

**Geological Magazine; Metamorphic Evolution of the Karimnagar Granulite Terrane,  
Eastern Dharwar Craton, South India; D. PRAKASH & I. N. SHARMA; “Appendix Table A1-A10”**

**Table A1: Representative Microprobe Analysis of Garnet (Twelve oxygen basis)**

Samp. No.	508A	508 A	508A	M1	M1	M1	M1	678	678	678	270A	270A	99/1	99/1
Point No.	3R	8R	9C	10R	11C	12R	13C	16C	18R	19C	1C	4R	9C	11R
Contact of	Opx	Bt		Bt		Bt			Pl			Crd		Bt
SiO <sub>2</sub>	38.06	38.38	38.72	38.59	38.72	37.90	36.77	39.93	38.41	40.43	39.21	39.32	38.70	38.14
Al <sub>2</sub> O <sub>3</sub>	21.51	21.78	21.88	22.14	21.90	21.35	20.78	20.79	21.22	22.27	21.42	21.87	22.10	21.71
Cr <sub>2</sub> O <sub>3</sub>	0.28	0.18	0.22	0.17	0.16	0.22	0.20	0.11	0.15	0.07	0.22	0.11	0.04	0.24
Fe <sub>2</sub> O <sub>3</sub>	0.00	0.41	0.276	0.00	0.00	0.00	0.81	1.482	0.66	0.00	0.000	0.00	0.00	0.00
FeO	27.87	26.18	25.19	26.06	25.97	33.13	33.86	24.56	29.71	25.12	29.79	28.02	26.92	32.03
MnO	4.66	4.78	4.56	4.86	4.63	1.30	1.46	0.80	0.93	0.73	2.25	1.78	1.74	2.69
MgO	7.47	7.99	8.57	7.51	8.34	5.42	5.51	12.27	8.84	11.32	5.97	8.41	8.86	4.40
CaO	1.32	1.40	1.55	1.42	1.39	0.92	0.94	1.98	1.12	1.37	1.39	1.34	1.39	1.27
<b>Total</b>	<b>101.17</b>	<b>101.10</b>	<b>101.00</b>	<b>100.75</b>	<b>101.11</b>	<b>100.24</b>	<b>100.33</b>	<b>101.92</b>	<b>101.04</b>	<b>101.31</b>	<b>98.86</b>	<b>99.51</b>	<b>98.36</b>	<b>99.21</b>
Si	2.993	2.975	2.984	2.985	2.998	3.002	2.961	3.042	3.010	3.006	3.044	3.010	2.992	3.051
Al	1.994	1.990	1.987	2.018	1.993	1.989	1.974	1.867	1.960	1.952	1.960	1.973	2.014	1.995
Cr	0.017	0.011	0.013	0.010	0.010	0.013	0.013	0.006	0.009	0.004	0.014	0.007	0.003	0.015
Fe <sup>3+</sup>	0.000	0.025	0.016	0.000	0.000	0.000	0.049	0.085	0.039	0.000	0.000	0.000	0.000	0.000
Fe <sup>2+</sup>	1.702	1.672	1.607	1.686	1.617	2.193	2.200	1.416	1.836	1.532	1.899	1.793	1.741	2.088
Mn	0.310	0.314	0.297	0.318	0.304	0.086	0.102	0.052	0.062	0.046	0.148	0.115	0.114	0.178
Mg	0.876	0.923	0.985	0.866	0.962	0.638	0.663	1.393	0.987	1.366	0.691	0.993	1.021	0.512
Ca	0.111	0.116	0.128	0.118	0.116	0.076	0.082	0.161	0.095	0.109	0.116	0.110	0.115	0.106
X <sub>Mg</sub>	0.340	0.356	0.380	0.339	0.373	0.225	0.232	0.496	0.350	0.447	0.242	0.330	0.341	0.178

