16.13	16.02	16.62
CaO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	83.83	87.34	87.03	88.17	85.74	85.39	86.73	85.37	84.95	87.55
cat Si	2.688	2.615	2.631	2.589	2.614	2.618	2.673	2.611	2.615	2.665
cat Al	2.623	2.749	2.750	2.807	2.842	2.820	2.740	2.795	2.775	2.747
cat Ti	0.002	0.009	0.005	0.000	0.011	0.004	0.000	0.000	0.007	0.000
cat Fe	1.806	1.988	1.921	1.994	1.913	1.943	1.965	2.007	2.027	1.978
cat Mn	0.006	0.007	0.007	0.000	0.021	0.000	0.004	0.010	0.000	0.000
cat Mg	2.873	2.631	2.676	2.617	2.553	2.583	2.575	2.568	2.565	2.571
cat Ca	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total cations	9.998	10.001	9.989	10.007	9.954	9.968	9.957	9.991	9.990	9.961
<u>Tetrahedral</u>										
Si	2.688	2.615	2.631	2.589	2.614	2.618	2.673	2.611	2.615	2.665
Al	1.312	1.385	1.369	1.411	1.386	1.382	1.327	1.389	1.385	1.335
<u>Octahedral</u>										
Al	1.312	1.365	1.381	1.396	1.456	1.438	1.413	1.406	1.390	1.412
Ti	0.002	0.009	0.005	0.000	0.011	0.004	0.000	0.000	0.007	0.000
Fe	1.806	1.988	1.921	1.994	1.913	1.943	1.965	2.007	2.027	1.978
Mn	0.006	0.007	0.007	0.000	0.021	0.000	0.004	0.010	0.000	0.000
Mg	2.873	2.631	2.676	2.617	2.553	2.583	2.575	2.568	2.565	2.571
	5.998	6.001	5.989	6.007	5.954	5.968	5.957	5.991	5.990	5.961
Fe/(fe+Mg)	0.386	0.430	0.418	0.432	0.428	0.429	0.433	0.439	0.441	0.435
Fe/(fe+Mg+Mn)	0.385	0.430	0.417	0.432	0.426	0.429	0.432	0.438	0.441	0.435

V 240 BIOTITE

analysis #	1	4	5	6	1a	2a	3a	M1	M2	M3
SiO2	37.13	37.30	38.55	37.87	37.07	37.44	38.27	37.50	37.57	36.68
Al2O3	16.34	16.44	17.55	16.66	17.21	16.70	17.36	16.80	17.11	17.07
TiO2	1.49	1.30	1.28	1.00	1.31	0.91	1.11	1.38	1.05	1.21
FeO	17.95	17.76	17.45	18.44	20.31	19.12	18.85	18.87	18.52	19.56
MnO	0.22	0.09	0.00	0.20	0.01	0.14	0.00	0.00	0.01	0.11
MgO	12.85	13.10	13.63	14.02	13.01	12.58	12.97	12.42	13.32	12.84
CaO	0.05	0.00	0.02	0.24	0.00	0.11	0.00	0.11	0.02	0.05
Na2O	0.40	0.00	0.22	0.44	0.11	0.00	0.00	0.00	0.15	0.31
K2O	9.31	9.31	8.96	9.25	8.76	9.19	9.35	9.38	9.35	9.22
Cl	0.15	0.11	0.05	0.00	0.08	0.06	0.03	0.00	0.05	0.15
Total	95.89	95.41	97.71	98.12	97.87	96.25	97.94	96.46	97.15	97.20
<u>Tetrahedral</u>										
Si	5.590	5.620	5.620	5.563	5.488	5.618	5.614	5.606	5.568	5.483
Al	2.410	2.380	2.380	2.437	2.512	2.382	2.386	2.394	2.432	2.517
	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000
<u>Octahedral</u>										
Al	0.490	0.539	0.635	0.447	0.490	0.571	0.616	0.565	0.556	0.490
Ti	0.169	0.147	0.140	0.110	0.146	0.103	0.122	0.155	0.117	0.136
Fe	2.260	2.238	2.127	2.265	2.514	2.399	2.313	2.359	2.295	2.445
Mn	0.028	0.011	0.000	0.025	0.001	0.018	0.000	0.000	0.001	0.014
Mg	2.884	2.942	2.962	3.070	2.871	2.814	2.837	2.768	2.943	2.861
	5.831	5.878	5.865	5.918	6.022	5.905	5.888	5.847	5.912	5.946
<u>A site</u>										
Ca	0.008	0.000	0.003	0.038	0.000	0.018	0.000	0.018	0.003	0.008
Na	0.117	0.000	0.062	0.125	0.032	0.000	0.000	0.000	0.043	0.090
K	1.788	1.790	1.666	1.733	1.654	1.759	1.750	1.789	1.768	1.758
	1.913	1.790	1.732	1.896	1.686	1.777	1.750	1.806	1.814	1.856
xFe	0.388	0.381	0.363	0.383	0.417	0.406	0.393	0.403	0.388	0.411
xMg	0.495	0.501	0.505	0.519	0.477	0.477	0.482	0.473	0.498	0.481
xTi	0.029	0.025	0.024	0.019	0.024	0.017	0.021	0.027	0.020	0.023
xAl	0.084	0.092	0.108	0.076	0.081	0.097	0.105	0.097	0.094	0.082

V240 MICAS

analysis #	mica 1-3	mica 5-7	marg 1-3	mag 1-3	mica 1-3	ms-matrix	ms-matrix	ms-matrix	para-matrix
SiO2	43.06	43.68	39.77	33.40	45.17	47.75	48.29	46.04	47.64
Al2O3	37.13	37.44	39.35	44.42	31.51	28.55	29.65	28.5	36.81
TiO2	0.14	0.13	0.16	0.00	0.63	0.3	0.32	0.41	0.23
FeO	1.06	1.30	1.56	1.59	2.85	3.19	3.55	2.88	1.1
MnO	0.00	0.06	0.10	0.09	0.02	0.2	0.07	0.03	0
MgO	0.26	0.28	0.21	0.36	0.75	1.92	1.8	1.71	0.24
CaO	1.71	1.58	4.30	9.41	0.06	0.19	0.11	0	0.48
Na2O	7.14	7.00	5.36	2.21	2.11	1.09	1.54	1.2	5.17
K2O	0.59	0.23	0.21	0.09	8.86	9.73	9.15	9.67	0.95
Total	91.10	91.70	91.04	91.57	91.97	92.92	94.48	90.44	92.62
<u>Tetrahedral</u>									
Si	5.834	5.862	5.435	4.605	6.278	6.583	6.532	6.518	6.234
Al	2.166	2.138	2.565	3.395	1.722	1.417	1.468	1.482	1.766
	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000
<u>Octahedral</u>									
Al	3.762	3.784	3.772	3.824	3.440	3.221	3.259	3.273	3.912
Ti	0.015	0.013	0.017	0.000	0.066	0.031	0.033	0.044	0.023
Fe	0.120	0.146	0.179	0.183	0.331	0.368	0.402	0.341	0.120
Mn	0.000	0.007	0.011	0.011	0.002	0.023	0.008	0.004	0.000
Mg	0.053	0.055	0.043	0.074	0.156	0.395	0.363	0.361	0.047
	3.950	4.006	4.022	4.092	3.996	4.038	4.064	4.023	4.102
<u>A site</u>									
Ca	0.248	0.227	0.630	1.391	0.009	0.028	0.016	0.000	0.067
Na	1.876	1.822	1.421	0.590	0.568	0.291	0.404	0.329	1.312
K	0.103	0.039	0.037	0.016	1.572	1.711	1.579	1.747	0.159
	2.226	2.089	2.087	1.996	2.148	2.031	1.999	2.076	1.538
x musc	0.046	0.109	0.018	0.697	0.732	0.843	0.790	0.841	0.103
x para	0.842	0.872	0.681	0.295	0.264	0.143	0.202	0.159	0.853
xAl	0.953	0.945	0.938	0.052	0.861	0.798	0.802	0.814	0.044
x cel	0.044	0.050	0.055	0.684	0.122	0.189	0.188	0.174	0.954

V634A Microprobe data**V634A GARNET**

analysis #	1-3	4-6	7-9	10-12	13-15	16-18	19-21	1a	2a	3a
SiO ₂	36.98	37.62	37.46	36.93	37.14	37.75	37.66	38.12	37.443	36.627
Al ₂ O ₃	20.11	20.28	20.65	20.28	20.69	20.61	20.54	0.00	0.057	0.053
TiO ₂	0.13	0.02	0.01	0.09	0.01	0.11	0.06	21.38	20.627	20.34
FeO	32.31	33.23	34.53	33.72	34.85	36.14	36.19	38.58	37.443	37
MnO	4.65	4.86	2.96	3.42	2.31	0.76	0.50	1.01	1.543	2.28
MgO	2.15	2.13	2.66	2.42	2.77	3.17	3.12	2.32	1.877	1.617
CaO	1.34	1.14	0.99	1.15	0.86	0.44	0.38	0.47	0.757	1.06
Total	97.69	99.27	99.26	98.00	98.64	98.97	98.45	101.88	99.75	98.98

Almandine	75.9	76.6	79.3	78.5	80.6	83.8	84.7	87.0	86.4	85.0
Grossular	4.04	3.37	2.90	3.42	2.54	1.30	1.13	1.36	2.24	3.12
Pyrope	9.01	8.74	10.90	10.05	11.44	13.09	13.02	9.34	7.72	6.62
Spessartine	11.07	11.33	6.89	8.06	5.40	1.79	1.19	2.31	3.61	5.30
Fe/(Fe+Mg)	0.894	0.898	0.879	0.886	0.876	0.865	0.867	0.903	0.918	0.928
Fe/(Fe+Mg+Mn)	0.791	0.792	0.817	0.812	0.827	0.849	0.856	0.882	0.884	0.877
Mn/(Mn+Mg+Fe)	0.115	0.117	0.071	0.083	0.055	0.018	0.012	0.023	0.037	0.055

V634A GARNET

analysis #	4a	5a	6a	7a	8a	9a	10a	11a	12a	13a	14a
SiO ₂	37.023	36.533	36.627	36.03	36.693	37.22	37.453	37.62	36.757	37.297	36.67
Al ₂ O ₃	0.02	0.04	0.047	0.043	0.043	0.047	0.077	0.03	0	0.07	0.017
TiO ₂	20.263	19.907	19.997	19.88	20.37	20.697	20.773	21.143	20.91	20.683	20.867
FeO	35.37	33.867	33.123	33.91	33.847	35.697	37.103	38.66	39.077	38.847	38.64
MnO	3.913	5.14	6.043	5.74	5.277	3.387	2.747	1.06	0.7	0.57	3.73
MgO	1.337	0.833	1.097	0.703	1.187	1.167	1.843	2.003	2.193	1.57	2.08
CaO	1.243	1.58	1.453	1.54	1.513	1.13	1.057	0.5	0.383	0.273	0.36
Total	99.17	97.90	98.39	97.85	98.93	99.35	101.05	101.02	100.02	99.31	102.36

