Variation in Vein Mineralogy and Mineral Chemistry around the Marathon Cu-Pd Deposit, Ontario: Insights into the development of an exploration tool

M. Brzozowski[1], I. Samson[1], J. Gagnon[1], R. Linnen[2], D. Good[3], D. Ames[4]
[1]Department of Earth and Environmental Sciences, University of Windsor, Windsor, ON, Canada; [2]Department of Earth Sciences, Western University, London, ON, Canada; [3]Stillwater Canada Inc., Hamilton, ON, Canada; [4]Geological Survey of Canada; Ottawa, ON, Canada

Abstract

The Marathon Cu-Pd deposit is hosted within the Two Duck Lake Intrusion (TDLI), a late-stage phase of the Eastern Gabbro in the Coldwell Complex. Late-stage chlorite ± calcite veins are present throughout the Marathon deposit, indicating sub-solidus movement of fluids throughout mineralized and unmineralized rocks. Metals may have been remobilized at this stage of the system, and evidence of that mobility may be recorded by the chemistry of vein minerals. Chlorite and calcite veins were obtained from drill cores spanning the length of the deposit and represent variable amounts of mineralization. Chlorite occurs as very fine-grained, bladed crystals in massive, radiating, or aligned aggregates. Energy-dispersive spectroscopy (EDS) and Electron Probe Microanalysis (EPMA) were used to identify the chlorite species as chamosite and clinochlore. LA-ICP-MS was carried out on a large population of samples spanning the entire deposit. Transition metals are detected in all chlorite veins, whereas metalloids are only detected in a subset of samples. In individual veins crosscutting plagioclase and pyroxene, the major and transition element concentrations remain the same, however, where individual veins cut magnetite, altered olivine, and pyrrhotite, they show distinct changes in some transition metal concentrations (e.g. Ti, V) indicating that chlorite chemistry can be controlled on a very local scale. As a function of proximity to mineralization, major elements showed no variation above or below mineralization; however, the concentrations of Co and Ni are higher above mineralization. Manganese concentrations in chlorite increase linearly towards mineralization, whereas Co, Ni, Cu, and Zn decrease. Applying this method as an exploration tool must take into consideration grain scale variations in chlorite because controls on its chemistry at such a small scale may invalidate its applicability as an exploration tool, however, preliminary results suggest that the chemistry of chlorite does vary as a function of proximity to mineralization.