**Table A2: Representative Microprobe Analysis of Cordierite (Eight oxygen basis)**

Samp. No. Point No. Contact of	99/1	99/1	508A	508A	508A	270A	270A	M1	M1	M1	678	678	N157	N157	P2	P2	P2	N18	N18	69- XIX	69-XIX	69-XIX
	1R	3C	5C	6R	8R	9R	12R	13R	14C	15C	16R	17R	8R	10R	2R	3R	4R	5C	6C	13R	14R	15R
	Grt			Crd	Grt	Grt	Opx	Grt			Pl	Bt	Bt	Opx	Spr	Bt	Spr			Spl	Crd	Bt
SiO <sub>2</sub>	49.40	49.25	49.39	49.48	49.37	50.30	49.89	49.07	48.48	49.48	49.44	49.13	48.49	48.70	49.38	49.42	49.20	49.58	49.35	49.82	49.81	49.79
TiO <sub>2</sub>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.02	0.02	0.27	0.28	0.30	0.00	0.00	0.00
Al <sub>2</sub> O <sub>3</sub>	32.61	32.30	32.92	32.43	32.31	33.51	33.18	33.30	33.33	33.85	32.35	32.24	33.86	33.28	32.34	32.47	33.06	32.13	33.10	32.56	32.66	32.61
Fe <sub>2</sub> O <sub>3</sub>	0.32	0.41	0.00	0.00	0.35	0.00	0.75	0.29	0.19	0.88	1.90	3.19	0.37	1.01	0.22	0.40	1.33	1.31	0.55	0.76	0.80	0.70
FeO	5.76	4.25	4.45	4.49	5.47	4.17	5.13	5.80	6.21	5.89	5.55	5.75	1.31	1.85	3.28	3.40	3.37	3.42	3.12	3.58	3.67	3.63
MnO	0.06	0.04	0.08	0.05	0.00	0.05	0.05	0.06	0.06	0.11	0.13	0.11	0.03	0.07	0.13	0.06	0.04	0.07	0.00	0.04	0.03	0.02
MgO	9.94	10.77	9.90	10.11	10.04	10.28	10.95	10.14	10.87	10.86	11.49	12.65	12.81	12.99	10.95	11.22	11.93	11.35	11.11	11.54	11.57	11.59
CaO	0.02	0.01	0.00	0.00	0.03	0.00	0.03	0.04	0.02	0.06	0.05	0.04	0.02	0.02	0.06	0.01	0.01	0.02	0.16	0.03	0.02	0.01
Na <sub>2</sub> O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.13	0.07	0.06	0.03	0.18	0.03	0.08	0.09	0.07
K <sub>2</sub> O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.04	0.00	0.01	0.06	0.09	0.00	0.01	0.02
Total	98.09	97.02	96.74	96.56	97.54	98.31	99.95	98.66	99.14	101.07	100.86	99.92	96.72	97.07	96.27	96.66	97.92	97.09	97.26	97.65	98.56	98.35
Si	5.048	5.058	5.065	5.085	5.066	5.067	5.014	4.985	4.918	4.939	4.999	4.939	4.924	4.943	5.071	5.052	4.977	5.057	5.016	5.053	5.041	5.044
Al	3.928	3.910	3.979	3.928	3.910	3.978	3.930	3.988	3.986	3.983	3.856	3.821	4.051	3.979	3.911	3.921	3.942	3.864	3.966	3.889	3.898	3.895
Ti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.003	0.000	0.002	0.002	0.021	0.021	0.023	0.305	0.311	0.308
Fe <sup>3+</sup>	0.025	0.032	0.000	0.000	0.027	0.000	0.057	0.022	0.092	0.066	0.145	0.241	0.028	0.077	0.017	0.031	0.101	0.101	0.042	0.058	0.061	0.061
Fe <sup>2+</sup>	0.493	0.365	0.382	0.386	0.469	0.352	0.431	0.493	0.527	0.492	0.469	0.483	0.110	0.159	0.284	0.289	0.285	0.292	0.265	0.004	0.003	0.002
Mn	0.005	0.003	0.007	0.004	0.000	0.004	0.004	0.005	0.005	0.009	0.011	0.009	0.002	0.006	0.011	0.005	0.003	0.006	0.000	1.743	1.745	1.750
Mg	1.514	1.650	1.514	1.548	1.535	1.544	1.640	1.535	1.643	1.616	1.731	1.895	1.940	1.965	1.678	1.709	1.798	1.725	1.683	0.003	0.002	0.001
Ca	0.002	0.001	0.000	0.000	0.004	0.000	0.003	0.004	0.002	0.006	0.005	0.004	0.002	0.002	0.007	0.001	0.001	0.002	0.017	0.012	0.017	0.014
Na	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.028	0.026	0.014	0.012	0.006	0.036	0.006	0.000	0.000	0.003
K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.004	0.005	0.000	0.001	0.008	0.012	0.000	0.000	0.000
X <sub>Mg</sub>	0.754	0.819	0.800	0.800	0.766	0.814	0.792	0.757	0.757	0.767	0.787	0.797	0.946	0.925	0.855	0.855	0.863	0.855	0.864	0.851	0.849	0.850