Almandine	81.7	79.5	76.9	79.0	78.3	83.7	83.3	88.0	88.4	91.2	82.9
Grossular	3.68	4.75	4.32	4.59	4.48	3.39	3.04	1.46	1.11	0.82	0.99
Pyrope	5.50	3.49	4.54	2.92	4.89	4.88	7.38	8.13	8.85	6.57	7.96
Spessartine	9.15	12.23	14.21	13.54	12.36	8.04	6.25	2.44	1.60	1.36	8.11
Fe/(Fe+Mg)	0.937	0.958	0.944	0.964	0.941	0.945	0.919	0.915	0.909	0.933	0.912
Fe/(Fe+Mg+Mn)	0.848	0.835	0.804	0.828	0.819	0.866	0.859	0.893	0.894	0.920	0.838
Mn/(Mn+Mg+Fe)	0.095	0.128	0.149	0.142	0.129	0.083	0.064	0.025	0.016	0.014	0.082

V634A CHLORITOID

analysis #	1-3	4-6	7-9	10-12	13-15	16-18	19-21
SiO ₂	25.16	25.18	25.55	25.65	25.62	25.33	25.70
Al ₂ O ₃	39.54	39.51	39.57	39.93	40.08	39.60	39.96
TiO ₂	0.09	0.00	0.08	0.02	0.03	0.11	0.06
FeO	24.12	23.73	23.60	24.14	24.09	24.12	23.74
MnO	0.28	0.39	0.33	0.40	0.22	0.03	0.04
MgO	3.25	3.14	3.17	3.30	3.70	3.82	3.95
CaO	0.02	0.06	0.03	0.04	0.04	0.02	0.06
Total	92.47	92.01	92.35	93.48	93.78	93.03	93.51
cat Si	2.073	2.082	2.101	2.088	2.077	2.072	2.084
cat Al	3.840	3.850	3.834	3.831	3.829	3.816	3.819
cat Ti	0.006	0.000	0.005	0.001	0.002	0.007	0.003
cat Fe	1.662	1.641	1.623	1.644	1.633	1.649	1.610
cat Mn	0.019	0.028	0.023	0.028	0.015	0.002	0.003
cat Mg	0.399	0.387	0.389	0.400	0.447	0.466	0.478
cat Ca	0.002	0.005	0.002	0.003	0.004	0.001	0.005
Total cations	8.001	7.993	7.977	7.995	8.007	8.013	8.003
Fe/(Fe+Mg)	0.806	0.809	0.807	0.804	0.785	0.780	0.771
Fe/(Fe+Mg+Mn)	0.799	0.798	0.797	0.793	0.779	0.779	0.770
Mn/(Fe+Mg+Mn)	0.009	0.013	0.011	0.013	0.007	0.001	0.001

V634A CHLORITOID

analysis #	22-24	1a	2a	3a	4a	5a	6a
SiO ₂	25.23	25.053	25.05	25.2	24.05	24.17	24.72
Al ₂ O ₃	39.29	41.7	40.85	41.82	40.817	40.507	41.24
TiO ₂	0.04	0	0.083	0.067	0.117	0	0
FeO	23.61	26.723	26.83	26.737	26.85	26.533	26.773
MnO	0.24	0.703	0.403	0.14	0.53	0.093	0.48
MgO	3.31	2.053	2	2.903	2.153	2.337	2.407
CaO	0.04	0	0.017	0.013	0.04	0.08	0.143
Total	91.75	96.23	95.23	96.88	94.56	93.72	95.76
cat Si	2.089	2.007	2.028	1.999	1.969	1.989	1.992
cat Al	3.835	3.936	3.898	3.910	3.938	3.930	3.917
cat Ti	0.002	0.000	0.005	0.004	0.007	0.000	0.000
cat Fe	1.635	1.790	1.817	1.774	1.838	1.826	1.805
cat Mn	0.017	0.048	0.028	0.009	0.037	0.006	0.033
cat Mg	0.409	0.245	0.241	0.343	0.263	0.287	0.289
cat Ca	0.003	0.000	0.001	0.001	0.004	0.007	0.012
Total cations	7.991	8.025	8.018	8.042	8.055	8.046	8.049
Fe/(Fe+Mg)	0.800	0.880	0.883	0.838	0.875	0.864	0.862
Fe/(Fe+Mg+Mn)	0.793	0.859	0.871	0.834	0.860	0.862	0.849
Mn/(Fe+Mg+Mn)	0.008	0.023	0.013	0.004	0.017	0.003	0.015

V634A STAUROLITE

analysis #	1-3	4-5	7-9	10-12	13-15	16-18	10a	11a
SiO ₂	29.65	28.93	28.90	29.01	28.87	29.07	28.36	27.873
Al ₂ O ₃	53.79	54.26	54.45	54.77	53.59	54.24	52.36	52.277
TiO ₂	0.72	0.57	0.63	0.67	0.75	0.78	0.56	0.48
FeO	15.16	14.32	14.73	14.27	14.64	14.64	16.09	15.607
MnO	0.01	0.01	0.02	0.05	0.06	0.12	0.04	0.05
MgO	2.45	2.08	2.20	2.20	2.14	1.85	0.78	1.14
ZnO	0.17	0.27	0.16	0.33	0.29	0.00	0.00	0
CaO	0.03	0.00	0.02	0.00	0.08	0.06	0.02	0.05
Total	101.97	100.43	101.10	101.31	100.42	100.76	98.20	97.48
cat Si	3.97	3.92	3.89	3.89	3.92	3.92	3.96	3.92
cat Al	8.48	8.66	8.64	8.66	8.58	8.63	8.61	8.65
cat Ti	0.07	0.06	0.06	0.07	0.08	0.08	0.06	0.05
cat Fe	1.70	1.62	1.66	1.60	1.66	1.65	1.88	1.83
cat Mn	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01
cat Mg	0.49	0.42	0.44	0.44	0.43	0.37	0.16	0.24
cat Zn	0.02	0.03	0.02	0.04	0.03	0.00	0.00	0.00
cat Ca	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
Total cations	14.72	14.70	14.72	14.71	14.72	14.68	14.68	14.71
Fe/(Fe+Mg)	0.78	0.79	0.79	0.78	0.79	0.82	0.92	0.88

V634A STAUROLITE

analysis #	12a	13a	14a	15a	16a	17a	18a	19a
SiO ₂	28.17	28.523	27.75	27.933	28.11	27.927	28.193	26.893
Al ₂ O ₃	51.923	52.06	52.063	52.733	51.96	52.67	52.533	51.803
TiO ₂	0.503	0.533	0.627	0.433	0.187	0.733	0.463	0.283
FeO	16.38	16.51	16.56	16.103	16.77	16.707	17.117	16.613
MnO	0	0.117	0.05	0.057	0.023	0.04	0.03	0.013
MgO	0.7	1.13	0.933	0.627	1.213	0.55	0.817	0.163
ZnO	0	0	0	0	0	0	0	0
CaO	0.043	0.007	0.103	0	0	0	0.047	0.023
Total	97.72	98.88	98.09	97.89	98.26	98.63	99.20	95.79
cat Si	3.96	3.96	3.89	3.91	3.94	3.90	3.92	3.87
cat Al	8.60	8.53	8.61	8.71	8.58	8.66	8.60	8.78
cat Ti	0.05	0.06	0.07	0.05	0.02	0.08	0.05	0.03
cat Fe	1.92	1.92	1.94	1.89	1.96	1.95	1.99	2.00
cat Mn	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00
cat Mg	0.15	0.23	0.20	0.13	0.25	0.11	0.17	0.03
cat Zn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
cat Ca	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00
Total cations	14.69	14.72	14.73	14.69	14.75	14.70	14.73	14.71
Fe/(Fe+Mg)	0.93	0.89	0.91	0.94	0.89	0.94	0.92	0.98

V634A MUSCOVITE

analysis #	1-3	4-6	7-9	10-12	1a	2a	3a	4a	3b
SiO ₂	47.49	47.56	47.38	47.93	46.95	46.223	46.4	45.39	46.3
Al ₂ O ₃	33.21	33.90	34.27	33.86	34.07	34.25	34.27	34.39	33.873
TiO ₂	0.63	0.58	0.51	0.43	0.49	0.397	0.343	0.35	0.417
FeO	1.69	1.36	1.47	1.27	1.74	1.45	1.437	1.54	1.967
MnO	0.10	0.05	0.00	0.02	0.30	0.17	0.027	0.06	0.023
MgO	1.13	0.95	0.85	1.12	0.25	0.117	0.207	0	0.06
CaO	0.04	0.18	0.04	0.09	0.02	0	0.027	0	0.047
Na ₂ O	1.64	1.96	2.02	1.89	1.36	1.603	1.137	1.37	1.297
K ₂ O	8.55	8.57	8.46	8.60	9.14	9.037	9.057	9.06	8.73
Cl	0.06	0.04	0.06	0.04	0.00	0	0	0	0
Total	94.55	95.14	95.07	95.25	94.31	93.25	92.91	92.16	92.71
<u>Tetrahedral</u>									
Si	6.336	6.300	6.279	6.332	6.294	6.260	6.288	6.220	6.298
Al	1.664	1.700	1.721	1.668	1.706	1.740	1.712	1.780	1.702
	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000
<u>Octahedral</u>									
Al	3.557	3.593	3.631	3.603	3.677	3.727	3.761	3.774	3.728
Ti	0.063	0.058	0.051	0.043	0.049	0.040	0.035	0.036	0.043
Fe	0.188	0.151	0.163	0.140	0.195	0.164	0.163	0.176	0.224
Mn	0.012	0.006	0.000	0.002	0.034	0.020	0.003	0.007	0.003
Mg	0.224	0.187	0.167	0.221	0.049	0.024	0.042	0.000	0.012
	4.044	3.994	4.013	4.009	4.004	3.975	4.004	3.993	4.009
<u>A site</u>									
Ca	0.006	0.026	0.006	0.013	0.003	0.000	0.004	0.000	0.007
Na	0.425	0.503	0.520	0.484	0.354	0.421	0.299	0.364	0.342
K	1.456	1.448	1.430	1.450	1.563	1.561	1.566	1.584	1.515
	1.887	1.977	1.956	1.947	1.920	1.982	1.868	1.948	1.864
x musc	0.771	0.732	0.731	0.745	0.814	0.788	0.838	0.813	0.813
x para	0.225	0.255	0.266	0.249	0.184	0.212	0.160	0.187	0.184
xAl	0.880	0.900	0.905	0.899	0.918	0.938	0.939	0.945	0.930

