

**TABLE DR-4. Average muscovite compositions and grain sizes in selected crystalline rocks from the southern Black Hills**

	Sillimanite zone ---->						Staurolite zone ---->														
	S/N	SI-23	SI-25	SI-47	SI-103	SI-107	KB-2	ST-5	ST-15	ST-17	ST-18	ST-42	ST-45	ST-47	ST-60	ST-61	ST-68	ST-77	ST-87	ST-88	ST-103
Wt. %																					
SiO2	44.917	46.134	45.714	45.744	46.372	n.d.		46.050	46.105	45.748	45.616	46.246	45.923	46.316	45.497	45.448	45.744	46.502	46.699	46.187	45.857
TiO2	0.696	0.491	0.701	0.486	0.418	n.d.		0.324	0.332	0.429	0.705	0.564	0.344	0.451	0.358	0.542	0.546	0.559	0.531	0.341	0.467
Al2O3	35.911	36.029	35.845	35.962	35.757	n.d.		35.070	37.485	37.080	35.461	35.507	36.862	36.297	35.115	36.737	37.040	34.616	35.524	36.716	36.037
MgO	0.761	0.625	0.734	0.654	0.850	n.d.		0.939	0.364	0.405	0.795	0.868	0.468	0.613	0.634	0.636	0.515	1.023	0.713	0.492	0.664
CaO	0.005	0.000	0.000	0.001	0.003	n.d.		0.006	0.002	0.005	0.005	0.010	0.006	0.000	0.006	0.002	0.000	0.001	0.007	0.006	0.006
MnO	0.036	0.006	0.018	0.032	0.015	n.d.		0.005	0.013	0.017	0.031	0.013	0.022	0.005	0.008	0.000	0.054	0.031	0.007	0.006	0.007
FeO	1.245	1.314	1.207	1.249	1.529	n.d.		1.489	1.243	0.766	1.799	1.240	0.965	1.205	2.693	1.251	1.107	1.699	1.358	1.003	1.482
Na2O	0.417	0.465	0.736	0.730	0.436	n.d.		0.427	1.122	1.483	0.614	0.672	1.396	0.952	1.049	1.583	1.028	0.389	0.654	1.466	0.692
K2O	11.047	10.753	10.442	10.911	11.142	n.d.		10.825	9.501	9.092	10.681	10.664	8.945	10.367	9.751	8.759	9.754	11.287	10.784	9.650	10.316
BaO	0.194	0.226	0.187	0.267	0.265	n.d.		0.198	0.154	0.226	0.245	0.279	0.225	0.283	0.413	0.438	0.205	0.194	0.274	0.290	0.258
F	0.123	0.190	0.119	0.108	0.067	n.d.		0.327	n.d.	n.d.	0.094	0.101	n.d.	0.107	n.d.	0.100	0.087	0.170	0.126	0.121	n.d.
Cl	0.002	0.024	0.010	0.003	0.010	n.d.		0.004	n.d.	n.d.	0.013	0.012	n.d.	0.008	n.d.	0.000	0.000	0.018	0.004	0.002	n.d.
O = F	-0.052	-0.080	-0.050	-0.042	-0.028	n.d.		-0.138	n.d.	n.d.	-0.040	-0.043	n.d.	-0.045	n.d.	-0.042	-0.037	-0.072	-0.053	-0.051	n.d.
