

Table 3.1a: Results of microprobe analysis and temperature calculations, HMB diorite

Microprobe analysis of coexisting hornblende-plagioclase pairs in O/C-118a

Analysis	68	70	80	76	78	79	81
Location	1	2	5	3	4	5	5
SiO ₂	47.43	47.74	48.62	42.94	50.47	52.93	48.20
TiO ₂	0.85	0.31	1.33	0.23	0.17	0.06	0.14
Al ₂ O ₃	6.54	6.12	6.36	8.64	4.91	2.31	6.47
FeO	16.56	15.11	17.43	17.86	18.19	16.07	16.61
MnO	0.20	0.27	0.19	0.27	0.20	0.40	0.31
MgO	13.34	13.81	13.07	14.14	11.14	15.53	14.74
CaO	10.62	11.37	10.35	7.76	12.65	9.80	9.36
Na ₂ O	1.11	0.64	1.27	0.21	0.52	0.25	0.40
K ₂ O	0.25	0.11	0.21	0.07	0.11	0.09	0.08
Total	96.90	95.49	98.81	92.12	98.36	97.45	96.32

Recalculation of amphibole analysis following Holland and Blundy (1994)

Si	6.967	7.060	7.035	6.568	7.398	7.680	7.057
Al	1.033	0.940	0.965	1.432	0.602	0.320	0.943
	8	8	8	8	8	8	8
Al	0.099	0.126	0.118	0.125	0.246	0.075	0.172
Ti	0.094	0.034	0.145	0.026	0.019	0.006	0.016
Fe ³⁺	0.693	0.721	0.522	1.240	0.272	0.216	0.721
Mg	2.921	3.045	2.819	3.226	2.435	3.360	3.217
Fe ²⁺	1.193	1.074	1.397	0.383	1.957	1.343	0.875
Mn	0	0	0	0	0.024	0	0
Ca	0	0	0	0	0.047	0	0
	5	5	5	5	5	5	5
Fe ²⁺	0.148	0.074	0.192	0.662	0.000	0.391	0.438
Mn	0.025	0.033	0.023	0.034	0.000	0.050	0.038
Ca	1.670	1.801	1.605	1.273	1.939	1.524	1.468
Na	0.157	0.091	0.181	0.032	0.061	0.036	0.056
	2	2	2	2	2	2	2
Na	0.160	0.093	0.174	0.032	0.086	0.036	0.056
K	0.046	0.020	0.039	0.013	0.020	0.017	0.015
	0.207	0.112	0.213	0.044	0.106	0.053	0.071

Mg-# of amphibole and composition of coexisting plagioclase (see also appendix C)

Mg-#	0.685	0.726	0.640	0.755	0.554	0.660	0.710
X _{Ab}	0.643	0.646	0.639	0.823	0.905	0.924	0.639

Calculation of temperatures using thermometers A and B at pressure P

P (kbar)	A: T (°C)							average	1σ
1	761	704	750	654	579	510	656	659	84
2	751	696	741	647	573	502	649	651	83
3	741	687	731	639	568	495	642	643	82
4	731	678	721	631	562	488	634	635	81
P (kbar)	B: T (°C)								
1	752	686	755	-	-	-	-	731	32
2	753	688	756	-	-	-	-	732	31
3	755	690	758	-	-	-	-	734	31
4	756	692	760	-	-	-	-	736	31

Table 3.1b: Results of microprobe analysis and temperature calculations, HMB diorite

Microprobe analysis of coexisting hornblende-plagioclase pairs in O/C-376

Analysis	40	41	48	49	53	55	64
Location	2	2	1	1	3	3	5
SiO ₂	47.45	46.09	50.05	47.88	47.19	50.93	53.87
TiO ₂	1.10	1.23	0.48	1.19	1.00	0.10	0.24
Al ₂ O ₃	6.83	7.46	5.11	6.55	7.01	4.01	2.62
FeO	18.40	18.08	17.05	18.45	17.58	17.31	15.73
MnO	0.35	0.34	0.41	0.40	0.43	0.49	0.26
MgO	11.99	11.85	13.45	12.10	12.42	13.64	14.75
CaO	10.82	10.80	11.06	10.87	11.38	11.01	12.34
Na ₂ O	1.40	1.34	0.87	1.32	1.20	0.51	0.34
K ₂ O	0.28	0.36	0.25	0.26	0.32	0.18	0.09
Total	98.62	97.55	98.73	99.02	98.53	98.17	100.24