APPENDIX-4

MnKFMASH datafile

%

Chlorite order-disorder model

%

chl 5

x(chl) 0.350 % bulk Fe/(Fe+Mg)
y(chl) 0.500 % y 1/2 clinocllore-amesite
Q(chl) 0.485 % order parameter
M(chl) 0.001 % bulk Mn/(Fe+Mg+Mn)

% -----

p(afchl) 1 1 1 2 -1 y -1 Q
p(clin) 2 1 0 1 2 Q 2 0 2 -2/5 x -2/5 M 3 1 -1 y
p(daph) 1 2 0 1 2/5 x 3 1 -1 y
p(ames) 1 1 0 2 1 y -1 Q
p(mnchl) 1 2 0 1 2/5 M 3 1 -1 y

% -----

sf

W(afch,clin)	18	0	0
W(afchl,daph)	14.5	0	0
W(afchl,ames)	20	0	0
W(afchl,mnchl)	0	0	0
W(clin,daph)	2.5	0	0
W(clin,ames)	18	0	0
W(clin,mnchl)	0	0	0
W(daph,ames)	13.5	0	0
W(daph,mnchl)	0	0	0
W(ames,mnchl)	0	0	0

% -----

13 % no of site fractions

x(Fe,M23) 1 1 0 1 1 x
x(Mg,M23) 1 1 1 2 -1 x -1 M
x(Mn,M23) 1 1 0 1 1 M
x(Al,M1) 1 1 0 2 1 y -1 Q
x(Fe,M1) 1 2 0 1 1 x 1 2 -1 y 1 Q
x(Mg,M1) 1 2 1 2 -1 x -1 M 1 2 -1 y 1 Q
x(Mn,M1) 1 2 0 1 1 M 1 2 -1 y 1 Q
x(Al,M4) 1 1 0 2 1 y 1 Q
x(Fe,M4) 1 2 0 1 1 x 1 2 -1 y -1 Q
x(Mg,M4) 1 2 1 2 -1 x -1 M 1 2 -1 y -1 Q
x(Mn,M4) 1 2 0 1 1 M 1 2 -1 y -1 Q
x(Al,T2) 1 1 0 1 1 y
x(Si,T2) 1 1 1 1 -1 y

% -----

afchl 1 4 x(Mg,M23) 4 x(Mg,M1) 1 x(Mg,M4) 1 x(Si,T2) 2
 check 0 0 0 0

clin 4 5 x(Mg,M23) 4 x(Mg,M1) 1 x(Al,M4) 1 x(Al,T2) 1 x(Si,T2) 1
 check 0 1/2 1/2 0

daph 4 5 x(Fe,M23) 4 x(Fe,M1) 1 x(Al,M4) 1 x(Al,T2) 1 x(Si,T2) 1
 check 1 1/2 1/2 0

ames 1 4 x(Mg,M23) 4 x(Al,M1) 1 x(Al,M4) 1 x(Al,T2) 2
 check 0 1 0 0

mnchl 4 5 x(Mn,M23) 4 x(Mn,M1) 1 x(Al,M4) 1 x(Al,T2) 1 x(Si,T2) 1
 check 0 1/2 1/2 1

% _____
Biotite order-disorder model
 % _____

bi 5

x(bi) 0.560 % bulk Fe/(Fe+Mg+Mn)
 y(bi) 0.250 % x(Al,M1)
 Q(bi) 0.09 % 3(x - x(Fe,M2))
 M(bi) 0.003 % bulk Mn/(Fe+Mg+Mn)

% -----

p(phl) 2 2 1 2 -1 x -1 M 1 1 -1 y 1 0 1 -2/3 Q
 p(ann) 1 1 0 2 1 x -1/3 Q
 p(east) 1 1 0 1 1 y
 p(obi) 2 2 0 1 -1 x 0 1 1 y 1 0 1 1 Q
 p(mnbi) 1 1 0 1 1 M

% -----

sf

W(phl,ann)	9	0	0
W(phl,east)	10	0	0
W(phl,obi)	3	0	0
W(phl,mnbi)	0	0	0
W(ann,east)	-1	0	0
W(ann,obi)	6	0	0
W(ann,mnbi)	0	0	0
W(east,obi)	10	0	0
W(east,mnbi)	0	0	0
W(obi,mnbi)	0	0	0

% -----

9 % no of site fractions

x(Al,M1) 1 1 0 1 1 y
 x(Fe,M1) 2 2 0 1 1 x 1 1 -1 y 1 0 1 2/3 Q
 x(Mg,M1) 2 2 1 2 -1 x -1 M 1 1 -1 y 1 0 1 -2/3 Q
 x(Mn,M1) 1 1 0 1 1 M
 x(Fe,M2) 1 1 0 2 1 x -1/3 Q
 x(Mg,M2) 1 1 1 3 -1 x 1/3 Q -1 M
 x(Mn,M2) 1 1 0 1 1 M
 x(Al,T1) 1 1 1/2 1 1/2 y
 x(Si,T1) 1 1 1/2 1 -1/2 y

% -----

ph 4 4 x(Mg,M1) 1 x(Mg,M2) 2 x(Al,T1) 1 x(Si,T1) 1
 check 0 0 0 0

an 4 4 x(Fe,M1) 1 x(Fe,M2) 2 x(Al,T1) 1 x(Si,T1) 1
 check 1 0 0 0

east 1 3 x(Al,M1) 1 x(Mg,M2) 2 x(Al,T1) 2
 check 0 1 0 0

obi 4 4 x(Fe,M1) 1 x(Mg,M2) 2 x(Al,T1) 1 x(Si,T1) 1

make 2 phl 2/3 ann 1/3
 DQF -10.73 0 0
 check 1/3 0 1 0

mnbi 4 4 x(Mn,M1) 1 x(Mn,M2) 2 x(Al,T1) 1 x(Si,T1) 1
 check 0 0 0 1

% -----

Cordierite ideal

% -----

cd 4
 x(cd) 0.3
 h(cd) 0.5
 M(cd) 0.01

% -----

p(crd) 1 1 1 3 -1 x -1 h -1 M
 p(fcrd) 1 1 0 1 1 x
 p(hcrd) 1 1 0 1 1 h
 p(mncrd) 1 1 0 1 1 M

% -----

5 % no of site fractions

x(Mg)	1 1	1 2 -1	x -1 3
x(Fe)	1 1	0 1 1	x
x(Mn)	1 1	0 1 1	M
h	1 1	0 1 1	h % H2O
noth	1 1	1 1 -1	h % not H2O

% -----

crd	1 2	x(Mg) 2	noth 1
fcrd	1 2	x(Fe) 2	noth 1
hcr	1 2	x(Mg) 2	h 1
mncrd	1 2		
x(Mn) 2			
noth	1		

% -----

Staurolite

% -----

st 3
x(st) 0.82
M(st) 0.02

% -----

p(mst)	1 1	1 2 -1	x -1 M
p(fst)	1 1	0 1 1	x
p(mnst)	1 1	0 1 1	M

% -----

sf

w(mst,fst)	-8	0	0
w(mst,mnst)	0	0	0
w(fst,mnst)	0	0	0

% -----

3x(Mg)	1 1	1 2 -1	x -1 M
x(Fe)	1 1	0 1 1	x
x(Mn)	1 1	0 1 1	M
mst	1 1	x(Mg) 4	
fst	1 1	x(Fe) 4	
mnst	1 1	x(Mn) 4	

% _____

Chloritoid

% _____

ctd 3

x(ctd) 0.799

M(ctd) 0.01

% -----

p(mctd) 1 1 1 2 -1 x -1 M

p(fctd) 1 1 0 1 1 x

p(mnctd) 1 1 0 1 1 M

% -----

sf

w(mctd,fctd) 1 0 0

w(mctd,mnctd) 0 0 0

w(fctd,mnctd) 0 0 0

% -----

3x(Mg) 1 1 1 2 -1 x -1 M

x(Fe) 1 1 0 1 1 x

x(Mn) 1 1 0 1 1 M

mctd 1 1 x(Mg) 1

fctd 1 1 x(Fe) 1

mnctd 1 1 x(Mn) 1

% _____

Garnet

% _____

g 3

x(g) 0.800

M(g) 0.120

% -----

p(py) 1 1 1 2 -1 x -1 M

p(alm) 1 1 0 1 1 x

p(spss) 1 1 0 1 1 M

% -----

sf

w(pyr,alm)	2.5	0	0
w(pyr,spss)	4.5	0	0
w(alm,spss)	0	0	0

% -----

3

x(Mg)	1 1	1 2 -1	x -1 M
x(Fe)	1 1	0 1 1	x
x(Mn)	1 1	0 1 1	M

py	1 1	x(Mg) 3
alm	1 1	x(Fe) 3
spss	1 1	x(Mn) 3

%

Muscovite ideal

%

mu 3

x(mu) 0.84

y(mu) 0.81

% -----

p(mu)	1 1	0 1 1	y
p(ctl)	1 2	1 1 -1	x 1 1 -1 y
p(fctl)	1 2	0 1 1	x 1 1 -1 y

% -----

5

x(Al,M2A)	1 1	0 1 1	y
x(Mg,M2A)	1 2	1 1 -1	x 1 1 -1 y
x(Fe,M2A)	1 2	0 1 1	x 1 1 -1 y
x(Al,T1)	1 1	0 1 1/2	y
x(Si,T1)	1 1	1 1 -1/2	y

% -----

mu	4 3	x(Al,M2A) 1	x(Al,T1) 1	x(Si,T1) 1
ctl	1 2	x(Mg,M2A) 1	x(Si,T1) 2	
fctl	1 2	x(Fe,M2A) 1	x(Si,T1) 2	

%

ky and sill q H2O

*

fluidpresent yes
 fluidexcess yes
 setexcess mu q

calctatp ask
 setdefTwindow yes 400.001 800.001
 setdefPwindow yes 0.001 22.001

calcsdnle yes
 pseudosection yes
 setmodeiso yes
 zeromodeiso yes
 setiso ask
 %dogmin yes
 project no

```
% -----
%           Al2O3 MgO  FeO K2O
% -----
setproject  A    1    0    0    0
setproject  F    0    0    1    0
setproject  M    0    1    0    0
% -----
```

pseudosection ask
 % [script to enter the bulk composition info]
 % Al2O3 MgO FeO K2O MnO
 % V240 17.61 3.12 8.60 2.54 0.12
 % V634A 15.29 1.72 7.24 2.93 0.13
 % V436B 15.13 3.13 7.62 3.73 0.17
 % -----
 % Al2O3 MgO FeO K2O MnO
 setbulk yes 15.13 3.13 7.62 3.73 0.17
 % -----
 projcomp no
 drawpd yes
 moreprec yes
 *