**Table A3: Representative Microprobe Analysis of Biotite (Twenty two oxygen basis)**

Samp. NO.	508A	508A	270A	270A	M1	M1	678	678	P2	P2	N18	N18	N157	N16	N16	P7	P7	M2	M2	572	572
Point No.	3C	6R	13C	15R	17R	21R	22R	27C	2R	9R	12R	15C	16R	18C	19R	20C	21R	22C	23R	24C	25C
Contact of		Crd		Crd	Grt	Grt	Grt		Crd	Crd	Crd		Spr		Opx		Opx		Opx		
SiO <sub>2</sub>	37.64	36.18	36.58	37.58	37.22	36.97	37.12	36.48	38.33	39.77	37.98	38.10	38.09	39.88	39.49	37.21	36.57	37.32	36.97	41.34	41.78
TiO <sub>2</sub>	5.35	4.93	6.27	3.18	3.81	6.44	5.13	5.17	1.69	1.70	2.57	1.94	5.15	1.52	1.50	3.85	3.87	2.78	2.64	0.76	0.925
Al <sub>2</sub> O <sub>3</sub>	14.59	15.59	14.96	15.15	14.27	15.98	17.22	16.00	17.13	18.05	16.46	16.69	15.03	14.83	14.19	14.37	14.26	14.87	14.98	12.78	13.37
Cr <sub>2</sub> O <sub>3</sub>	0.32	0.12	0.55	0.15	0.62	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.13
FeO	11.78	17.37	15.37	11.04	12.24	9.61	10.75	14.37	6.97	7.98	5.84	6.61	4.77	9.63	9.66	16.00	15.56	12.32	13.24	5.36	6.53
MnO	0.01	0.00	0.08	0.00	0.03	0.10	0.04	0.00	0.05	0.06	0.10	0.08	0.00	0.04	0.00	0.05	0.05	0.06	0.05	0.01	0.02
MgO	16.05	11.52	12.14	18.23	15.41	16.79	16.05	13.85	20.99	18.39	22.98	22.82	22.80	19.51	19.43	15.38	15.56	17.82	17.87	23.59	23.12
CaO	0.01	0.00	0.02	0.00	0.01	0.10	0.00	0.03	0.00	0.05	0.00	0.01	0.07	0.02	0.02	0.13	0.24	0.13	0.11	0.05	0.06
K <sub>2</sub> O	9.52	9.19	9.51	9.28	10.33	10.25	8.92	9.20	10.21	10.45	8.76	8.72	8.43	10.09	10.50	9.38	8.94	9.76	9.83	9.70	9.59
Na <sub>2</sub> O	0.09	0.05	0.22	0.13	0.14	0.28	0.42	0.07	0.04	0.06	0.27	0.61	0.29	0.16	0.21	0.04	0.04	0.17	0.15	0.19	0.14
Total	95.36	94.95	95.7	94.74	94.08	97.24	95.65	95.17	95.41	96.51	94.96	95.58	94.63	95.68	95.00	96.41	95.09	95.23	95.84	94.05	95.67
Si	5.541	5.486	5.475	5.566	5.601	5.319	5.383	5.431	5.503	5.638	5.427	5.418	5.436	5.769	5.772	5.526	5.495	5.527	5.470	5.952	5.931
Al <sup>IV</sup>	2.459	2.514	2.525	2.434	2.399	2.681	2.617	2.569	2.497	2.362	2.573	2.582	2.521	2.231	2.228	2.474	2.505	2.473	2.530	2.048	2.069
Al <sup>VI</sup>	0.072	0.273	0.113	0.212	0.133	0.030	0.327	0.238	0.401	0.653	0.192	0.221	0.000	0.288	0.215	0.043	0.022	0.123	0.083	0.121	0.167
Ti	0.592	0.562	0.706	0.354	0.431	0.697	0.560	0.579	0.181	0.179	0.275	0.205	0.549	0.165	0.167	0.429	0.433	0.310	0.294	0.082	0.099
Cr	0.037	0.014	0.065	0.171	0.074	0.082	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.015
Fe	1.451	2.202	1.924	1.244	1.540	1.156	1.304	1.789	0.837	0.945	0.696	0.786	0.566	1.164	1.177	1.991	1.958	1.526	1.638	0.645	0.775
Mn	0.002	0.000	0.010	0.000	0.004	0.012	0.004	0.000	0.006	0.007	0.012	0.009	0.000	0.005	0.000	0.006	0.006	0.008	0.006	0.000	0.001
Mg	3.523	2.604	2.708	4.026	3.456	3.600	3.470	3.074	4.493	3.883	4.894	4.836	4.844	4.205	4.235	3.401	3.483	3.933	3.941	5.063	4.892
Ca	0.001	0.000	0.003	0.000	0.002	0.015	0.001	0.005	0.000	0.008	0.000	0.002	0.010	0.003	0.004	0.021	0.039	0.021	0.017	0.007	0.009
K	1.787	1.778	1.815	1.754	1.983	1.881	1.651	1.748	1.862	1.890	1.598	1.590	1.526	1.860	1.950	1.786	1.714	1.844	1.856	1.781	1.737
Na	0.026	0.014	0.064	0.038	0.041	0.078	0.117	0.021	0.010	0.017	0.076	0.168	0.080	0.046	0.060	0.011	0.011	0.049	0.043	0.053	0.038
X <sub>Mg</sub>	0.708	0.542	0.585	0.764	0.692	0.757	0.727	0.632	0.843	0.804	0.875	0.860	0.895	0.783	0.783	0.631	0.640	0.720	0.706	0.887	0.863