Recalculation of amphibole analysis following Holland and Blundy (1994)

Si	6.928	6.801	7.235	6.968	6.875	7.399	7.620
Al	1.072	1.199	0.765	1.032	1.125	0.601	0.380
	8	8	8	8	8	8	8
Al	0.102	0.097	0.105	0.090	0.079	0.086	0.056
Ti	0.120	0.137	0.051	0.130	0.109	0.011	0.025
Fe ³⁺	0.650	0.730	0.505	0.589	0.715	0.459	0.254
Mg	2.610	2.606	2.899	2.624	2.697	2.954	3.111
Fe ²⁺	1.518	1.429	1.440	1.567	1.400	1.490	1.554
Mn	0	0	0	0	0	0	0
Ca	0	0	0	0	0	0	0
	5	5	5	5	5	5	5
Fe ²⁺	0.079	0.072	0.116	0.090	0.026	0.154	0.052
Mn	0.043	0.042	0.050	0.049	0.053	0.060	0.032
Ca	1.692	1.707	1.713	1.695	1.776	1.714	1.870
Na	0.186	0.178	0.120	0.165	0.144	0.071	0.046
	2	2	2	2	2	2	2
Na	0.210	0.206	0.122	0.206	0.195	0.072	0.046
K	0.052	0.068	0.045	0.048	0.060	0.033	0.016
	0.262	0.274	0.168	0.254	0.255	0.105	0.062

Mg-# of amphibole and composition of coexisting plagioclase (see also appendix C)

Mg-#	0.620	0.634	0.651	0.613	0.654	0.642	0.659
X _{Ab}	0.672	0.557	0.445	0.716	0.475	0.880	0.836

Calculation of temperatures using thermometers A and B at pressure P

P (kbar)	A: T (°C)							average 1σ	
1	775	823	728	762	833	607	550	725	100
2	764	812	719	752	821	599	542	716	98
3	754	801	709	741	810	591	534	706	97
4	744	790	700	731	799	582	526	696	96
P (kbar)	B: T (°C)								
1	757	812	791	721	818	561	-	743	88
2	758	813	793	733	819	562	-	746	88
3	760	815	795	734	820	563	-	748	88
4	761	816	796	735	821	565	-	749	88

Table 3.2: Results of microprobe analysis and temperature calculations, HQ diorite

Microprobe analysis of coexisting hornblende-plagioclase pairs in O/C-229

Analysis	125	134	135	136	137	138	139
Location	2	4	5	5	5	5	5
SiO ₂	47.72	46.37	48.08	47.46	48.45	48.24	49.10
TiO ₂	1.06	0.90	1.36	0.82	0.27	1.25	1.01
Al ₂ O ₃	7.56	9.08	7.78	7.25	7.75	6.77	6.46
FeO	16.05	18.20	16.44	17.12	17.68	15.93	14.60
MnO	0.39	0.51	0.55	0.38	0.37	0.51	0.54
MgO	13.48	13.16	13.41	12.91	11.98	13.65	14.55
CaO	10.92	10.46	11.06	11.37	11.97	11.63	10.82
Na ₂ O	1.18	0.78	0.86	0.80	0.79	0.78	0.81
K ₂ O	0.16	0.23	0.19	0.18	0.24	0.21	0.19
Total	98.53	99.68	99.72	98.30	99.50	98.97	98.08

Recalculation of amphibole analysis following Holland and Blundy (1994)

Si	6.874	6.627	6.859	6.881	6.966	6.926	7.069
Al	1.126	1.373	1.141	1.119	1.034	1.074	0.931
	8	8	8	8	8	8	8
Al	0.157	0.155	0.166	0.120	0.278	0.072	0.164
Ti	0.115	0.097	0.146	0.089	0.030	0.135	0.110
Fe ³⁺	0.703	0.976	0.647	0.781	0.646	0.686	0.508
Mg	2.895	2.803	2.851	2.791	2.567	2.922	3.121
Fe ²⁺	1.130	0.969	1.189	1.219	1.479	1.185	1.097
Mn	0	0	0	0	0	0	0
Ca	0	0	0	0	0	0	0
	5	5	5	5	5	5	5
Fe ²⁺	0.102	0.230	0.126	0.076	0.001	0.040	0.152
Mn	0.048	0.062	0.066	0.047	0.045	0.062	0.066
Ca	1.687	1.601	1.690	1.765	1.844	1.789	1.669
Na	0.163	0.107	0.118	0.111	0.110	0.109	0.112
	2	2	2	2	2	2	2
Na	0.167	0.108	0.120	0.113	0.112	0.110	0.114
K	0.029	0.041	0.035	0.033	0.043	0.039	0.035
	0.195	0.150	0.155	0.146	0.155	0.150	0.149