APPENDIX-5

V261A Microprobe Data

V261A GARNET

analysis #	rim	21-23	23	24-26	27-29	r 30	r 31	32	30-32
SiO ₂	37.39	36.32	37.36	36.74	36.51	36.5	36.89	37.13	36.84
Al ₂ O ₃	21.48	20.40	20.05	20.32	20.10	20.03	20.01	20.74	20.26
TiO ₂	0.03	0.10	0.08	0.10	0.13	0	0.08	0	0.03
FeO	36.61	28.51	31.19	29.32	27.67	30.76	30.17	31.43	30.79
MnO	0.32	4.34	4.35	3.20	5.51	0.17	0.3	0.39	0.29
MgO	2.94	1.56	1.86	1.80	1.35	2.68	2.24	3.08	2.67
CaO	3.40	5.77	5.78	6.30	6.27	5.71	5.53	5.6	5.61
Total	102.16	97.24	100.78	97.83	97.71	96.03	95.28	98.43	96.58
Almandine	78.7	66.2	67.3	66.9	63.3	71.5	72.6	70.6	71.6
Grossular	9.37	17.2	16.0	18.4	18.4	17.0	17.1	16.1	16.7
Pyrope	11.2	6.44	7.17	7.32	5.51	11.1	9.61	12.3	11.0
Spessartine	0.70	10.2	9.50	7.39	12.77	0.40	0.73	0.89	0.67
Fe/(Fe+Mg)	0.87	0.91	0.90	0.90	0.92	0.87	0.88	0.85	0.87

V261A GARNET

analysis #	32	33-35	36-38	39-41	1-3	4-6	7-9	10-12	13-15	16-18
SiO ₂	37.78	37.15	37.31	37.19	37.46	37.96	38.06	37.29	37.03	37.96
Al ₂ O ₃	21.78	20.65	20.49	20.68	20.37	20.82	21.02	20.07	19.97	20.56
TiO ₂	0	0.14	0.08	0.13	0.05	0.01	0.14	0.02	0.07	0.05
FeO	30.64	26.13	25.84	29.58	30.55	31.69	31.29	25.30	28.32	26.48
MnO	0.8	7.35	8.32	3.33	2.03	0.30	0.43	8.54	4.72	6.90
MgO	3.34	1.84	1.71	2.44	3.01	3.44	3.63	1.43	2.12	1.68
CaO	5.62	6.19	6.59	5.18	5.21	5.49	5.43	6.38	5.80	6.59
Total	100.09	99.67	100.51	98.71	98.69	99.70	100.00	99.01	98.03	100.22
Almandine	68.7	58.3	56.5	67.3	68.42	70.19	69.30	56.64	63.91	58.98
Grossular	16.1	17.7	18.5	15.1	14.96	15.57	15.40	18.29	16.77	18.80
Pyrope	13.3	7.32	6.66	9.91	12.02	13.57	14.34	5.69	8.53	6.66
Spessartine	1.82	16.6	18.41	7.68	4.60	0.67	0.96	19.37	10.79	15.56
Fe/(Fe+Mg)	0.84	0.89	0.89	0.87	0.85	0.84	0.83	0.91	0.88	0.90

V261
PLAGIOCLASE

	20-22	22-25	26-28	29-31	33-35	36-38	39-41	42-44	45-47	48-50
SiO ₂	66.07	67.28	66.65	66.30	63.37	67.77	64.55	64.66	64.33	65.15
Al ₂ O ₃	22.18	21.08	21.24	21.38	21.58	19.12	21.58	22.15	21.59	21.16
TiO ₂	0.03	0.02	0.02	0.05	0.00	0.03	0.11	0.09	0.03	0.00
FeO	0.30	0.22	0.07	0.12	0.68	0.64	0.72	0.27	0.13	0.20
MnO	0.00	0.06	0.09	0.05	0.02	0.06	0.18	0.06	0.03	0.00
MgO	0.19	0.18	0.08	0.08	0.00	0.04	0.04	0.24	0.06	0.00
CaO	3.77	2.52	2.60	2.79	4.06	1.07	3.54	3.92	3.61	3.74
Na ₂ O	8.46	8.77	8.31	8.71	7.68	9.38	8.02	8.45	8.18	7.97
K ₂ O	0.18	0.06	0.04	0.01	0.09	0.03	0.11	0.02	0.00	0.12
Total	101.21	100.22	99.12	99.52	97.48	98.19	98.89	99.91	98.00	98.33
cat Si	2.868	2.932	2.929	2.912	2.859	3.007	2.871	2.847	2.877	2.901
cat Al	1.135	1.083	1.100	1.107	1.147	1.000	1.131	1.150	1.138	1.110
cat Ti	0.001	0.001	0.001	0.002	0.000	0.001	0.004	0.003	0.001	0.000
cat Fe	0.011	0.008	0.003	0.004	0.026	0.024	0.027	0.010	0.005	0.007
cat Mn	0.000	0.002	0.003	0.002	0.001	0.002	0.007	0.002	0.001	0.000
cat Mg	0.013	0.011	0.005	0.005	0.000	0.003	0.002	0.016	0.004	0.000
cat Ca	0.175	0.117	0.122	0.131	0.196	0.051	0.169	0.185	0.173	0.178
cat Na	0.712	0.741	0.708	0.741	0.672	0.807	0.691	0.722	0.709	0.688
cat K	0.010	0.004	0.002	0.000	0.005	0.002	0.006	0.001	0.000	0.007
Total cations	4.924	4.898	4.875	4.905	4.906	4.897	4.909	4.936	4.908	4.892
Mole% Ab	79.33	85.96	85.01	84.90	76.95	93.85	79.79	79.47	80.39	78.79
Mole% An	19.56	13.64	14.70	15.05	22.45	5.93	19.47	20.38	19.61	20.43
Mole% Or	1.11	0.41	0.29	0.04	0.59	0.22	0.74	0.14	0.00	0.78
Sum	100	100	100	100	100	100	100	100	100	100

V261A BIOTITE

V261A MUSCOVITE

	bi 1-3	bi 4-6	bi 7-9	bi 10-12	bi 13-15	ave		mu 1-3	mu 4-6	mu 7-9	mu 10-12
SiO2	33.63	37.69	36.85	37.10	38.30	37.49	SiO2	46.60	46.32	47.29	46.74
Al2O3	18.40	17.42	17.20	17.67	17.96	17.56	Al2O3	30.27	31.51	31.40	31.59
TiO2	1.58	1.37	1.29	1.59	1.73	1.49	TiO2	0.30	0.37	0.58	0.63
FeO	22.28	19.87	19.76	19.77	18.97	19.59	FeO	3.28	3.24	2.72	4.23
MnO	0.08	0.08	0.10	0.08	0.14	0.10	MnO	0.00	0.09	0.02	0.00
MgO	11.37	10.81	11.04	11.41	11.83	11.27	MgO	1.31	1.19	1.17	1.28
CaO	0.02	0.06	0.13	0.09	0.13	0.10	CaO	0.16	0.02	0.08	0.08
Na2O	0.06	0.13	0.34	0.12	0.67	0.31	Na2O	1.09	1.17	0.96	1.23
K2O	6.48	8.75	9.17	8.45	8.75	8.78	K2O	8.55	9.10	8.83	8.37
Total	93.89	96.27	95.89	96.29	98.51	96.70	Total	91.62	93.04	93.09	94.19
<u>Tetrahedral</u>							<u>Tetrahedral</u>				
Si	5.209	5.648	5.575	5.551	5.582	5.512	Si	6.467	6.352	6.435	6.334
Al	2.791	2.352	2.425	2.449	2.418	2.488	Al	1.533	1.648	1.565	1.666
	8.000	8.000	8.000	8.000	8.000	8.000		8.000	8.000	8.000	8.000
<u>Octahedral</u>							<u>Octahedral</u>				
Al	0.569	0.724	0.641	0.667	0.668	0.654	Al	3.416	3.445	3.472	3.379
Ti	0.184	0.154	0.146	0.179	0.190	0.170	Ti	0.032	0.038	0.060	0.064
Fe	2.886	2.491	2.501	2.474	2.312	2.541	Fe	0.381	0.372	0.310	0.480
Mn	0.010	0.011	0.012	0.010	0.018	0.012	Mn	0.000	0.010	0.003	0.000
Mg	2.627	2.416	2.490	2.545	2.570	2.527	Mg	0.271	0.244	0.238	0.259
	6.275	5.795	5.791	5.875	5.756	5.903		4.100	4.109	4.082	4.182
<u>A site</u>							<u>A site</u>				
Ca	0.003	0.009	0.021	0.014	0.021	0.013	Ca	0.024	0.003	0.012	0.012
Na	0.018	0.039	0.099	0.034	0.188	0.070	Na	0.294	0.310	0.253	0.324
K	1.280	1.673	1.771	1.612	1.627	1.593	K	1.513	1.592	1.532	1.446
	1.301	1.721	1.890	1.660	1.837	1.676		1.831	1.905	1.798	1.783
xFe	0.460	0.430	0.432	0.421	0.402	0.430	x musc	0.826	0.835	0.852	0.811
xMg	0.419	0.417	0.430	0.433	0.446	0.428	x para	0.161	0.163	0.141	0.182
xTi	0.029	0.027	0.025	0.031	0.033	0.029	xAl	0.833	0.838	0.851	0.808
xAl	0.091	0.125	0.111	0.113	0.116	0.111	Phengite	0.159	0.152	0.135	0.177

V257 Microprobe data**V257 GARNET**

analysis #	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30	31-33	34-36	37-39
SiO2	38.22	38.63	38.15	38.56	38.66	38.18	38.53	38.82	38.59	38.93	38.17	37.66	37.86
Al2O3	20.95	21.09	20.90	21.02	20.93	20.91	20.82	21.32	21.28	21.45	20.96	20.44	20.43
TiO2	0.21	0.03	0.16	0.06	0.05	0.09	0.09	0.06	0.02	0.06	0.16	0.08	0.02
FeO	30.00	29.34	30.26	31.22	31.43	29.84	30.17	31.59	31.75	31.19	27.98	30.43	31.07
MnO	2.97	2.88	1.40	0.71	0.19	2.60	1.11	0.73	0.11	0.23	3.77	0.79	0.24
MgO	1.68	1.50	1.74	2.37	3.55	1.86	2.35	2.53	3.54	3.70	2.15	2.45	3.24
CaO	6.97	7.89	7.56	7.50	5.92	7.13	7.87	6.94	6.43	5.77	6.83	6.62	5.96
Total	100.99	101.36	100.18	101.44	100.73	100.61	100.94	102.00	101.71	101.35	100.03	98.46	98.82
Almandine	66.78	65.14	68.04	68.21	69.02	66.43	66.22	69.09	68.41	68.67	63.04	69.04	69.48
Grossular	19.87	22.43	21.79	20.98	16.66	20.33	22.12	19.44	17.76	16.28	19.73	19.25	17.07
Pyrope	6.65	5.95	6.97	9.24	13.90	7.39	9.18	9.85	13.60	14.53	8.62	9.90	12.90
Spessartine	6.69	6.48	3.20	1.56	0.42	5.85	2.47	1.62	0.23	0.52	8.61	1.81	0.54
Fe/(Fe+Mg)	0.909	0.916	0.907	0.881	0.832	0.900	0.878	0.875	0.834	0.825	0.880	0.875	0.843