**Table A4a: Representative Microprobe Analyses of Orthopyroxene (Six oxygen basis)**

Samp. No.	N16	N16	P7	P7	P7	M2	M2	572	572	572	508A	508A	M1	M1	M1	678	678	678	N157	N157
Point No.	1R	5R	6C	9R	10R	12C	12R	15R	16C	17R	21C	22C	25C	26C	27C	28R	29C	30R	31R	32C
Contact of	Cpx	Pl		Mag	Cpx		Cpx	Cpx		Cpx		Grt	Opx	26C		Bt		Crd	Crd	
SiO <sub>2</sub>	52.78	53.22	53.98	50.70	51.53	51.06	52.09	53.87	54.14	52.81	50.11	51.68	48.84	49.97	49.83	53.87	54.14	52.81	53.75	53.11
TiO <sub>2</sub>	0.05	0.01	0.06	0.06	0.03	0.01	0.04	0.00	0.01	0.00	1.24	0.06	0.05	0.07	0.09	0.00	0.00	0.00	0.15	0.14
Al <sub>2</sub> O <sub>3</sub>	0.69	0.72	0.84	0.73	0.67	0.79	0.77	0.86	0.67	0.94	2.83	3.22	4.24	4.19	4.14	0.86	0.67	0.94	3.75	3.44
Cr <sub>2</sub> O <sub>3</sub>	0.14	0.16	0.17	0.00	0.00	0.05	0.04	0.00	0.00	0.00	0.00	0.00	0.34	0.35	0.37	0.00	0.00	0.00	0.10	0.09
Fe <sub>2</sub> O <sub>3</sub>	0.86	1.11	0.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.21	1.55	0.38	0.00	0.00	0.00	4.35	5.01
FeO	19.51	18.81	18.80	25.34	27.75	27.45	26.29	20.33	18.63	20.23	22.76	21.92	24.87	24.14	25.15	20.33	18.63	20.23	5.87	5.59
MnO	0.51	0.57	0.50	0.80	1.48	1.63	1.48	0.48	0.46	0.52	1.52	1.49	0.37	0.33	0.33	0.48	0.46	0.52	0.52	0.46
MgO	23.66	24.20	24.74	19.71	16.82	16.95	17.25	24.65	26.33	24.59	21.09	21.61	18.97	19.26	19.06	24.65	26.33	24.59	31.35	32.11
CaO	0.51	0.50	0.48	0.84	0.75	0.86	1.55	0.55	0.48	0.00	0.11	0.12	0.06	0.10	0.11	0.55	0.48	0.52	0.11	0.12
Na <sub>2</sub> O	0.01	0.05	0.00	0.01	0.00	0.03	0.03	0.00	0.04	0.01	0.01	0.06	0.17	0.19	0.12	0.00	0.04	0.01	0.06	0.05
K <sub>2</sub> O	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.16	0.00	0.00	0.00	0.00	0.01	0.03
NiO	0.35	0.38	0.43	n.d.	0.16	0.17	0.06	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.00	0.00	0.00	0.00	0.00
Total	99.07	99.73	100.21	99.27	99.21	99.00	99.60	100.74	100.76	99.10	99.7	100.16	99.19	100.35	99.59	100.74	100.75	99.62	100.02	100.15
Si	1.968	1.966	1.980	1.939	1.997	1.987	1.999	1.971	1.966	1.960	1.891	1.924	1.881	1.884	1.893	1.971	1.966	1.958	1.879	1.859
Al <sup>IV</sup>	0.031	0.032	0.020	0.034	0.003	0.013	0.001	0.029	0.029	0.040	0.109	0.076	0.119	0.116	0.107	0.029	0.029	0.041	0.121	0.141
Al <sup>VI</sup>	0.000	0.000	0.016	0.000	0.028	0.023	0.034	0.008	0.000	0.009	0.017	0.066	0.074	0.070	0.079	0.008	0.000	0.000	0.034	0.001
Ti	0.002	0.000	0.002	0.002	0.001	0.000	0.001	0.000	0.000	0.000	0.035	0.002	0.001	0.002	0.003	0.000	0.000	0.000	0.004	0.004
Cr	0.004	0.005	0.005	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.010	0.010	0.011	0.000	0.000	0.000	0.003	0.002
Fe <sup>3+</sup>	0.024	0.031	0.000	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.035	0.044	0.011	0.000	0.000	0.000	0.114	0.132
Fe <sup>2+</sup>	0.608	0.581	0.577	0.810	0.898	0.893	0.844	0.622	0.566	0.627	0.718	0.683	0.869	0.761	0.799	0.622	0.566	0.627	0.172	0.164
Mn	0.016	0.018	0.016	0.025	0.049	0.054	0.048	0.015	0.014	0.016	0.049	0.047	0.012	0.011	0.011	0.015	0.014	0.016	0.015	0.014
Mg	1.315	1.333	1.352	1.124	0.971	0.982	0.986	1.344	1.425	1.359	1.187	1.199	1.089	1.082	1.079	1.344	1.425	1.359	1.633	1.675
Ca	0.021	0.020	0.019	0.035	0.030	0.035	0.065	0.022	0.019	0.021	0.004	0.005	0.002	0.004	0.004	0.022	0.021	0.021	0.004	0.005
Na	0.001	0.004	0.000	0.001	0.000	0.002	0.002	0.000	0.003	0.001	0.001	0.004	0.003	0.003	0.002	0.000	0.003	0.001	0.004	0.003
K	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.002	0.012	0.000	0.000	0.000	0.000	0.000	0.001
Ni	0.010	0.011	0.013	n.d.	0.005	0.005	0.002	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000
X <sub>Mg</sub>	0.684	0.696	0.701	0.581	0.520	0.524	0.539	0.684	0.716	0.684	0.623	0.713	0.556	0.587	0.575	0.684	0.715	0.684	0.905	0.911

