Characterization and origin of dunitic rocks in the Ni-Cu sulfide-bearing Kevitsa intrusion: whole-rock and mineral compositional constrains

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The ca. 2.06 Ga mafic-ultramafic Kevitsa intrusion is located in the Central Lapland greenstone belt (CLGB). A large disseminated Ni-Cu-PGE sulfide ore deposit occurs within the ultramafic olivine-pyroxene cumulates. The intrusion is associated with a separate km-sized dunitic body (termed the Central Dunite) with an overall discordant relationship to the Kevitsa intrusive succession. In addition, dunitic and related ultramafic rocks occur as numerous inclusions within the Kevitsa intrusion, being most common in the mineralized zone. Two distinct types of inclusions are recognized: i) cumulate-textured (termed the Kevitsa Dunite) and ii) recrystallized ultramafic inclusions.

The Central Dunite and Kevitsa Dunite are texturally and mineralogically similar olivine-chromite cumulates and show comparable whole-rock and mineral compositions, suggesting that they are cogenetic. The parental magmas for the dunitic cumulates were probably picritic and relate to the picritic and basaltic volcanic rocks in the CLGB. The whole-rock major and trace element data and mineral compositions of the dunitic cumulates and Kevitsa olivine pyroxenites fall on the same linear trends and both record similar REE characteristics, indicating a genetic link between these two. A two-stage magmatic model is proposed to explain the field characteristics and compositional trends in the dunitic cumulates and Kevitsa ultramafic rocks.

Whole-rock and mineral chemical characteristics of the recrystallized inclusions suggest that they represent clasts of dunitic cumulates and dehydrated (komatiitic) metavolcanic country rock xenoliths. A decrease in the flow rate of the Kevitsa magmas due to entrapment of a high number of inclusions is proposed as a mechanism to promote concentration of sulfides, contributing to the formation of the Ni-Cu-PGE ore.