V257 EPIDOTE

analysis #	1-3	4-6	7-9	10-12	13-15	16-18
SiO2	39.76	39.54	39.46	39.95	40.07	39.60
TiO2	0.04	0.13	0.10	0.04	0.05	0.14
Al2O3	24.95	24.55	24.77	24.74	25.37	24.39
Fe2O3	11.53	12.65	11.81	11.96	11.25	11.20
FeO	0.47	0.11	0.28	0.23	0.22	0.86
MnO	0.19	0.38	0.18	0.21	0.32	0.24
MgO	0.25	0.08	0.42	0.31	0.36	0.12
CaO	23.28	22.23	22.83	23.16	22.81	23.43
Na2O	0.30	0.13	0.21	0.03	0.03	0.06
K2O	0.05	0.00	0.00	0.05	0.09	0.03
Totals	100.82	99.81	100.06	100.67	100.56	100.06
Si	3.05	3.06	3.05	3.07	3.07	3.07
Ti	0.00	0.01	0.01	0.00	0.00	0.01
Al	2.26	2.24	2.26	2.24	2.29	2.23
Fe3	0.67	0.74	0.69	0.69	0.65	0.65
Fe2	0.03	0.01	0.02	0.02	0.01	0.06
Mn	0.01	0.03	0.01	0.01	0.02	0.02
Mg	0.03	0.01	0.05	0.04	0.04	0.01
Ca	1.91	1.84	1.89	1.91	1.87	1.94
Na	0.04	0.02	0.03	0.00	0.00	0.01
K	0.01	0.00	0.00	0.00	0.01	0.00
Sum	8.01	7.95	7.99	7.97	7.97	7.99

V257 PLAGIOCLASE

analysis #	1-3	13-15	22-24	25-27	28-30	31-33	34-36	1-3a	4-6a	1-3b
SiO ₂	65.77	66.61	64.14	66.52	66.49	65.80	66.09	66.95	67.62	65.20
Al ₂ O ₃	21.62	20.97	22.18	21.88	21.88	21.64	21.58	21.65	20.98	22.52
TiO ₂	0.08	0.07	0.01	0.10	0.00	0.00	0.00	0.17	0.00	0.13
FeO	0.11	0.36	0.09	0.31	0.04	0.24	0.32	0.00	0.00	0.26
MnO	0.01	0.01	0.06	0.09	0.23	0.07	0.07	0.03	0.07	0.00
MgO	0.00	0.01		0.36	0.24	0.00	0.15	0.30	0.39	0.30
CaO	3.37	2.91	4.25	3.71	3.50	3.58	3.69	3.45	2.60	3.80
Na ₂ O	8.83	9.19	8.24	9.08	8.46	9.11	8.64	9.43	9.45	8.52
K ₂ O	0.09	0.13	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.11
Total	98.79	99.59	99.35	102.05	100.89	100.44	100.54	101.98	101.11	100.84
cat Si	2.888	2.915	2.847	2.868	2.887	2.880	2.886	2.884	2.925	2.843
cat Al	1.119	1.082	1.160	1.112	1.120	1.116	1.111	1.099	1.070	1.157
cat Ti	0.003	0.002	0.000	0.003	0.000	0.000	0.000	0.006	0.000	0.004
cat Fe	0.004	0.013	0.003	0.011	0.001	0.009	0.012	0.000	0.000	0.009
cat Mn	0.000	0.000	0.002	0.003	0.008	0.003	0.003	0.001	0.003	0.000
cat Mg	0.000	0.001	0.000	0.023	0.016	0.000	0.010	0.019	0.025	0.020
cat Cr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
cat Ca	0.159	0.136	0.202	0.171	0.163	0.168	0.173	0.159	0.121	0.178
cat Na	0.751	0.780	0.709	0.759	0.712	0.773	0.731	0.787	0.793	0.720
cat K	0.005	0.007	0.003	0.000	0.003	0.000	0.000	0.000	0.000	0.006
Total cations	4.929	4.936	4.928	4.952	4.910	4.948	4.925	4.955	4.936	4.937
Mole% Ab	82.11	84.44	77.58	81.58	81.14	82.16	80.91	83.18	86.80	79.68
Mole% An	17.34	14.77	22.09	18.42	18.55	17.84	19.09	16.82	13.20	19.64
Mole% Or	0.55	0.79	0.33	0.00	0.32	0.00	0.00	0.00	0.00	0.68

V257 BIOTITE

analysis #	1-3	4-6	7-9	1-3	10-12	13-15	16-18
SiO ₂	38.85	37.56	38.40	37.61	38.59	38.18	38.20
Al ₂ O ₃	16.95	17.55	17.64	17.49	17.44	17.96	17.51
TiO ₂	1.66	1.84	1.47	1.67	1.77	1.76	1.69
FeO	18.43	19.70	18.56	17.99	18.44	17.52	18.44
MnO	0.00	0.02	0.10	0.04	0.00	0.18	0.06
MgO	11.80	12.10	12.55	11.98	12.01	11.72	12.03
CaO	0.22	0.15	0.10	0.10	0.15	0.08	0.13
Na ₂ O	0.07	0.28	0.23	0.10	0.02	0.28	0.16
K ₂ O	9.16	8.73	9.15	8.93	9.39	9.22	9.10
Total	97.13	97.93	98.21	95.90	97.81	96.91	97.31
<u>Tetrahedral</u>							
Si	5.724	5.529	5.606	5.610	5.654	5.626	5.625
Al	2.276	2.471	2.394	2.390	2.346	2.374	2.375
	8.000	8.000	8.000	8.000	8.000	8.000	8.000
<u>Octahedral</u>							
Al	0.668	0.575	0.642	0.685	0.666	0.746	0.663
Ti	0.184	0.204	0.161	0.187	0.195	0.195	0.188
Fe	2.271	2.425	2.266	2.244	2.259	2.159	2.271
Mn	0.000	0.002	0.012	0.005	0.000	0.022	0.007
Mg	2.593	2.655	2.732	2.664	2.623	2.576	2.641
	5.715	5.861	5.814	5.784	5.742	5.699	5.769
xFe	0.397	0.414	0.390	0.388	0.393	0.379	0.394
xMg	0.454	0.453	0.470	0.460	0.457	0.452	0.458
xTi	0.032	0.035	0.028	0.032	0.034	0.034	0.033
xAl	0.117	0.098	0.110	0.118	0.116	0.131	0.115

V257 MUSCOVITE

analysis #	1-3inc	1-3	4-6	10-12	13-15	16-18
SiO ₂	48.64	49.06	48.30	48.31	48.35	48.51
Al ₂ O ₃	31.18	31.57	32.39	31.82	31.44	31.80
TiO ₂	0.87	0.46	0.62	0.69	0.68	0.61
FeO	3.01	2.24	1.88	2.04	2.31	2.12
MnO	0.04	0.03	0.03	0.02	0.06	0.03
MgO	1.72	1.78	1.13	1.59	1.71	1.55
CaO	0.06	0.09	0.08	0.07	0.12	0.09
Na ₂ O	0.85	1.30	1.33	1.40	1.30	1.33
K ₂ O	10.08	9.48	9.32	9.22	9.03	9.26
Total	96.45	96.01	95.07	95.16	95.00	95.31
<u>Tetrahedral</u>						
Si	6.441	6.480	6.425	6.430	6.448	6.446
Al	1.559	1.520	1.575	1.570	1.552	1.554
	8.000	8.000	8.000	8.000	8.000	8.000
<u>Octahedral</u>						
Al	3.307	3.393	3.503	3.420	3.388	3.426
Ti	0.086	0.046	0.062	0.069	0.068	0.061
Fe	0.333	0.248	0.210	0.227	0.257	0.235
Mn	0.004	0.003	0.004	0.002	0.007	0.004
Mg	0.340	0.350	0.223	0.315	0.341	0.307
	4.071	4.040	4.001	4.033	4.061	4.034
A site						
Ca	0.009	0.013	0.011	0.010	0.017	0.013
Na	0.217	0.332	0.342	0.360	0.335	0.342
K	1.702	1.597	1.582	1.566	1.536	1.570
	1.929	1.942	1.935	1.936	1.889	1.926
x musc	0.883	0.822	0.817	0.809	0.813	0.816
x para	0.113	0.171	0.177	0.186	0.178	0.178
xAl	0.812	0.840	0.875	0.848	0.834	0.849

V436A Microprobe Data

V436A
GARNET

analysis #	1-3	4-6	10-12	13-15	16-18	19-21	22-24	25-26	27-29
SiO ₂	35.88	36.53	36.81	37.04	36.53	36.88	37.21	36.99	36.55
Al ₂ O ₃	19.67	20.27	20.78	20.53	20.78	20.59	20.51	21.70	20.60
TiO ₂	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	40.68	40.52	40.17	37.42	39.43	41.76	38.55	19.10	42.36
MnO	0.14	0.10	1.00	2.40	1.15	0.07	1.92	0.64	0.15
MgO	1.82	2.11	2.61	2.40	2.51	2.07	2.12	2.31	1.82
CaO	0.48	0.47	0.53	1.77	0.51	0.37	1.31	0.46	0.34
Total	98.67	100.00	101.90	101.545	100.91	101.74	101.62	81.20	101.83
Almandine	91.03	90.07	86.37	80.66	86.25	90.80	83.90	78.12	91.69
Grossular	1.37	1.35	1.47	4.87	1.42	1.03	3.65	2.43	0.94
Pyrope	7.27	8.36	9.99	9.22	9.78	8.01	8.21	16.81	7.04
Spessartine	0.32	0.23	2.17	5.24	2.56	0.16	4.23	2.65	0.34
Fe/(Fe+Mg)	0.93	0.92	0.90	0.90	0.90	0.92	0.91	0.82	0.93