**Table A4b: Representative Microprobe Analysis of Clinopyroxene (Six Oxygen basis)**

Samp. No.	N16	P7	M2	M2	M2	572	572	572
Point No.	1R	2C	3R	6C	8C	11R	13C	14C
Contact of	Opx	Hbl	Opx			Hbl		
SiO <sub>2</sub>	52.10	51.22	52.00	51.81	52.45	52.52	52.09	51.91
TiO <sub>2</sub>	0.18	0.14	0.04	0.07	0.05	0.04	0.05	0.08
Al <sub>2</sub> O <sub>3</sub>	1.36	1.25	1.01	1.33	1.46	1.40	1.89	1.79
Cr <sub>2</sub> O <sub>3</sub>	0.13	0.08	0.07	0.03	0.00	0.00	0.00	0.00
Fe <sub>2</sub> O <sub>3</sub>	1.56	2.24	1.27	0.84	0.00	0.00	0.00	0.00
FeO	8.69	8.88	9.51	13.71	7.06	6.95	7.26	7.55
MnO	0.44	0.35	0.66	0.76	0.13	0.14	0.21	0.23
MgO	13.63	13.61	12.40	12.72	15.62	15.55	14.94	15.19
NiO	n.d.	n.d.	0.15	0.10	0.00	0.00	0.00	0.00
CaO	21.60	20.97	22.34	18.55	22.04	22.04	21.97	21.79
Na <sub>2</sub> O	0.30	0.26	0.26	0.21	0.52	0.39	0.60	0.52
K <sub>2</sub> O	0.00	0.02	0.00	0.00	0.01	0.02	0.03	0.02
<b>Total</b>	<b>99.99</b>	<b>99.02</b>	<b>99.71</b>	<b>100.13</b>	<b>99.33</b>	<b>99.03</b>	<b>99.01</b>	<b>99.06</b>
Si	1.952	1.941	1.967	1.964	1.955	1.961	1.951	1.955
Al <sup>IV</sup>	0.048	0.055	0.033	0.036	0.045	0.039	0.049	0.045
Al <sup>VI</sup>	0.012	0.000	0.012	0.023	0.019	0.022	0.035	0.034
Ti	0.005	0.004	0.001	0.002	0.001	0.001	0.001	0.002
Cr	0.004	0.002	0.002	0.001	0.000	0.000	0.000	0.000
Fe <sup>3+</sup>	0.044	0.064	0.036	0.024	0.000	0.000	0.000	0.000
Fe <sup>2+</sup>	0.272	0.282	0.300	0.434	0.220	0.217	0.227	0.238
Mn	0.014	0.011	0.021	0.025	0.004	0.004	0.005	0.007
Mg	0.761	0.770	0.700	0.718	0.868	0.866	0.834	0.853
Ni	n.d.	n.d.	0.005	0.003	0.000	0.000	0.000	0.000
Ca	0.867	0.852	0.905	0.754	0.880	0.882	0.882	0.851
Na	0.022	0.019	0.019	0.016	0.038	0.028	0.044	0.036
K	0.000	0.001	0.000	0.000	0.001	3.001	5.001	6.001
XMg	0.737	0.732	0.700	0.623	0.800	0.818	0.786	0.782

**Table A5: Representative Microprobe Analysis of Hornblende (Twenty three oxygen basis)**

	N16	N16	P7	P7	P7	P7	572	572
Point No.	3R	4C	5C	6R	7C	8C	10C	11C
Contact of	Opx	Opx	Cpx	Pl	Cpx	Opx		
SiO <sub>2</sub>	47.26	46.28	42.30	42.31	42.40	42.28	45.56	47.00
TiO <sub>2</sub>	0.86	0.89	1.69	1.76	1.82	1.52	0.30	0.18
Al <sub>2</sub> O <sub>3</sub>	8.76	9.40	9.77	10.17	9.97	10.32	9.73	8.91
Cr <sub>2</sub> O <sub>3</sub>	n.d.	0.40	0.04	0.00	0.07	0.00	0.38	0.31
Fe <sub>2</sub> O <sub>3</sub>	4.03	4.17	5.63	4.43	7.89	6.10	6.36	8.58
FeO	5.69	7.25	11.74	11.90	9.28	11.03	3.38	0.59
MnO	0.15	0.10	0.43	0.24	0.30	0.34	0.11	0.05
MgO	16.11	14.86	11.15	11.27	11.80	11.25	16.55	17.77
CaO	11.90	12.15	11.48	11.27	11.03	11.34	11.93	11.42
Na <sub>2</sub> O	1.01	1.15	0.90	1.14	1.11	1.14	1.57	1.66
K <sub>2</sub> O	1.64	1.12	2.57	2.53	2.32	2.28	1.27	1.10
<b>Total</b>	<b>97.41</b>	<b>97.77</b>	<b>97.70</b>	<b>97.02</b>	<b>97.99</b>	<b>97.60</b>	<b>97.14</b>	<b>97.57</b>
Si	6.877	6.765	6.469	6.471	6.447	6.459	6.687	6.823
Al <sup>IV</sup>	1.123	1.235	1.531	1.529	1.553	1.541	1.313	1.177
Al <sup>VI</sup>	0.382	0.382	0.233	0.309	0.237	0.312	0.370	0.348
Ti	0.096	0.097	0.193	0.202	0.210	0.175	0.033	0.019
Cr	n.d.	0.053	0.006	0.000	0.009	0.000	0.045	0.036
Fe <sup>3+</sup>	0.438	0.454	0.639	0.504	0.886	0.690	0.692	0.918
Fe <sup>2+</sup>	0.686	0.877	1.481	1.506	1.158	1.387	0.408	0.071
Mn	0.017	0.009	0.056	0.031	0.038	0.044	0.013	0.006
Mg	3.499	3.242	2.545	2.574	2.676	2.560	3.620	3.846
Ca	1.855	1.906	1.884	1.847	1.799	1.853	1.876	1.776
Na	0.280	0.334	0.276	0.330	0.328	0.330	0.446	0.467
K	0.298	0.210	0.496	0.496	0.456	0.440	0.237	0.204
X <sub>Mg</sub>	0.755	0.707	0.542	0.559	0.562	0.548	0.764	0.792

