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COEXISTING PYROXENES IN SOME GRANULITE-FACIES GNEISSES FROM SOMERSET ISLAND [1]

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The Precambrian rocks of Somerset Island in the Canadian Arctic consist mainly of a variety of high-grade gneisses and granulites (Blackadar 1967). In 1964 and 1965, the University of Ottawa Arctic Expedition, led by D. L. Dineley, obtained information on the Precambrian geology between Stanwell-Fletcher Lake and Creswell Bay, and numerous specimens were collected. This report describes seven of the specimens and presents chemical data on the contained orthopyroxene and calcic pyroxene.

The rocks of the study-area consist of a variety of light to dark coloured gneisses, amphibolites, and migmatites, all of which consist of various combinations and proportions of quartz, plagioclase, potassium feldspar, orthopyroxene, calcic pyroxene, hornblende, biotite, and garnet. Sillimanite and kyanite are uncommon and sapphirine is rare. Rocks with hornblende and biotite are interlayed with rocks that do not contain these minerals, and all the rocks are assigned to the granulite facies.

The mineral assemblages and proportions found in seven specimens of gneiss are listed in table 1. The composition of the contained plagioclase ranges from An 30 to An 55.

TABLE 1. MINERAL ASSEMBLAGES AND PROPORTIONS (point-count analysis).

Reference number :	1	2	3	4	5	6	7
Specimen number	1	8	34	36	56	94	125
Quartz	26	28	5	—	—	—	—
Plagioclase	50	64	59	68	47	50	73
K feldspar	—	—	—	—	—	3	—
Orthopyroxene	7	3	18	11	12	9	8
Capyroxene	12	1	18	16	16	24	17
Hornblende	3	1	1	—	—	6	—
Biotite	1	1	—	1	23	—	—
Chlorite	—	1	—	—	—	—	—
Apatite	—	1	—	1	1	—	1
Magnetite, ilmenite	—	3	2	4	1	9	3

[1] Extract of a thesis by J.F. Giguère (1968).

Partial chemical analyses of the contained orthopyroxene and calcic pyroxene are given in Table 2.

The question of the distribution of Mg and Fe^{2+} between orthopyroxene and calcic pyroxene in metamorphic rocks has been considered by Kretz (1963) and others. The results from Somerset Island are shown in Fig. 1, and can be expressed by the equation,

$$\frac{X^H}{1-X^H} \cdot \frac{1-X^C}{X^C} = K_D = 0.60,$$

where X = Mg / [Mg + Fe^{2+}], and H and C denote orthopyroxene and calcic pyroxene respectively, and K_D is the distribution coefficient.. In specimens 1 and 7, Fe^{2+} is estimated from [Fe total]. The results agree with those obtained from granulite facies rocks in India by Howie (1955). The distribution of Mn between the pyroxene minerals is shown in Fig. 2, and can be approximately expressed by the equation $Y^H / Y^C = K_D = 1.16$ where Y = [Mn] / [Mg + Fe^{2+} + Mn]. These results also agree well with those obtained by Howie (1955).