Mg-# of amphibole and composition of coexisting plagioclase (see also appendix C)

Mg-#	0.702	0.700	0.684	0.683	0.634	0.704	0.714
X _{Ab}	0.56	0.56	0.53	0.51	0.46	0.59	0.75

Calculation of temperatures using thermometers A and B at pressure P

P (kbar)	A: T (°C)							average	1σ
1	784	788	765	776	719	761	687	754	35
2	775	779	757	767	713	751	679	746	34
3	766	770	748	757	707	741	671	737	33
4	757	761	740	748	702	731	663	729	32
P (kbar)	B: T (°C)								
1	775	769	756	768	711	750	654	740	40
2	777	771	759	770	715	751	657	743	40
3	780	773	761	772	719	752	659	745	40
4	782	776	764	774	724	753	662	748	40

Table 3.3a: Results of microprobe analysis and temperature calculations, metagabbro

Microprobe analysis of coexisting hornblende-plagioclase pairs in MRH-78/1

Analysis	141	143	145	150	151	156	165
Location	1	1	1	2	3	4	4
SiO ₂	41.45	46.04	42.68	43.68	45.26	46.06	42.70
TiO ₂	0.58	0.43	0.46	0.52	0.50	0.90	0.59
Al ₂ O ₃	13.74	10.84	15.32	14.64	12.05	11.38	14.45
FeO	20.49	14.07	15.56	15.71	13.80	15.14	15.75
MnO	0.28	0.50	0.37	0.32	0.43	0.59	0.44
MgO	11.21	13.07	10.46	10.89	13.24	13.20	11.46
CaO	9.15	11.74	11.92	12.04	11.53	11.00	11.82
Na ₂ O	0.97	1.39	1.47	1.37	1.29	1.41	1.52
K ₂ O	0.12	0.13	0.21	0.13	0.08	0.17	0.14
Total	97.99	98.21	98.43	99.30	98.18	99.86	98.85

Recalculation of amphibole analysis following Holland and Blundy (1994)

Si	6.044	6.612	6.176	6.253	6.462	6.510	6.131
Al	1.956	1.388	1.824	1.747	1.538	1.490	1.869
	8	8	8	8	8	8	8
Al	0.403	0.444	0.785	0.720	0.489	0.405	0.572
Ti	0.063	0.046	0.050	0.056	0.053	0.095	0.064
Fe ³⁺	1.395	0.748	0.751	0.770	0.915	0.852	1.015
Mg	2.437	2.797	2.256	2.323	2.818	2.782	2.453
Fe ²⁺	0.702	0.941	1.131	1.110	0.726	0.866	0.875
Mn	0	0.024	0.027	0.021	0	0	0.021
Ca	0	0	0	0	0	0	0
	5	5	5	5	5	5	5
Fe ²⁺	0.401	0.000	0.000	0.000	0.008	0.072	0.000
Mn	0.034	0.037	0.018	0.018	0.051	0.071	0.032
Ca	1.429	1.806	1.847	1.847	1.764	1.667	1.818
Na	0.136	0.156	0.135	0.135	0.177	0.190	0.150
	2	2	2	2	2	2	2
Na	0.138	0.231	0.276	0.245	0.181	0.195	0.271
K	0.021	0.024	0.037	0.025	0.016	0.030	0.025
	0.160	0.255	0.314	0.270	0.197	0.226	0.297

Mg-# of amphibole and composition of coexisting plagioclase (see also appendix C)

Mg-#	0.688	0.748	0.666	0.677	0.793	0.748	0.737
X _{Ab}	0.883	0.766	0.766	0.853	0.794	0.719	0.719

Calculation of temperatures using thermometer B. Pressure P is assumed.

