Predicting stable metamorphic assemblages in P-T space using phase equilibria modelling and characterization of mafic metavolcanic rocks south of Detour Lake Mine

M Bouchard[1], D Tinkham[1],

[1]Mineral Exploration Research Centre, Department of Earth Sciences, Laurentian University, Sudbury, ON Canada

Petrographic analysis of samples collected in proximity to a gold mineralization zone has revealed four dominant metamorphic rock types in rocks previously interpreted as mafic metavolcanics. The groups based on metamorphic assemblages and fabric are composed of: 1) Amphibole-Epidote Hornfels and Amphibole-Quartz-Epidote Schist, 2) Chlorite-Epidote-Quartz Hornfels and Chlorite-Epidote Schist, 3) Quartz-Biotite-Chlorite Schist and Quartz-Chlorite-Calcite Schist and 4) Plagioclase-Calcite-Epidote Hornfels and Plagioclase-Chlorite Schist. Differences in metamorphic assemblages occur above, below and within an interpreted shear zone and there is an apparent correlation between abundance of chlorite and carbonate bands with fabric intensity. Metamorphic grade is estimated as upper greenschist to middle amphibolite facies. Phase equilibria modelling of sample 075-009 from the Amphibole-Epidote Hornfels group containing metamorphic amphibole, epidote, chlorite and quartz in the presence of an H_2O-rich fluid, predicts chlorite to be stable only at temperatures below 510-540 °C. The chlorite in this sample is dominantly within discrete mm-cm scale mylonitic shear bands containing porphyroclastic amphibole that crosscut a weak fabric defined by aligned amphibole. The chlorite locally replaces porphyroclastic amphibole and is interpreted to have formed after the peak-metamorphic amphibole indicating peak metamorphism reached temperatures in excess of prograde chlorite stability at 510-540 °C and that localized simple shearing and H_2O introduction produced chlorite during retrograde or downgrade metamorphism. Further work is underway to determine if the larger zones of chlorite-rich rocks nearby experienced the same history of deformation and fluid infiltration as did thin shears in sample 075-009 or if chlorite-rich assemblages in these rocks simply reflect stability of chlorite at peak metamorphic conditions due to differences in bulk rock composition.