O = Cl	0.000	-0.005	-0.002	-0.001	-0.002	n.d.		-0.001	n.d.	n.d.	-0.003	-0.003	n.d.	-0.002	n.d.	0.000	0.000	-0.004	-0.001	0.000	n.d.
Total	95.302	96.171	95.661	96.104	96.833	n.d.		95.523	96.321	95.252	96.014	96.129	95.157	96.556	95.524	95.453	96.042	96.412	96.626	96.226	95.784
Cations per 24 O,OH																					
Si	6.022	6.109	6.080	6.077	6.117	n.d.		6.154	6.045	6.053	6.075	6.128	6.078	6.100	6.095	6.025	6.033	6.175	6.158	6.082	6.088
Al(iv)	1.978	1.891	1.920	1.923	1.883	n.d.		1.846	1.955	1.947	1.925	1.872	1.922	1.900	1.905	1.975	1.967	1.825	1.842	1.918	1.912
Total tetra.	8.000	8.000	8.000	8.000	8.000	n.d.		8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000	8.000
Al(vi)	3.696	3.732	3.698	3.707	3.676	n.d.		3.677	3.838	3.835	3.640	3.673	3.829	3.733	3.640	3.765	3.789	3.593	3.679	3.780	3.727
Ti	0.070	0.049	0.070	0.049	0.041	n.d.		0.033	0.033	0.043	0.071	0.056	0.034	0.045	0.036	0.054	0.054	0.056	0.053	0.034	0.047
Mg	0.152	0.123	0.146	0.129	0.167	n.d.		0.187	0.071	0.080	0.158	0.171	0.093	0.120	0.127	0.126	0.101	0.202	0.140	0.097	0.132
Fe	0.140	0.145	0.134	0.139	0.169	n.d.		0.166	0.136	0.085	0.200	0.137	0.106	0.133	0.302	0.139	0.122	0.189	0.150	0.110	0.165
Mn	0.004	0.001	0.002	0.004	0.002	n.d.		0.001	0.001	0.002	0.003	0.001	0.003	0.001	0.001	0.000	0.006	0.004	0.001	0.001	0.001
Total octa.	4.057	4.050	4.048	4.024	4.053	n.d.		4.063	4.080	4.044	4.069	4.038	4.064	4.031	4.105	4.084	4.067	4.040	4.022	4.021	4.070
K	1.889	1.816	1.771	1.849	1.875	n.d.		1.845	1.589	1.534	1.814	1.802	1.510	1.742	1.667	1.481	1.641	1.912	1.814	1.621	1.747
Na	0.108	0.119	0.190	0.188	0.111	n.d.		0.110	0.285	0.381	0.158	0.173	0.359	0.243	0.273	0.407	0.263	0.100	0.167	0.374	0.178
Ca	0.010	0.012	0.010	0.014	0.014	n.d.		0.010	0.000	0.001	0.013	0.014	0.001	0.015	0.001	0.023	0.011	0.010	0.014	0.015	0.001
Ba	0.001	0.000	0.000	0.000	0.000	n.d.		0.001	0.008	0.012	0.001	0.001	0.012	0.000	0.022	0.000	0.000	0.000	0.001	0.001	0.013
Total interl.	2.009	1.948	1.971	2.051	2.000	n.d.		1.967	1.883	1.928	1.986	1.991	1.881	1.999	1.962	1.911	1.914	2.022	1.996	2.011	1.939