V436A MUSCOVITE

V436A BIOTITE

analysis #	1-3	4-6	7-9	10-12	13-15	16-18		1-3	4-6
SiO ₂	45.72	45.49	46.01	45.41	45.38	45.78	SiO ₂	34.75	34.18
Al ₂ O ₃	31.78	32.12	31.37	32.46	31.59	32.21	Al ₂ O ₃	17.56	17.00
TiO ₂	0.31	0.59	0.44	0.47	0.37	0.34	TiO ₂	1.86	2.73
FeO	2.44	2.26	2.78	2.21	2.39	2.71	FeO	25.31	25.59
MnO	0.03	0.02	0.00	0.03	0.00	0.04	MnO	0.02	0.00
MgO	1.21	1.26	1.12	1.20	1.01	1.23	MgO	6.89	6.71
CaO	0.05	0.15	0.13	0.24	0.16	0.00	CaO	0.09	0.17
Na ₂ O	1.36	1.07	1.17	1.28	1.12	1.44	Na ₂ O	0.38	0.44
K ₂ O	8.97	9.13	8.95	8.85	9.00	8.98	K ₂ O	8.52	8.07
Total	91.87	92.09	91.97	92.15	91.02	92.71	Total	95.36	94.88
Si	6.324	6.276	6.361	6.255	6.332	6.284	Si	5.434	5.383
Al	1.676	1.724	1.639	1.745	1.668	1.716	Al	2.566	2.617
	8.000	8.000	8.000	8.000	8.000	8.000		8.000	8.000
Al	3.505	3.499	3.473	3.524	3.527	3.496	Al	0.670	0.539
Ti	0.032	0.061	0.045	0.048	0.039	0.035	Ti	0.218	0.324
Fe	0.282	0.261	0.321	0.255	0.279	0.311	Fe	3.310	3.371
Mn	0.003	0.003	0.000	0.004	0.000	0.004	Mn	0.002	0.000
Mg	0.249	0.260	0.232	0.246	0.210	0.252	Mg	1.606	1.576
	4.072	4.084	4.072	4.077	4.055	4.098		5.808	5.810
<u>A site</u>							<u>A site</u>		
Ca	0.007	0.022	0.020	0.036	0.023	0.000	Ca	0.015	0.028
Na	0.365	0.285	0.314	0.343	0.304	0.382	Na	0.114	0.133
K	1.583	1.607	1.578	1.555	1.601	1.572	K	1.699	1.621
x musc	0.81	0.84	0.83	0.80	0.83	0.80			
x para	0.19	0.15	0.16	0.18	0.16	0.20	Fe/(Fe+Mg)	0.67	0.68
xAl	0.86	0.86	0.85	0.86	0.87	0.85	Mg/(Mg+Fe)	0.33	0.32

V436B Microprobe data**V436B GARNET**

analysis #	1	3	4	5	6	7	8	9	10	11	12
SiO2	36.53	36.22	36.38	37.14	36.49	35.63	37.53	37.35	37.29	36.68	37.09
Al2O3	20.46	19.2	20.15	20.7	19.83	19.58	20.97	20.49	20.95	20.21	20.83
TiO2	0.00	0	0.22	0.2	0.24	0.11	0.16	0	0	0.11	0.07
FeO	29.95	30.96	31.78	31.72	31.98	33.61	34.54	34.05	34.41	35.27	34.6
MnO	7.14	6.98	3.92	4.84	4.04	0.15	0	0.54	0.48	0.26	0.32
MgO	1.01	0.63	1.07	1.23	0.89	1.99	2.23	2.49	2.65	3.05	3.02
CaO	3.04	3.23	5.19	5	4.92	4.09	4.36	3.96	4.12	3.09	3.56
Total	98.13	97.22	98.71	100.83	98.39	95.16	99.79	98.88	99.90	98.67	99.49
Almandine	69.85	71.52	71.73	70.15	72.75	78.99	78.32	77.20	76.64	78.50	77.11
Grossular	9.08	9.56	15.01	14.17	14.34	12.31	12.67	11.50	11.76	8.81	10.17
Pyrope	4.20	2.59	4.30	4.85	3.61	8.34	9.01	10.06	10.52	12.10	12.00
Spessartine	16.87	16.33	8.96	10.84	9.31	0.36	0.00	1.24	1.08	0.59	0.72
Fe/(Fe+Mg)	0.94	0.96	0.94	0.94	0.95	0.90	0.90	0.88	0.88	0.87	0.87

V653 Microprobe Data**V653 GARNET**

analysis #	1	2	3	4	5	6	7	8	9	10
SiO2	38.2	38.51	38.09	38.73	38.68	38.92	39.2	38.79	38.65	39.53
Al2O3	20.31	20.22	19.65	20.05	19.94	19.79	20.43	20.55	19.65	20.57
TiO2	0	0	0.03	0.11	0.03	0.13	0.04	0	0	0.13
FeO	36.43	35.61	32.85	33.87	32.74	33.28	34.66	33.91	35.25	37.31
MnO	0.63	1.38	2.93	3.6	4.17	3.95	2.79	2.2	1.65	0.5
MgO	2.68	2.13	1.97	2.17	2.04	2.17	2.07	2.47	1.65	2.3
CaO	0.61	0.63	1.78	1.66	2.03	1.87	1.6	1.58	1.5	0.47
Total	98.86	98.48	97.30	100.19	99.63	100.11	100.79	99.50	98.35	100.81
Almandine	85.46	85.58	78.95	77.84	75.79	76.43	80.18	79.67	84.36	87.75
Grossular	1.83	1.94	5.48	4.89	6.02	5.50	4.74	4.76	4.60	1.42
Pyrope	11.21	9.12	8.44	8.89	8.42	8.88	8.54	10.34	7.04	9.64
Spessartine	1.50	3.36	7.13	8.38	9.78	9.19	6.54	5.23	4.00	1.19
Fe/(Fe+Mg)	0.88	0.90	0.90	0.90	0.90	0.90	0.90	0.89	0.92	0.90

V653 GARNET

analysis #	11	12	13	14	15	16	17	18	19	20
SiO ₂	38.74	39.23	38.22	38.73	38.76	38.54	39.26	38.48	38.93	39.16
Al ₂ O ₃	20.09	19.91	19.8	19.93	19.69	20.24	20.36	20.36	19.96	20.28
TiO ₂	0.22	0	0.16	0.13	0.04	0.04	0.04	0.07	0.01	0.08
FeO	36.98	35.75	36.51	36.41	32.97	37.00	34.66	38.06	36.87	37.00
MnO	0.72	0.46	0.39	0.52	3.65	0.55	1.82	0.38	1.13	0.61
MgO	2.35	2.49	2.43	2.42	2.07	2.24	2.90	2.09	2.27	2.65
CaO	0.66	0.56	0.63	0.62	1.87	0.75	0.76	0.51	0.87	0.80
Total	99.76	98.40	98.14	98.77	99.07	99.35	99.80	99.95	100.05	100.58
Almandine	86.52	86.41	86.84	86.59	77.10	87.05	81.26	88.88	85.41	85.33
Grossular	1.98	1.73	1.92	1.88	5.61	2.25	2.27	1.54	2.58	2.35
Pyrope	9.80	10.73	10.30	10.27	8.64	9.39	12.14	8.69	9.36	10.89
Spessartine	1.71	1.13	0.94	1.26	8.65	1.30	4.33	0.90	2.65	1.42
Fe/(Fe+Mg)	0.90	0.89	0.89	0.89	0.90	0.90	0.87	0.91	0.90	0.89

V653 CHLORITOID

analysis #	1	2	3	4	5	6	7	8	9	10	11	12
SiO ₂	25.2	25.42	24.86	25.11	25.34	25.37	26.09	25.28	25.58	25.09	25.17	25.79
Al ₂ O ₃	37.75	38.69	38.26	38.21	38.69	38.53	39.15	37.97	38.55	38.5	38.6	38.49
TiO ₂	0	0.07	0.1	0	0	0	0	0	0	0.06	0	0.04
FeO	24.69	24.48	23.41	23.98	23.17	23.26	24.32	23.83	24.19	24.28	24.35	24.11
MnO	0.12	0.18	0	0.1	0	0	0.14	0	0.23	0	0	0
MgO	2.17	2.22	2.14	1.91	2.31	2.23	2.02	2.21	2.35	2.56	2.42	2.43
CaO	0	0	0.21	0.04	0.06	0	0.01	0	0.15	0	0.07	0.06
Cl	0.00	0.02	0	0	0	0	0.02	0.1	0.04	0	0.05	0.01
Total	89.93	91.06	88.98	89.35	89.57	89.39	91.73	89.29	91.05	90.49	90.61	90.92
cat Si	2.143	2.129	2.123	2.140	2.142	2.150	2.161	2.153	2.141	2.114	2.118	2.156
cat Al	3.783	3.819	3.851	3.838	3.854	3.847	3.822	3.811	3.802	3.822	3.828	3.792
cat Ti	0.000	0.004	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.003
cat Fe	1.756	1.715	1.672	1.709	1.638	1.648	1.685	1.697	1.693	1.710	1.713	1.686
cat Mn	0.009	0.013	0.000	0.007	0.000	0.000	0.010	0.000	0.016	0.000	0.000	0.000
cat Mg	0.275	0.277	0.272	0.243	0.291	0.282	0.249	0.281	0.293	0.321	0.304	0.303
cat Ca	0.000	0.000	0.019	0.004	0.005	0.000	0.001	0.000	0.013	0.000	0.006	0.005
Total cations	7.966	7.957	7.945	7.941	7.931	7.927	7.928	7.942	7.958	7.972	7.968	7.945
Fe/(Fe+Mg)	0.865	0.861	0.860	0.876	0.849	0.854	0.871	0.858	0.852	0.842	0.850	0.848

V653 STAUROLITE

analysis #	4	5	6	7	8	9	10	8a	9a	10a	11a	12a
SiO ₂	29.3	29.22	29.29	28.93	28.16	27.31	29.57	29.26	29.32	29.15	29.99	28.95
Al ₂ O ₃	50.17	51.04	50.76	49.51	48.89	49.74	51.32	50.13	51.02	50.66	51.04	50.08
TiO ₂	0.53	0.78	0.38	0.33	0.5	0.27	0.34	0.36	0.48	0.61	0.6	0.64
FeO	11.33	12.17	11.64	11.13	10.17	11.87	14.4	13.93	14.32	13.85	14.04	14.13
MnO	0.02	0.06	0.04	0	0	0	0	0.04	0	0	0	0.34
MgO	1.7	2.45	1.99	0.77	0.5	0.84	2.27	1.64	1.95	1.69	2.01	1.49
CaO	0	0.06	0.06	0.06	0	0	0	0	0	0.05	0	0.07
Total	93.05	95.78	94.16	90.73	88.22	90.03	97.90	95.36	97.09	96.01	97.68	95.70
cat Si	4.21	4.10	4.17	4.25	4.24	4.08	4.10	4.16	4.10	4.11	4.16	4.12
cat Al	8.49	8.45	8.51	8.58	8.68	8.75	8.39	8.40	8.41	8.43	8.34	8.39
cat Ti	0.06	0.08	0.04	0.04	0.06	0.03	0.04	0.04	0.05	0.06	0.06	0.07
cat Fe	1.36	1.43	1.38	1.37	1.28	1.48	1.67	1.66	1.68	1.64	1.63	1.68
cat Mn	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
cat Mg	0.36	0.51	0.42	0.17	0.11	0.19	0.47	0.35	0.41	0.36	0.42	0.32
cat Ca	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
Total cations	14.49	14.59	14.54	14.42	14.37	14.52	14.67	14.60	14.64	14.61	14.61	14.62
Fe/(Fe+Mg)	0.79	0.74	0.77	0.89	0.92	0.89	0.78	0.83	0.80	0.80	0.82	0.80