P (kbar)	T (°C)							average	1σ
2	651	635	583	553	630	689	670	630	44
4	661	648	603	572	643	701	686	645	42
6	672	660	624	590	657	712	702	660	39
8	682	673	645	609	670	724	717	674	37
10	692	685	666	627	684	736	733	689	35

Table 3.3b: Results of microprobe analysis and temperature calculations, metagabbro

Microprobe analysis of coexisting hornblende-plagioclase pairs in MRH-78/2

Analysis	41	43	49	51	52	54
Location	2	2	1	4	4	4
SiO ₂	44.82	45.09	44.48	45.90	46.28	44.93
TiO ₂	0.76	0.82	0.88	0.89	0.77	0.76
Al ₂ O ₃	11.24	10.11	10.81	10.14	8.91	8.85
FeO	15.62	13.50	13.21	13.99	14.54	15.29
MnO	0.31	0.37	0.48	0.59	0.52	0.54
MgO	13.41	14.46	13.95	13.78	14.37	14.95
CaO	10.36	11.75	11.44	10.87	10.58	10.31
Na ₂ O	1.04	1.04	1.17	1.22	1.33	1.25
K ₂ O	0.21	0.10	0.13	0.08	0.10	0.09
Total	97.77	97.24	96.55	97.46	97.39	96.96

Recalculation of amphibole analysis following Holland and Blundy (1994)

Si	6.462	6.482	6.446	6.615	6.676	6.536
Al	1.538	1.518	1.554	1.385	1.324	1.464
	8	8	8	8	8	8
Al	0.371	0.193	0.290	0.336	0.190	0.050
Ti	0.082	0.089	0.096	0.096	0.083	0.083
Fe ³⁺	0.952	1.124	1.042	0.831	0.939	1.060
Mg	2.883	3.097	3.014	2.962	3.091	3.241
Fe ²⁺	0.711	0.497	0.558	0.775	0.697	0.566
Mn	0	0	0	0	0	0
Ca	0	0	0	0	0	0
	5	5	5	5	5	5
Fe ²⁺	0.220	0.002	0.001	0.080	0.118	0.235
Mn	0.037	0.045	0.060	0.073	0.064	0.066
Ca	1.599	1.810	1.777	1.679	1.635	1.606
Na	0.144	0.143	0.163	0.168	0.184	0.093
	2	2	2	2	2	2
Na	0.147	0.146	0.166	0.172	0.188	0.259
K	0.038	0.019	0.023	0.015	0.019	0.017
	0.185	0.164	0.190	0.187	0.207	0.276

Mg-# of amphibole and composition of coexisting plagioclase (see also appendix C)

Mg-#	0.756	0.861	0.844	0.776	0.791	0.802
X _{Ab}	0.876	0.876	0.825	0.773	0.823	0.823

Calculation of temperatures using thermometer B. Pressure P is assumed.

P (kbar)	T (°C)						average	1σ
2	616	654	668	667	688	712	668	29
4	626	659	676	677	693	713	674	27
6	636	664	684	686	699	714	680	25
8	646	669	692	696	704	716	687	23
10	655	674	700	705	709	717	693	22

Table 3.3c: Results of microprobe analysis and temperature calculations, metagabbro

Microprobe analysis of coexisting hornblende-plagioclase pairs in O/C-373

Analysis	6	13	14	15	23	25	26	27	29
Location	1	4	4	4	3	3	3	3	3
SiO ₂	47.95	42.90	47.39	47.03	43.28	44.20	47.29	47.43	48.92
TiO ₂	0.70	0.31	0.65	0.90	0.39	0.55	0.74	0.45	0.69
Al ₂ O ₃	9.05	14.88	10.23	9.84	14.85	11.14	9.32	9.81	7.80
FeO	14.66	16.02	13.85	14.40	16.46	14.14	13.36	14.26	13.17
MnO	0.52	0.28	0.56	0.48	0.28	0.41	0.45	0.37	0.42
MgO	14.30	10.10	14.23	13.93	10.04	12.67	14.16	14.27	14.60
CaO	10.74	11.32	10.77	10.68	11.80	11.47	11.46	11.05	11.86
Na ₂ O	1.07	1.39	1.09	0.98	1.73	1.21	1.01	0.98	0.98
K ₂ O	0.11	0.15	0.10	0.10	0.15	0.17	0.09	0.11	0.08
Total	99.09	97.34	98.86	98.34	98.97	95.96	97.89	98.74	98.53

Recalculation of amphibole analysis following Holland and Blundy (1994)