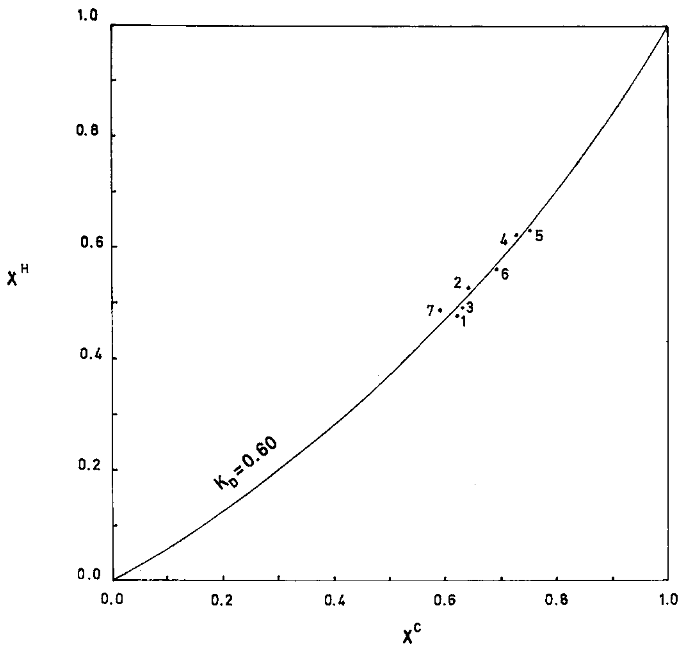

FIG. 1. The distribution of Mg and Fe between orthopyroxene (H) and calcic pyroxene (C) in gneisses from Somerset Island. X denotes atomic ratio Mg/Mg + Fe^{2+}.

TABLE 2. PARTIAL CHEMICAL ANALYSES OF ORTHOPYROXENE AND CALCIC PYROXENE.

	1	2	3	4	5	6	7
Orthopyroxene							
CaO	1.6	3.10	2.33	3.77	3.18	1.93	4.7
MgO	14.4	15.70	14.60	18.56	19.68	17.88	13.9
FeO	27.6 [1]	24.6	26.49	20.02	20.50	24.69	34.6 [1]
Fe_2O_3		1.35	1.43	0.40	1.35	1.37	
MnO	0.76	0.96	0.64	0.56	0.59	0.66	0.40
TiO_2	0.54	0.27	0.15	0.66	0.06	0.20	1.00
Calcic pyroxene							
CaO	17.9	20.32	20.69	21.02	20.81	21.50	18.37
MgO	11.6	11.42	10.90	12.73	12.81	12.15	10.55
FeO	12.6 [1]	11.57	11.44	8.37	7.59	9.66	12.9 [1]
Fe_2O_3		0.75	1.51	1.75	1.67	1.41	
MnO	0.39	0.50	0.32	0.30	0.27	0.30	0.23
TiO_2	0.32	0.25	0.26	0.26	0.19	0.39	0.26

[1] Total iron expressed as FeO.
E.L.P. Mercy, analyst.

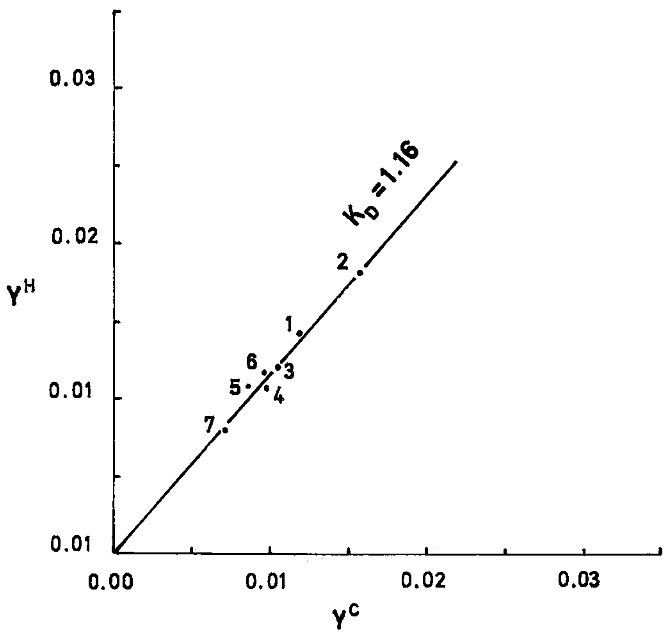

FIG. 2. The distribution of Mn between orthopyroxene (H) and calcic pyroxene (C). Y denotes atomic ratio $Mn/Mg + Fe^{2+} + Mn$.

The regular distribution of Mg, Fe^{2+} and Mn between orthopyroxene and calcic pyroxene in the Somerset Island gneisses provides further indication of the attainment of exchange equilibrium in high-grade metamorphic terrains in many widespread portions of the earth's crust.

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