V653 MUSCOVITE

analysis #	1	2	3	4	2a	3a	4a	5a	6a	7	8	9
SiO2	47.21	47.18	47.57	47.19	47.06	47.5	48.28	48.01	47.31	47.66	47.08	47.72
Al2O3	33.58	33.69	34.08	34.52	34.34	34.59	33.62	31.87	33.47	32.4	31.88	32.22
TiO2	0.40	0.22	0.31	0.41	0.27	0.33	0.52	0.32	0.31	0.44	0.24	0.46
FeO	1.73	1.91	1.5	1.38	2.05	1.5	1.99	2.62	2.45	2.24	2.83	2.02
MnO	0.00	0.03	0	0	0.06	0	0.09	0	0	0.12	0	0.07
MgO	0.86	0.54	0.71	0.77	1.04	0.77	0.8	1.02	1	1.07	1.2	0.79
CaO	0.00	0.14	0.01	0.05	0.03	0.14	0.11	0.15	0.16	0.14	0.19	0
Na2O	2.11	2	1.75	2.47	2.46	2.37	1.9	1.25	1.4	1.28	1.93	1.23
K2O	7.94	8.21	8.19	7.98	7.84	7.65	8.39	8.76	8.63	8.7	8.61	8.52
Cl	0.13	0.03	0.07	0.05	0.06	0	0.01	0	0.05	0.02	0.06	0.06
Total	93.96	93.95	94.19	94.82	95.21	94.85	95.71	94.00	94.78	94.07	94.02	93.09
Tetrahedral												
Si	6.324	6.329	6.339	6.259	6.238	6.281	6.359	6.460	6.315	6.402	6.370	6.455
Al	1.676	1.671	1.661	1.741	1.762	1.719	1.641	1.540	1.685	1.598	1.630	1.545
	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000
Octahedral												
Al	3.626	3.655	3.691	3.656	3.603	3.672	3.579	3.513	3.580	3.532	3.453	3.591
Ti	0.040	0.022	0.031	0.041	0.027	0.033	0.052	0.032	0.031	0.044	0.024	0.047
Fe	0.194	0.214	0.167	0.153	0.227	0.166	0.219	0.295	0.273	0.252	0.320	0.229
Mn	0.000	0.003	0.000	0.000	0.007	0.000	0.010	0.000	0.000	0.014	0.000	0.008
Mg	0.172	0.108	0.141	0.152	0.206	0.152	0.157	0.205	0.199	0.214	0.242	0.159
	4.032	4.003	4.030	4.002	4.069	4.022	4.016	4.045	4.083	4.056	4.040	4.034
A site												
Ca	0.000	0.020	0.001	0.007	0.004	0.020	0.016	0.022	0.023	0.020	0.028	0.000
Na	0.548	0.520	0.452	0.635	0.632	0.608	0.485	0.326	0.362	0.333	0.506	0.323
K	1.357	1.405	1.392	1.350	1.326	1.290	1.410	1.504	1.469	1.491	1.486	1.470
	1.905	1.945	1.846	1.993	1.962	1.918	1.911	1.851	1.855	1.844	2.020	1.793
x musc	0.712	0.722	0.754	0.678	0.676	0.673	0.738	0.812	0.792	0.808	0.736	0.820
x para	0.288	0.267	0.245	0.319	0.322	0.317	0.254	0.176	0.195	0.181	0.251	0.180
xAl	0.899	0.913	0.916	0.913	0.885	0.913	0.891	0.869	0.877	0.871	0.855	0.890

V653 BIOTITE

V653 CHLORITE

analysis #	1	2	3	4	5	6	analysis #	1	2	3
SiO2	33.96	34.13	34.69	36.41	34.79	34.40	SiO2	24.15	24.13	24.78
Al2O3	18.20	16.96	18.12	16.86	20.11	19.58	Al2O3	20.53	20.56	21.11
TiO2	1.67	2.03	1.44	1.57	1.06	1.11	TiO2	0.00	0.07	0.17
FeO	26.19	25.42	26.50	24.65	24.17	23.15	FeO	31.04	32.23	32.62
MnO	0.12	0.00	0.00	0.18	0.00	0.00	MnO	0.00	0.18	0.00
MgO	6.91	6.66	6.69	6.59	8.22	7.83	MgO	8.52	8.50	8.04
CaO	0.06	0.00	0.01	0.02	0.16	0.06	CaO	0.00	0.00	0.00
Na2O	0.00	0.00	0.13	0.00	1.11	0.08	Na2O	0.00	0.00	0.00
K2O	7.09	7.31	7.05	8.19	6.16	6.32	K2O	0.00	0.00	0.00
Cl	0.08	0.00	0.09	0.05	0.11	0.10	Cl	0.00	0.00	0.00
Total	94.28	92.51	94.72	94.52	95.89	92.63	Total	84.24	85.67	86.73
Tetrahedral										
Si	5.356	5.475	5.438	5.688	5.302	5.395	cat Si	2.743	2.714	2.744
Al	2.644	2.525	2.562	2.312	2.698	2.605	cat Al	2.748	2.725	2.755
	8.000	8.000	8.000	8.000	8.000	8.000	cat Ti	0.000	0.006	0.014
Octahedral										
Al	0.739	0.681	0.785	0.792	0.913	1.013	cat Fe	2.949	3.031	3.021
Ti	0.198	0.245	0.170	0.184	0.121	0.131	cat Mn	0.000	0.017	0.000
Fe	3.454	3.410	3.474	3.220	3.080	3.036	cat Mg	1.443	1.425	1.327
Mn	0.016	0.000	0.000	0.024	0.000	0.000	cat Ca	0.000	0.000	0.001
Mg	1.625	1.593	1.563	1.535	1.867	1.830	Total cations	9.883	9.918	9.864
	6.031	5.929	5.992	5.756	5.982	6.011	Fe/(Fe+Mg)	0.671	0.680	0.695
A site										
Ca	0.010	0.000	0.002	0.003	0.026	0.010				
Na	0.000	0.000	0.040	0.000	0.328	0.024				
K	1.426	1.496	1.410	1.632	1.198	1.264				
	1.437	1.496	1.451	1.636	1.552	1.299				
xFe	0.573	0.575	0.580	0.560	0.515	0.505				
xMg	0.269	0.269	0.261	0.267	0.312	0.305				
xTi	0.033	0.041	0.028	0.032	0.020	0.022				
xAl	0.122	0.115	0.131	0.138	0.153	0.169				
Fe/(Fe+Mg)	0.680	0.682	0.690	0.677	0.623	0.624				
Mg/(Mg+Fe)	0.320	0.318	0.310	0.323	0.377	0.376				

APPENDIX-6

NCMnKFMASH datafile

%

Chlorite % order-disorder mode

%

chl 5

x(chl) 0.590 % bulk Fe/(Fe+Mg)
y(chl) 0.660 % y = 1/2 = clinochlore-amesite
Q(chl) 0.300 % order parameter
M(chl) 0.01

% -----

p(afchl) 1 1 1 2 -1 y -1 Q
p(clin) 2 1 0 1 2 Q 2 0 2 -2/5 x -2/5 M 3 1 -1 y
p(daph) 1 2 0 1 2/5 3 1 -1 y
p(ames) 1 1 0 2 1 y -1 Q
p(mnchl) 1 2 0 1 2/5 M 3 1 -1 y

% -----

sf

W(afch,clin) 18 0 0
W(afchl,daph) 14.5 0 0
W(afchl,ames) 20 0 0
W(afchl,mnchl) 0 0 0
W(clin,daph) 2.5 0 0
W(clin,ames) 18 0 0
W(clin,mnchl) 0 0 0
W(daph,ames) 13.5 0 0
W(daph,mnchl) 0 0 0
W(ames,mnchl) 0 0 0

% -----

13

x(Fe,M23) 1 1 0 1 1 x
x(Mg,M23) 1 1 1 2 -1 x -1 M
x(Mn,M23) 1 1 0 1 1 M
x(Al,M1) 1 1 0 2 1 y -1 Q
x(Fe,M1) 1 2 0 1 1 x 1 2 -1 y 1 Q
x(Mg,M1) 1 2 1 2 -1 x -1 M 1 2 -1 y 1 Q
x(Mn,M1) 1 2 0 1 1 M 1 2 -1 y 1 Q
x(Al,M4) 1 1 0 2 1 y 1 Q
x(Fe,M4) 1 2 0 1 1 x 1 2 -1 y -1 Q
x(Mg,M4) 1 2 1 2 -1 x -1 M 1 2 -1 y -1 Q
x(Mn,M4) 1 2 0 1 1 M 1 2 -1 y -1 Q
x(Al,T2) 1 1 0 1 1 y

x(Si,T2 1 1 1 1 -1 y

% -----

afchl 1 4 x(Mg,M23) 4 x(Mg,M1) 1 x(Mg,M4) 1 x(Si,T2) 2
check 0 0 0 0

clin 4 5 x(Mg,M23) 4 x(Mg,M1) 1 x(Al,M4) 1 x(Al,T2) 1 x(Si,T2) 1
check 0 1/2 1/2 0

daph 4 5 x(Fe,M23) 4 x(Fe,M1) 1 x(Al,M4) 1 x(Al,T2) 1 x(Si,T2) 1
check 1 1/2 1/2 0

ames 1 4 x(Mg,M23) 4 x(Al,M1) 1 x(Al,M4) 1 x(Al,T2) 2
check 0 1 0 0

mnchl 4 5 x(Mn,M23) 4 x(Mn,M1) 1 x(Al,M4) 1 x(Al,T2) 1 x(Si,T2) 1
check 0 1/2 1/2 1

% -----

Biotite order-disorder mode

% -----

bi 5

x(bi) 0.68 % bulk Fe/(Fe + Mg + Mn)
y(bi) 0.59 % x(Al,M1)
Q(bi) 0.12 % 3(x - x(Fe,M2))
M(bi) 0.01

% -----

p(phl) 2 2 1 2 -1 x -1 M 1 1 -1 y 1 0 1 -2/3 Q
p(ann) 1 1 0 2 1 x -1/3 Q
p(east) 1 1 0 1 1 y
p(obi) 2 2 0 1 -1 x 0 1 1 y 1 0 1 1 Q
p(mnbi) 1 1 0 1 1 M

% -----

sf

W(phl,ann)	9	0	0
W(phl,east)	10	0	0
W(phl,obi)	3	0	0
W(phl,mnbi)	0	0	0
W(ann,east)	-1	0	0
W(ann,obi)	6	0	0
W(ann,mnbi)	0	0	0
W(east,obi)	10	0	0