Cations total	14.066	13.998	14.019	14.074	14.053	n.d.		14.030	13.963	13.971	14.055	14.029	13.946	14.030	14.066	13.995	13.981	14.063	14.018	14.032	14.009
Fe#	48.6	54.2	48.4	52.4	50.5	n.d.		47.1	66.0	52.0	56.4	44.7	54.1	52.6	70.5	52.5	55.9	48.7	51.8	53.5	55.6
Mg#	51.4	45.8	51.6	47.6	49.5	n.d.		52.9	34.0	48.0	43.6	55.3	45.9	47.4	29.5	47.5	44.1	51.3	48.2	46.5	44.4
Na#	5.4	6.2	9.7	9.2	5.6	n.d.		5.6	15.2	19.9	8.0	8.7	19.2	12.2	14.1	21.6	13.8	5.0	8.4	18.8	9.2
ppm																					
Sr	18.1	16.6	40.1	44.1	38.3	n.d.		52.1	122.6	75.2	38.3	29.4	118.9	49.5	108.0	133.0	78.9	24.0	79.6	51.8	77.0
Ba	1630	870	2010	2150	2340	n.d.		1490	1280	2050	2220	2600	1940	2300	3280	3930	1870	1680	1850	2460	2120
La	25	2	18	9	6	n.d.		44	10	18	15	20	30	7	31	34	29	11	14	18	39
Zr	68	90	107	137	78	n.d.		134	108	112	101	93	146	87	139	184	106	92	125	146	166
Y	6.9	1.6	4.9	3.5	3.4	n.d.		13.3	3.9	4.8	5.4	6.4	5.3	3.0	5.6	5.3	6.6	6.7	n.d.	n.d.	n.d.
Yb	0.2	n.d.	0.4	0.8	0.4	n.d.		1.3	0.7	0.5	0.9	0.6	0.3	0.7	0.5	0.7	0.7	0.9	n.d.	n.d.	n.d.
Cr	221	148	147	248	186	n.d.		118	168	89	180	147	134	142	99	119	150	98	201	209	141
Sc	71	36	34	42	47	n.d.		45	22	29	29	31	38	30	29	34	28	22	39	38	38
V	258	152	182	278	219	n.d.		164	172	184	185	174	232	170	185	356	180	112	205	226	118
Cu	59	33	21	13	36	n.d.		18	50	8	10	30	11	35	34	60	26	32	20	21	74
Mn	104	75	71	77	88	n.d.		202	2	40	107	169	46	220	98	114	45	202	29	24	298
Li	65	205	47	59	19	n.d.		255	44	n.d.	117	n.d.	19	31	38	31	27	67	14	19	33
Diam (mm)	0.258	0.353	0.224	1.068	n.d.	0.180		0.585	0.156	0.209	0.120	0.101	0.295	0.180	0.134	n.d.	0.179	0.156	0.116	0.174	n.d.
StdErr (mm)	0.041	0.045	0.026	0.061	n.d.	0.036		0.049	0.017	0.027	0.010	0.007	0.028	0.021	0.017	n.d.	0.037	0.015	0.015	0.012	n.d.
Thickn (mm)	0.059	0.078	0.028	0.221	n.d.	0.063		0.081	0.022	0.019	0.020	0.014	0.029	0.011	0.019	n.d.	0.021	0.021	0.012	0.021	n.d.
StdErr (mm)	0.009	0.008	0.003	0.036	n.d.	0.010		0.013	0.003	0.003	0.002	0.002	0.003	0.002	0.002	n.d.	0.001	0.002	0.001	0.002	n.d.