**Table A6a: Representative Microprobe Analysis of K-feldspar (Eight oxygen basis)**

Sample No.	99/1	99/1	M1	M1	P2	P2	N157	N157
Point No.	1C	2C	3C	5C	7C	9C	10C	11C
SiO <sub>2</sub>	65.22	67.39	63.76	63.69	65.73	65.26	65.70	65.81
Al <sub>2</sub> O <sub>3</sub>	18.40	18.72	20.84	20.88	18.09	18.02	18.43	18.24
CaO	0.14	0.16	0.08	0.09	0.05	0.02	0.01	0.04
K <sub>2</sub> O	13.45	8.88	10.42	10.34	13.52	14.90	14.53	14.11
Na <sub>2</sub> O	1.79	4.85	4.50	4.59	2.26	1.22	1.77	1.81
Total	99.00	100.00	99.60	99.59	99.65	99.42	100.44	100.01
Si	3.009	3.022	2.918	2.915	3.018	3.015	3.004	3.014
Al	1.000	0.989	1.124	1.127	0.977	0.983	0.993	0.985
Ca	0.007	0.008	0.004	0.004	0.002	0.001	0.001	0.002
K	0.792	0.508	0.650	0.645	0.794	0.878	0.847	0.825
Na	0.160	0.422	0.399	0.407	0.198	0.112	0.157	0.160
X <sub>K</sub>	0.826	0.542	0.617	0.611	0.799	0.886	0.843	0.836

**Table A6b: Representative Microprobe Analysis of Plagioclase Feldspar (Eight oxygen basis)**

Samp. No.	270A	270A	M1	M1	678	678	K99/1	K99/1	572	572	572	572	N16	N16	N16	N16	N16	P7	P7	P7	P7	M2
Point	2C	4C	9C	10R	11R	12C	14C	15C	16C	18C	21C	23R	24R	25R	27C	28C	30R	31R	33C	34C	35C	36C
				Grt	Grt							Cpx		Opx	Hbl		Hbl	Opx				
SiO <sub>2</sub>	58.26	58.49	57.60	57.72	57.94	57.54	58.73	58.26	58.82	58.50	58.79	57.22	56.83	56.57	58.00	57.92	56.15	56.98	56.04	56.88	57.46	59.21
Al <sub>2</sub> O <sub>3</sub>	27.19	26.43	26.47	26.71	26.06	26.62	24.96	27.19	25.89	25.70	26.20	27.09	27.33	27.60	27.05	27.06	27.13	27.51	27.09	27.09	27.16	26.66
CaO	6.10	8.84	8.18	8.26	8.22	8.62	8.23	6.10	8.05	8.68	7.57	9.59	8.93	10.39	9.39	9.58	10.43	10.41	10.35	10.15	9.01	8.02
K <sub>2</sub> O	1.62	0.10	0.19	0.21	0.34	0.41	0.67	0.62	0.13	0.15	0.09	0.19	0.62	0.08	0.31	0.02	0.06	0.07	0.09	0.09	0.12	0.08
Na <sub>2</sub> O	6.14	6.27	7.44	7.52	6.54	6.62	6.84	6.84	6.79	6.59	7.27	6.07	5.71	5.59	5.92	5.48	5.54	5.53	5.46	5.68	6.22	6.75
Total	99.31	100.13	99.88	100.42	99.10	99.81	99.43	99.01	99.68	99.62	99.92	100.16	99.42	100.23	100.67	100.06	99.31	100.50	99.03	99.89	99.97	100.72
Si	2.617	2.609	2.587	2.580	2.614	2.585	2.647	2.616	2.633	2.642	2.626	2.563	2.562	2.535	2.580	2.585	2.540	2.544	2.541	2.555	2.572	2.621
Al	1.440	1.390	1.402	1.408	1.386	1.410	1.326	1.439	1.366	1.368	1.379	1.430	1.452	1.458	1.418	1.423	1.447	1.449	1.449	1.435	1.433	1.391
Ca	0.294	0.423	0.394	0.396	0.398	0.415	0.398	0.293	0.386	0.387	0.362	0.460	0.432	0.499	0.447	0.458	0.506	0.499	0.504	0.488	0.432	0.381
K	0.093	0.006	0.011	0.012	0.020	0.023	0.039	0.036	0.007	0.008	0.005	0.011	0.035	0.005	0.018	0.001	0.003	0.004	0.005	0.005	0.007	0.005
Na	0.535	0.542	0.648	0.652	0.572	0.577	0.598	0.596	0.590	0.577	0.630	0.527	0.499	0.486	0.511	0.474	0.484	0.478	0.480	0.496	0.540	0.579
X <sub>Ca</sub>	0.319	0.436	0.374	0.374	0.402	0.409	0.385	0.317	0.393	0.398	0.363	0.461	0.447	0.504	0.458	0.491	0.510	0.509	0.510	0.493	0.441	0.395