W(east,mnbi) 0 0 0
W(obi,mnbi) 0 0 0

% -----

9 % no of site fractions

x(Al,M1) 1 1 0 1 1 y
x(Fe,M1) 2 2 0 1 1 x 1 1 -1 y 1 0 1 2/3 Q
x(Mg,M1) 2 2 1 2 -1 x -1 M 1 1 -1 y 1 0 1 -2/3 Q
x(Mn,M1) 1 1 0 1 1 M
x(Fe,M2) 1 1 0 2 1 x -1/3 Q
x(Mg,M2) 1 1 1 3 -1 x 1/3 Q -1 M
x(Mn,M2) 1 1 0 1 1 M
x(Al,T1) 1 1 1/2 1 1/2 y
x(Si,T1) 1 1 1/2 1 -1/2 y

% -----

phl 4 4 x(Mg,M1) 1 x(Mg,M2) 2 x(Al,T1) 1 x(Si,T1) 1
check 0 0 0 0

ann 4 4 x(Fe,M1) 1 x(Fe,M2) 2 x(Al,T1) 1 x(Si,T1) 1
check 1 0 0 0

eas 1 3 x(Al,M1) 1 x(Mg,M2) 2 x(Al,T1) 2
check 0 1 0 0

obi 4 4 x(Fe,M1) 1 x(Mg,M2) 2 x(Al,T1) 1 x(Si,T1) 1
make 2 phl 2/3 ann 1/3
DQF -10.73 0 0
check 1/3 0 1 0

mnbi 4 4 x(Mn,M1) 1 x(Mn,M2) 2 x(Al,T1) 1 x(Si,T1) 1
check 0 0 0 1

% -----

Staurolite

% -----

st 3
x(st) 0.90
M(st) 0.023

% -----

p(mst) 1 1 1 2 -1 x -1 M
p(fst) 1 1 0 1 1 x
p(mnst) 1 1 0 1 1 M

% -----

sf
w(mst,fst) -8 0 0
w(mst,mnst) 0 0 0
w(fst,mnst) 0 0 0

% -----
3 % no of site fractions

3x(Mg) 1 1 1 2 -1 x -1 M
x(Fe) 1 1 0 1 1 x
x(Mn) 1 1 0 1 1 M

% -----

mst 1 1 x(Mg) 4
fst 1 1 x(Fe) 4
mnst 1 1 x(Mn) 4

% -----
Chloritoid
% -----

ctd 3
x(ctd) 0.827
M(ctd) 0.076

% -----

p(mctd) 1 1 1 2 -1 x -1 M
p(fctd) 1 1 0 1 1 x
p(mnctd) 1 1 0 1 1 M

% -----

sf
w(mctd,fctd) 1 0 0
w(mctd,mnctd) 0 0 0
w(fctd,mnctd) 0 0 0

% -----
3 % no of site fractions

3x(Mg) 1 1 1 2 -1 x -1 M
x(Fe) 1 1 0 1 1 x
x(Mn) 1 1 0 1 1 M

% -----

mctd 1 1 x(Mg) 1
 fctd 1 1 x(Fe) 1
 mnctd 1 1 x(Mn) 1

% _____

Plagioclase ternary plag: SF: symmetric

% _____

pl 3
 ca(pl) 0.30
 k(pl) 0.0003

% -----

p(ab) 1 1 1 2 -1 k -1 ca
 p(an) 1 1 0 1 1 ca
 p(san) 1 1 0 1 1 k

% -----

sf

w(aban) 0 0 0
 w(sanab) 15.3 0 0.225
 w(sanan) 45 0 0

% -----

3 % no of site fractions

x(K) 1 1 0 1 1 k
 x(Na) 1 1 1 2 -1 k -1 ca
 x(Ca) 1 1 0 1 1 ca

% -----

abh 1 1 x(Na) 1
 an 1 1 x(Ca) 1
 DQF 6.01 -0.0035 0 % C1 plag
 san 1 1 x(K) 1

% _____

Garnet

% _____

g 4
 F(g) 0.601 % Fe/Fe+Mg+Ca+Mn
 C(g) 0.12 % Ca/Fe+Mg+Ca+Mn
 M(g) 0.05 % Mn/Fe+Mg+Ca+Mn

%-----

p(gr) 1 1 0 1 1 C
 p(alm) 1 1 0 1 1 F
 p(spss) 1 1 0 1 1 M
 p(py) 1 1 1 3 -1 C -1 F -1 M

%-----

sf

W(gr,alm) 0 0 0
 W(gr,py) 33 0 0
 W(gr,spss) 0 0 0
 W(alm,py) 2.5 0 0
 W(alm,spss) 0 0 0
 W(py,spss) 4.5 0 0

%-----

4 % no of site fractions

x(Fe,M1) 1 1 0 1 1 F
 x(Ca,M1) 1 1 0 1 1 C
 x(Mn,M1) 1 1 0 1 1 M
 x(Mg,M1) 1 1 1 3 -1 C -1 F -1 M

%-----

gr 1 1 x(Ca,M1) 3
 check 0 1 0
 alm 1 1 x(Fe,M1) 3
 check 1 0 0
 spss 1 1 x(Mn,M1) 3
 check 0 0 1
 py 1 1 x(Mg,M1) 3
 check 0 0 0

%-----
Muscovite (Fe)celadonite, DQF paragonite mixing
 %-----

mu 4
 x(mu) 0.74 %Fe/Fe+Mg
 y(mu) 0.90 %Al,T1
 N(mu) 0.10 %Na/K+Na

% -----

p(mu)	1 1	0 2 1 y	-1 N
p(ce1)	1 2	1 1 -1 x	1 1 -1 y
p(fc1)	1 2	0 1 1 x	1 1 -1 y
p(pa)	1 1	0 1 1 N	

% -----

sf

W(mu,ce1)	0	0	0
W(mu,fc1)	0	0	0
W(mu,pa)	12	0	0.4
W(ce1,fc1)	0	0	0
W(ce1,pa)	14	0	0.2
W(fc1,pa)	14	0	0.2

% -----

7 % no of site fractions

x(Na,A)	1 1	0 1 1 N	
x(K,A)	1 1	1 1 -1 N	
x(Al,M2A)	1 1	0 1 1 y	
x(Mg,M2A)	1 2	1 1 -1 x	1 1 -1 y
x(Fe,M2A)	1 2	0 1 1 x	1 1 -1 y
x(Al,T1)	1 1	0 1 1/2 y	
x(Si,T1)	1 1	1 1 -1/2 y	

% -----

mu	4 4			
x(K,A) 1	x(Al,M2A) 1	x(Al,T1) 1	x(Si,T1) 1	
check 0 1 0				
ce1 1 3	x(K,A) 1	x(Mg,M2A)	x(Si,T1) 2	
check 0 0 0				
fc1 1 3	x(K,A) 1	x(Fe,M2A) 1	x(Si,T1) 2	
check 1 0 0				
pa 4 4	x(Na,A) 1	x(Al,M2A) 1	x(Al,T1) 1	x(Si,T1) 1
DQF 1.42 0 0.4				
check 0 1 1				

%

zo ky sill and q H2O

*

fluidpresent yes
 fluidexcess yes
 setexcess mu q
 calctatp ask
 setdefTwindow yes 400 800
 setdefPwindow yes 0.001 18
 calcsdnle yes
 pseudosection yes

% [script to enter the bulk composition info]

%	Al2O3	CaO	MgO	FeO	K2O	Na2O	MnO
% V240	17.61	0.83	3.12	8.60	2.54	2.15	0.12
% V634A	15.29	0.53	1.72	7.24	2.93	1.01	0.13
% V436B	15.13	0.69	3.13	7.62	3.73	0.91	0.17
% V261A	7.89	0.80	2.75	3.85	1.95	1.38	0.09
% V257	10.30	1.77	3.59	5.74	2.07	2.50	0.09
% V436A	7.86	0.19	1.05	7.86	1.68	0.48	0.09

%	Al2O3	CaO	MgO	FeO	K2O	Na2O	MnO
% -----							
setbulk yes	15.13	0.69	3.13	7.62	3.73	0.91	0.17
% -----							

setiso ask
 setmodeiso yes
 zeromodeiso yes
 project no
 drawpd yes
 moreprec yes

*

APPENDIX-7

SAMPLE	LITHO	ORIENTATION	FIA	Compositional maps	MONA ZITE	JCU Number
V3	S-Waits River	2 PTS-90, 120		1new		68213
V60	S-Waits River	1PTS-160				68214
V200B	O-Cram Hill (h)	1PTS	4			68215
V200C	O-Cram Hill (g)	1PTS				68216
V201	O-Cram Hill (g)	1PTS	4	1old tiff		68217
V203	O-Cram Hill (h)	1 PTS- 90	3,4	1, 1 new		68218
V204	O-Cram Hill (g)	1 PTS-100	4	1new, 1old tiffs		68219
V205	O-Cram Hill (g)	1PTS	3			68220
V208A	O-Cram Hill (fs)	1 PTS	4			68221
V209	O-Cram Hill (g)	2 PTS- 90, 140	1,2,4	1old, 1new		68222
V214	O-Cram Hill (g)	2 PTS- 90, 140	2,3			68223
V218	O-Moretown	3 PTS- 100, 120		2 new		68224
V240	CZ-Hoosac	1PTS, 1 ROUND 100, 120	2,3	2 partials, 2 high res.	dated	68225
V257	C-Rowe	2PTS- 140	1,3	1 new		68226
V258	CZ-Hoosac	2PTS- 90	2	1new		68227
V259A	O-Moretown	2 PTS	4	2old		68228
V260	C-Rowe	3 PTS- 100, 140	4			68229
V261A	O-Moretown	4 PTS-120,130, 140	1,3	1old, 4new		68230
V261B	O-Moretown	1PTS- 120	1			68231
V381	C-Hoosac	3 PTS- 90, 130		2 new		68232
V436A	O-Cram Hill (g)	3 PTS- 99, 110, 120	3,4	3new	dated	68233
V436B	O-Cram Hill (g)	2PTS- 90, 120	3	3new,1old	dated	68234
V436C	O-Cram Hill (g)	1 PTS		2new		68235
V437A	O-Cram Hill (g)	1 PTS	3	1 new		68236
V441	O-Cram Hill (g)	1 PTS	2	whole thin, 1old		68237
V444B	O-Cram Hill (g)	1 PTS	1,2,4	1 new		68238
V449B	O-Cram Hill (g)	1 PTS	3	1old,1new		68239
V450B	O-Moretown	2 PTS- 140	3,4	2new, 1partial		68240
V609	O-Cram Hill (q)	1 PTS			yes	68241
V634A	O-Cram Hill (g)	2 PTS 1 ROUND	2,3,4	3new	dated	68242
V641A	O-Cram Hill (g)	2 PTS		2new + Y,Fe		68243
V653	O-Cram Hill (q)	2 PTS- 83, 120	3	2new	dated	68244

PTS = polished thin-section, ROUND = 1 inch polished round mount. All orientations are for vertical thin-sections.