# Petrography and Geochemistry of Oxide Minerals in the Marathon Pd-Cu deposit, Coldwell Complex, Northwestern Ontario

**MJ Brzozowski[1], IM Samson[1], JE Gagnon[1], DJ Good[2], RL Linnen[2]**

[1]Department of Earth and Environmental Sciences, University of Windsor, Windsor, Ontario; [2]Department of Earth Sciences, Western University, London, Ontario

The Marathon Cu-Pd deposit is hosted by the Two Duck Lake Intrusion (TDLI), a late phase of the Eastern Gabbro (EG) in the Coldwell Complex. The EG is subdivided into the Fine-Grained Series, Layered Series, and Marathon Series, with the latter hosting all of the Cu-PGE mineralization. Magnetite is ubiquitous in all rock series, which, along with the sensitivity of magnetite chemistry to its environment of crystallization, make it a suitable mineral to help understand the genesis of the EG and the mineralization. Magnetite is disseminated in most gabbros, but can occur in (semi-)massive layers. Three types of magnetite are present. Interstitial, magmatic magnetite always contains very fine lamellae of Fe-Ti oxides ≤ 1 μm across. Analyses therefore represent a mineral mixture rather than homogeneous magnetite, which has implications for the internal standard chosen for LA-ICP-MS. Thick (5-20 μm) lamellae and euhedral to subhedral crystals of ilmenite are also typically present in the magnetite. Myrmekitic magnetite is present in orthopyroxene rims on olivine and similarly contains very fine lamellae of Fe-Ti oxides and crystals of ilmenite. Late magnetite is less abundant than interstitial magnetite and lacks exsolution. It commonly occurs as a replacement of sulphides, but can occur in patches and veinlets in silicates. Preliminary LA-ICP-MS analyses of magnetite and ilmenite show that late magnetite has distinguishably lower concentrations of trace metals, except for Ge, Pb, and Th, which are present in greater concentrations. Magnetite hosted by Fine-Grained Series has distinctly higher Cr, Ni, and Pt concentrations of the EG. Those hosted by Layered Series have distinctly higher Mo and Pd concentrations. Magnetite hosted by Marathon Series has intermediate concentrations of these elements. Ilmenite hosted by Fine-Grained Series has distinctly higher V, Cr, Ni, and Ge concentrations of the EG, whereas those hosted by Layered Series have distinctly higher Zn, Mo, Cd, Ta, and Au concentrations. Ilmenite hosted in Marathon Series has intermediate concentrations of these elements. Magnetite hosted by mineralized TDLI has distinctly higher Cr and Ni concentrations, but lower Mo than those hosted by barren TDLI, whereas ilmenite hosted in mineralized TDLI shows consistently higher concentrations of V, Cr, Ni, and Ge, but lower Mo, Ta, and W. These results suggest that oxide chemistry can distinguish between various rock series and between barren and mineralized TDLI.