**Table A7: Representative Microprobe Analysis of Spinel  
(Eight oxygen basis)**

Samp. No.	P2	N18	N18	69-XIX	69-XIX
Point No.	1R	2R	3C	4C	5R
Contact of	Spr	Crd			Krn
SiO <sub>2</sub>	0.08	0.07	0.00	0.05	0.01
TiO <sub>2</sub>	0.01	0.02	0.42	0.21	0.03
Al <sub>2</sub> O <sub>3</sub>	62.48	63.12	63.43	62.81	58.12
Cr <sub>2</sub> O <sub>3</sub>	0.00	0.03	0.00	0.02	3.23
Fe <sub>2</sub> O <sub>3</sub>	0.89	0.87	2.76	0.85	2.67
FeO	21.71	21.63	16.44	20.59	27.52
MnO	0.36	0.37	0.20	0.36	0.13
MgO	11.61	12.23	16.85	15.72	8.89
CaO	0.02	0.03	0.01	0.02	0.00
ZnO	2.21	2.31	0.07	0.04	0.23
<b>Total</b>	<b>99.37</b>	<b>100.68</b>	<b>100.18</b>	<b>100.67</b>	<b>100.83</b>
Si	0.004	0.004	0.000	0.001	0.000
Al	3.954	3.938	3.859	1.930	1.874
Ti	0.000	0.000	0.017	0.004	0.001
Cr	0.000	0.002	0.000	0.000	0.070
Fe <sub>3+</sub>	0.036	0.034	0.107	0.017	0.055
Fe <sub>2+</sub>	0.974	0.958	0.708	0.449	0.630
Mn	0.016	0.016	0.009	0.000	0.003
Mg	0.929	0.964	1.296	0.611	0.362
Ca	0.001	0.002	0.001	0.001	0.000
Zn	0.087	0.090	0.003	0.001	0.005
X <sub>Mg</sub>	0.488	0.502	0.647	0.576	0.366

**Table A8: Representative Microprobe analysis of magnetite, ilmenite & rutile  
(Mt on eight oxygen basis & ilmenite on six oxygen basis)**

Samp. No.	508A	508A	M1	M1	P7	P7	M2	M2	99/1	99/1	270A	270A
Point No.	1C	10C	11C	2C	3C	17C	8C	19C	12C	13C	14C	15C
SiO <sub>2</sub>	0.00	0.08	0.02	0.06	0.04	0.01	0.00	0.02	0.00	0.00	0.56	0.00
TiO <sub>2</sub>	0.13	95.36	51.30	0.12	0.18	51.98	2.47	52.41	51.19	0.15	0.20	51.12
Al <sub>2</sub> O <sub>3</sub>	0.27	0.01	0.00	0.30	0.27	0.00	1.65	0.03	0.00	0.46	1.42	0.07
Cr <sub>2</sub> O <sub>3</sub>	0.45	0.39	0.06	0.26	0.53	0.04	5.79	0.04	0.11	4.05	5.28	0.11
Fe <sub>2</sub> O <sub>3</sub>	68.00	0.00	1.93	68.31	66.96	1.58	56.75	0.79	2.75	63.78	61.27	1.82
FeO	31.26	0.92	44.47	31.34	30.74	44.62	33.03	43.44	43.67	30.98	31.63	46.65
MnO	0.02	0.14	0.98	0.07	0.02	1.78	0.42	2.88	0.07	0.01	0.05	0.54
MgO	0.00	0.65	0.20	0.00	0.08	0.23	0.04	0.50	0.21	0.09	0.18	0.48
ZnO	0.03	0.04	n.d.	0.00	0.05	0.00	n.d.	0.00	n.d.	0.00	0.00	0.00
NiO	0.00	0.04	0.10	0.10	0.05	0.00	0.33	0.00	0.14	0.01	0.00	0.00
<b>Total</b>	<b>100.16</b>	<b>97.63</b>	<b>99.16</b>	<b>100.56</b>	<b>98.92</b>	<b>100.24</b>	<b>100.48</b>	<b>100.11</b>	<b>98.46</b>	<b>99.53</b>	<b>100.59</b>	<b>100.79</b>
Si	0.000	0.002	0.002	0.005	0.003	0.001	0.000	0.001	0.000	0.000	0.028	0.000
Ti	0.008	1.965	1.962	0.007	0.011	1.967	0.140	1.981	1.969	0.006	0.008	1.308
Al	0.024	0.000	0.000	0.026	0.024	0.000	0.147	0.002	0.000	0.007	0.085	0.003
Cr	0.028	0.009	0.002	0.016	0.032	0.002	0.346	0.002	0.004	0.163	0.210	0.003
Fe <sup>3+</sup>	3.930	0.000	0.074	3.932	3.916	0.060	3.227	0.030	0.106	3.772	3.652	0.068
Fe <sup>2+</sup>	2.007	0.021	1.892	2.004	1.997	1.878	2.087	1.824	1.869	2.001	2.213	1.812
Mn	0.002	0.003	0.042	0.005	0.002	0.076	0.027	0.124	0.004	0.000	0.002	0.016
Mg	0.000	0.026	0.016	0.000	0.009	0.017	0.005	0.036	0.016	0.007	0.085	0.024
Zn	0.002	0.001	n.d.	0.000	0.003	0.000	n.d.	0.001	n.d.	0.000	0.000	0.000
Ni	0.000	0.001	0.004	0.006	0.003	0.000	0.021	0.000	0.006	0.163	0.000	0.000

**Table: A9**  
**Simultaneous calculation of P-T by TWQ program (version 2.32)**

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### **Quartz-free Spr-Spl granulite**

Equilibria plotted in Fig.