Si	6.806	6.268	6.719	6.726	6.263	6.490	6.773	6.736	6.961
Al	1.194	1.732	1.281	1.274	1.737	1.510	1.227	1.264	1.039
	8	8	8	8	8	8	8	8	8
Al	0.319	0.828	0.428	0.382	0.793	0.416	0.345	0.377	0.267
Ti	0.075	0.033	0.070	0.097	0.042	0.060	0.080	0.048	0.074
Fe ³⁺	0.699	0.756	0.689	0.676	0.631	0.904	0.697	0.764	0.603
Mg	3.025	2.200	3.008	2.970	2.166	2.774	3.024	3.021	3.097
Fe ²⁺	0.882	1.182	0.805	0.876	1.360	0.832	0.855	0.790	0.959
Mn	0	0	0	0	0.008	0.013	0	0	0
Ca	0	0	0	0	0	0	0	0	0
	5	5	5	5	5	5	5	5	5
Fe ²⁺	0.159	0.019	0.148	0.172	0.000	0.000	0.048	0.139	0.005
Mn	0.063	0.034	0.068	0.058	0.027	0.038	0.054	0.045	0.051
Ca	1.633	1.771	1.636	1.636	1.829	1.806	1.758	1.682	1.809
Na	0.145	0.175	0.148	0.135	0.145	0.157	0.140	0.134	0.134
	2	2	2	2	2	2	2	2	2
Na	0.148	0.219	0.151	0.137	0.342	0.186	0.142	0.136	0.137
K	0.020	0.028	0.018	0.019	0.027	0.031	0.017	0.020	0.015
	0.168	0.246	0.168	0.156	0.368	0.218	0.159	0.156	0.152

Mg-# of amphibole and composition of coexisting plagioclase (see also appendix C)

Mg-#	0.744	0.647	0.759	0.739	0.614	0.769	0.770	0.765	0.763
X _{Ab}	0.807	0.735	0.735	0.791	0.745	0.823	0.823	0.773	0.773

Calculation of temperatures using thermometer B. Pressure P is assumed.

P (kbar)	T (°C)									average	1σ
2	630	579	638	622	587	628	611	628	633	617	20
4	639	602	650	633	609	639	620	639	640	630	15
6	648	625	663	644	631	650	630	649	648	643	11
8	657	648	675	654	652	662	639	660	655	656	9
10	666	671	687	665	674	673	649	670	663	669	10

Table 3.4: Chemical analyses and proportional formula for run products (Poli, 1993) and results of temperature calculations using the geothermometers of Blundy and Holland (1994)

Microprobe analyses of run products (Poli, 1993)

Run-#	R8a	R5a	R11c
SiO ₂	44.63	46.44	47.17
TiO ₂	0.07	0.04	0.04
Al ₂ O ₃	13.57	10.68	12.96
FeO	13.36	12.21	11.1
Fe ₂ O ₃ *	3.71	3.39	3.08
MnO	0.07	0.64	0.02
MgO	9.54	10.76	11.33
CaO	11.1	10.64	10.43
Na ₂ O	2.24	1.86	2.56
K ₂ O	0.07	0.15	0.04
H ₂ O*	2.05	2.03	2.1
Total	100.41	98.84	100.83

Recalculation of microprobe analysis of amphiboles following method of Holland and Blundy (1994) with site-allocation following Robinson et al. (1982)

Si	6.534	6.846	6.746
Al	1.466	1.154	1.254
	8	8	8
Al	0.873	0.701	0.928
Ti	0.008	0.004	0.004
Fe ³⁺	0.408	0.458	0.380
Mg	2.082	2.364	2.416
Fe ²⁺	1.629	1.424	1.272
Mn	0	0.049	0
Ca	0	0	0
	5	5	5
Fe ²⁺	0.008	0	0.007
Mn	0.009	0.031	0.002
Ca	1.741	1.680	1.598
Na	0.242	0.289	0.394
	2	2	2
Na	0.394	0.243	0.315
K	0.013	0.028	0.007
	0.407	0.270	0.322

Compositions of coexisting plagioclase

X_{ab}^{plag}	0.75	0.8	0.8
X_{an}^{plag}	0.25	0.2	0.2

P-T conditions of experimental runs (Poli, 1993)

Run-#	R8a	R5a	R11c
P (kbar)	8	10	12
T (°C)	650	640	650

Results applying geothermometers (A) and (B)

1. Temperatures calculated by Holland and Blundy (1994; p.442)

(A) T (°C)	629	618	626
(B) T (°C)	633	629	631

2. Temperatures calculated using the Microsoft Excel macro programmed for this study with the equations given in the text

(A) T (°C)	629	618	629
(B) T (°C)	633	629	641

* Poli (1993) recalculated H₂O and Fe₂O₃ wt. percent on the basis of 2OH and Fe³⁺/Fe(total) = 0.2 in the formula, respectively