Notes: Major- and minor-element abundances (oxide wt.%) determined by Cameca SX-50 electron microprobe housed at Indiana University, Department of Geological Sciences (analysts: M. Dorais, T. Sinha, and P. Dahl).

Minor- and trace-element abundances (ppm) determined by Instrumentation Laboratories ICP spectrometer housed at Kent State University, Department of Geology (analysts: S. Feldmann, D. Wehn, and P. Dahl).

Fe# = [Fe/(Mg+Fe)]\*100; Mg# = [Mg/(Mg+Fe)]\*100; Na# = [Na/(K+Na)]\*100. Mean grain sizes determined in thin section from 10 representative grains, as measured by M. Pomfrey.

Abbreviations: S/N = sample number; Diam = mean diameter; Thickn = thickness; StdErr = standard error of the mean; tetra. = tetrahedral; octa. = octahedral; interl. = interlayer.

TABLE DR-4. Continued

ST-106	ST-107	ST-112	ST-116	T-27A	PR-1	IN-12	IN-21	IN-24	IN-25	Garnet zone GZ-85
45.615	46.485	45.636	45.809	n.d.	46.322	45.632	45.666	45.513	45.154	n.d.
0.434	0.296	0.471	0.383	n.d.	0.332	0.277	0.446	0.424	0.431	n.d.
35.030	34.908	34.992	36.158	n.d.	37.476	36.926	35.879	36.075	36.627	n.d.
1.093	0.766	0.751	0.479	n.d.	0.411	0.415	0.719	0.689	0.664	n.d.
0.023	0.006	0.008	0.000	n.d.	0.001	0.007	0.006	0.010	0.000	n.d.
0.064	0.035	0.029	0.000	n.d.	0.003	0.024	0.014	0.026	0.043	n.d.
1.632	2.539	2.459	2.177	n.d.	0.933	0.965	1.431	1.341	1.807	n.d.
0.618	1.664	1.390	1.555	n.d.	1.405	1.427	0.852	0.896	0.996	n.d.
10.334	9.302	9.294	9.110	n.d.	8.912	9.457	10.111	10.072	9.821	n.d.
0.186	0.294	0.468	0.491	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
n.d.	0.109	0.147	0.113	n.d.	0.062	0.086	0.450	0.472	0.404	n.d.
n.d.	0.004	0.010	0.019	n.d.	0.015	0.003	0.000	0.000	0.013	n.d.
n.d.	-0.046	-0.062	-0.048	n.d.	-0.026	-0.037	-0.190	-0.199	-0.170	n.d.
n.d.	-0.001	-0.002	-0.004	n.d.	-0.003	-0.001	0.000	0.000	-0.003	n.d.
95.026	96.360	95.590	96.242	n.d.	95.842	95.183	95.385	95.317	95.785	n.d.
6.114	6.158	6.103	6.065	n.d.	6.072	6.054	6.089	6.072	6.004	n.d.
1.886	1.842	1.897	1.935	n.d.	1.928	1.946	1.911	1.928	1.996	n.d.
8.000	8.000	8.000	8.000	n.d.	8.000	8.000	8.000	8.000	8.000	n.d.
3.647	3.607	3.618	3.707	n.d.	3.861	3.827	3.727	3.744	3.743	n.d.
0.044	0.030	0.047	0.038	n.d.	0.033	0.028	0.045	0.043	0.043	n.d.
0.218	0.151	0.150	0.095	n.d.	0.080	0.082	0.143	0.137	0.132	n.d.
0.183	0.281	0.275	0.241	n.d.	0.102	0.107	0.160	0.150	0.201	n.d.
0.007	0.004	0.003	0.000	n.d.	0.000	0.003	0.002	0.003	0.005	n.d.
4.100	4.069	4.090	4.081	n.d.	4.077	4.044	4.075	4.073	4.118	n.d.
1.767	1.572	1.586	1.539	n.d.	1.490	1.600	1.720	1.714	1.666	n.d.
0.160	0.427	0.360	0.399	n.d.	0.357	0.367	0.220	0.232	0.257	n.d.
0.003	0.015	0.025	0.025	n.d.	0.000	0.000	0.000	0.000	0.000	n.d.
0.010	0.001	0.001	0.000	n.d.	0.000	0.001	0.001	0.001	0.000	n.d.
1.940	2.015	1.972	1.963	n.d.	1.847	1.968	1.940	1.946	1.922	n.d.
14.040	14.084	14.062	14.044	n.d.	13.924	14.012	14.014	14.019	14.040	n.d.
46.6	65.3	65.0	71.8	n.d.	56.1	57.2	53.0	52.7	61.0	n.d.
53.4	34.7	35.0	28.2	n.d.	43.9	42.8	47.0	47.3	39.0	n.d.
8.3	21.4	18.5	20.6	n.d.	19.3	18.7	11.3	11.9	13.3	n.d.
116.3	103.9	300.0	82.0	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
2670	2760	20	3350	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
24	11	24	16	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
129	132	155	135	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
138	97	148	132	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
38	45	37	42	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
161	104	259	263	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
126	11	13	18	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
578	154	366	53	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
42	37	25	38	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
0.140	0.234	0.303	0.230	n.d.	0.230	0.133	0.136	0.115	0.116	0.070
0.013	0.029	0.040	0.022	n.d.	0.019	0.011	0.017	0.011	0.011	0.011
0.019	0.041	0.055	0.017	n.d.	0.027	0.016	0.019	0.019	0.015	0.010
0.003	0.007	0.005	0.002	n.d.	0.003	0.002	0.004	0.005	0.002	0.000