Metal Mobility and Hydrothermal Alteration within the Kevitsa Ni-Cu-PGE deposit, Lapland Finland

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The Kevitsa Intrusion in Lapland, Finland is host to a large, disseminated magmatic sulphide Ni-Cu-Pt-Pd deposit. A published resource of over 250Mt @ 0.30%Ni, 0.41%Cu, 0.21 gpt Pt, 0.15 gpt Pd, 0.11 gpt Au is presently being mined. The ores consist of a pyrrhotite-pentlandite-chalcopyrite assemblage with PGEs within mainly Bi-tellurides and sperrylite. Nickel and copper grades are high tenor; typically 4-7%, but can be as high as 20% in some ore lenses. Mineralization occurs in the centre of the intrusion as opposed to along the basal contact where most magmatic deposits typically concentrate. Host rocks to mineralization are olivine-pyroxenite and olivine-websterite. Two large dunitic bodies occur in the centre of the Intrusion and, in places, along the basal contact. Dunitic inclusions, up to several 10s of metres in size, also occur within the intrusion. The genetic relationship between these olivine-rich rocks to mineralization or other ultramafic rock units is contentious.

In several areas, the intrusive rocks have been altered to an amphibole dominated assemblage. The intensity is difficult to assess visually so the distribution is poorly constrained. Iron, as magnetite, appears to be mobilized during the hydration of pyroxene to amphibole so mapping magnetic susceptibility can be used as a mapping tool. Platinum Group Minerals have been found within amphibole, but this likely only characterizes local mobilization. XRD analyses reveal serpentine is much more abundant than visually estimated. Rocks that have been serpentinized in general are depleted in Ni, Cu, Pt and Pd.

Copper-rich veining associated with gabbroic dykes, carbonate veins and roddingite masses cross-cut the disseminated ores. The mineral assemblage is typically pyrrhotite-chalcopyrite-magnetite. Pt and Pd are also locally enriched. The dykes and veins are typically 1-2m in size, but can be >5m. A preferred orientation is not apparent; however most are too thin to correlate between diamond drill holes therefore the distribution is not well constrained spatially. Similar Cu-dominated vein mineralization has been recently discovered along the margins of the Kevitsa Intrusion within the Gabbro Unit. Gold is also enriched with Cu in these areas. At one location, Lipatti, Cu-rich veins also occur within the surrounding sedimentary rocks. Enrichment of Ag, As, and Mo with Cu-Au suggests metals from the surrounding sediments have been incorporated.

The Cu-PGE association in the veins and surrounding wallrocks may reflect a deuteritic origin, but the amphibole alteration is intensely developed where veining is prominent. Antigorite within the Cu veins is locally present and may indicate an association exists between the hydration event producing amphibole and serpentinization of the dunitic inclusions within Kevitsa Intrusion. The Cu-rich nature of this secondary mineralization may also support a hydrothermal mobilization of metals from the main disseminated Kevitsa orebody has occurred. This presents a different style of mineralization that can be targeted for future exploration at Kevitsa and other similar intrusions.