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IRON KNEBELITE FROM THE NORDMARKITE OF SHEFFORD MOUNTAIN, QUEBEC

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According to Deer, Howie & Zussman (1962), the manganese-rich members of the olivine group have a paragenesis restricted to manganiferous ore bodies and metasediments. In particular, the knebelitic varieties ($Fa_{90}Te_{10}$—$Fa_{30}Te_{70}$) "can generally be related to metamorphic or metasomatic reactions" (Deer, Howie & Zussman 1962, p. 39). This note records an exception : the occurrence of primary iron knebelite in an intrusive syenite.

Aside from certain alkalic dykes, the youngest rock on Shefford Mountain, a Monteregian Hills alkalic intrusive complex situated 45 miles east-southeast of Montreal, is nordmarkite. Field, petrographic and chemical data suggest that the Monteregian rocks — in the case of Shefford, gabbros, diorites, monzonites and syenites — are related by magmatic differentiation (Gold 1967). The Shefford nordmarkite is composed of more than 90 vol. per cent perthite (grain size : 2-3 mm), the remainder consisting of quartz (3%) and three mafic silicates, which have been analyzed by the writer with the electron probe. One of these is an arfvedsonitic amphibole with CaO 5.4%, Na_2O 4.3% and MnO 3.8% (more complete data are given by Frisch 1970). Clinopyroxene is zoned from ferrohedenbergite ($Ca_{42}Mg_8Fe_{50}$) with Na_2O 0.93% and MnO 2.66% to aegirine-augite with Na_2O 2.71% and MnO 2.63% ; this mineral will be described fully elsewhere. The two minerals are generally found intergrown, with the amphibole partially replacing the clinopyroxene.

The third mafic silicate is iron knebelite $Fa_{86}Te_{13}Fo_1$ (Table 1), occurring predominantly as discrete grains up to 0.8 mm in size and comprising 1.5% by volume of the specimen studied. Many grains are heavily iddingsitised and where in contact with mantling clinopyroxene or amphibole, the iron knebelite is rimmed by iddingsite, suggesting that iddingsitisation occurred prior to the crystallisation of clinopyroxene.

The nordmarkite is an extremely fresh rock of clearly igneous aspect. No manganese-rich rocks are known from the vicinity. Thus it can scarcely be doubted that the iron knebelite is a product of magmatic crystallisation. The occurrence of this mineral, as well as the abundance of

manganese in the coexisting clinopyroxene and amphibole, attests to the remarkable degree of manganese enrichment reached in the Shefford differentiation sequence at the time of nordmarkite crystallisation.

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References

Deer, W.A., Howie, R.A. & Zussman, J. (1962) : *Rock-forming minerals.* Vol. 1. *Ortho- and ring silicates.* Longmans, Green, London, 333 pp.

Frisch, T. (1970) : Chemical variations among the amphiboles of Shefford Mountain, a Monteregian intrusion in southern Quebec. *Canad. Mineral.* **10,** 553-570.

Gold, D.P. (1967) : Alkaline ultrabasic rocks in the Montreal area, Quebec. In *Ultramafic and related rocks* (Ed. P.J. Wyllie). John Wiley & Sons, New York, 288-302.

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Table 1. Microprobe Analysis of Iron Knebelite.

SiO_2	29.5	Cations on the	Si	0.995	
FeO *	61.4	basis of	Fe	1.728	2.01
MnO	9.12	4 oxygens	Mn	0.260	
MgO	0.45		Mg	0.022	
Total	100.5				
		Mol. per cent	Fa	86.0	
			Te	12.9	
			Fo	1.1	

* Total Fe as FeO.
Not detected at the 0.02 wt. % level : Al, Ti, Ca and Na.