1.  $5 \text{ En} + 10 \text{ Crn} = 2 \text{ Crda} + 6 \text{ Spl}$
2.  $\text{Phl} + 3 \text{ Crn} = 3 \text{ Spl} + \text{Kfs} + \text{H}_2\text{O}$
3.  $10 \text{ Phl} + 6 \text{ Crda} = 15 \text{ En} + 12 \text{ Spl} + 10 \text{ Kfs} + 10 \text{ H}_2\text{O}$
4.  $2 \text{ Phl} + 2 \text{ Crda} = 5 \text{ En} + 4 \text{ Crn} + 2 \text{ Kfs} + 2 \text{ H}_2\text{O}$

### **Mafic granulite**

Equilibria plotted in Fig.

1.  $\text{Di} + \text{East} + 3 \text{ Fsl} + \text{bQtz} = 3 \text{ cEn} + \text{An} + \text{Ann}$
2.  $\text{pEn} = \text{cEn}$
3.  $\text{gFe} = \text{aFe}$
4.  $3 \text{ Fsl} + \text{Phl} = 3 \text{ cEn} + \text{Ann}$
5.  $\text{Di} + \text{East} + 3 \text{ Fsl} + \text{bQtz} = 3 \text{ pEn} + \text{An} + \text{Ann}$
6.  $\text{Di} + \text{East} + \text{bQtz} = \text{Phl} + \text{An}$
7.  $\text{Ann} + 3 \text{ pEn} = \text{Phl} + 3 \text{ Fsl}$

### **Grt-Opx-Crd-Bt gneisses**

Equilibria plotted in Fig.

1.  $5 \text{ Fsl} + 6 \text{ Sil} = 2 \text{ fCrda} + 2 \text{ Alm}$
2.  $\text{fCrda} = 2 \text{ Sil} + \text{bQtz} + \text{Fsl}$
3.  $3 \text{ fCrda} = 4 \text{ Sil} + 5 \text{ bQtz} + 2 \text{ Alm}$
4.  $2 \text{ Alm} + 3 \text{ bQtz} = 2 \text{ Fsl} + \text{fCrda}$
5.  $2 \text{ Alm} + 2 \text{ bQtz} = 2 \text{ Sil} + 3 \text{ Fsl}$

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Phases used in calculation: aFe, Iron (alpha); Alm, almandine; An, Anorthite; bQtz, beta-quartz; cEn, Enstatite (clino); Crda, Cordierite (Dry); Crn, Corundum; Di, Diopside; East, Eastonite; En, Enstatite; fCrda, Fe- Cordierite (Dry); Fsl, Ferrosilite; gFe, Iron (gamma); H<sub>2</sub>O, Water; Kfs, Potassium Feldspar; pEn, Enstatite (proto); Phl, Phlogopite; Qtz, Quartz; Sil, Sillimanite; Spl, Spinel.



**Table A10: Results of conventional geothermobarometry**

Sample	Site position	TS	TOG											
Spr-Granulite N157	Spr (4R), Spl (1R)	800	857											
Sample	Site position	TBK	TWB	TW	TP	TBH	PH	PE						
Mafic-Granulite P7	Hbl (6R), Pl (27C)					818								
P7	Hbl (5C), Pl (23R)					858								
P7	Hbl (8C), Pl (24R)					861	5.7							
P7	Cpx (2C), Opx (6C)	876	911	919	790									
M2	Cpx (3R), Pl (28C)							5.38						
N16	Cpx (1R), Pl (23R)							4.71						
Sample	Site position	PB	PPCP <sub>Mg</sub>	PPCP <sub>Fe</sub>	PLP <sub>Mg</sub>	PLP <sub>Fe</sub>	PBP <sub>Mg</sub>	PBP <sub>Fe</sub>	TPe	TPeL	TH	TB	TAP	TL
Grt-Opx Gneiss M1	Grt (11C), Opx (25C), Pl (9C)	4.7	3.9	4.3	5.1	4.7	4.9	3.3	879	851	863	866	871	844
M1	Grt (10R), Opx (27C), Pl (10R)	5.0	3.0	4.6	4.2	5.0	4.0	3.8	760	711	734	753	754	721

Abbreviations: T (°C) P (kbar) estimates: TS-Temperature Sato, Miyamoto & Kawasaki (2006), TOG-Temperature Own and Greenough (1991), TBK- Temperature Brey and Köhler (1990), TWB-Temperature Wood and Banno (1973), TW-Temperature Wells (1977), TP-Temperature Powell (1978), TBH- Temperature Blundy and Holland (1990), PH-Pressure Hollister et al. (1987), PE-Pressure Ellis et al. (1980), PB-Pressure Bohlen et al. (1983), PPC-Pressure Perkin & Chipera (1985), PL-Pressure Lal (1993), PB- Pressure Bhattacharya et al. (1991), TPe-Temperature Perchuk et al (1985), TPeL-Temperature Perchuk and Laverenteva (1990), TH-Temperature Harley (1984), TB-Temperature Bhattacharya et al. (1991), TAP-Temperature Aranovich & Podlesskii (1989), TL-Temperature Lal (1993).

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