Brecciation and anatexis in the South Range of the Sudbury Igneous Complex

C-A Généreux, **DK Tinkham**, **B Lafrance**

Mineral Exploration Research Centre, Harquail School of Earth Sciences, Laurentian University, Sudbury, Ontario

Breccias in the thermally metamorphosed footwall basement rocks of the 1.85 Ga Sudbury Igneous Complex (SIC) are often spatially associated with PGE mineralization, but how they exactly formed remains unresolved. Breccias near the SIC contact either formed by shock brecciation during the Sudbury impact event, by partial melting during the cooling of the SIC, or by a combination of both processes. The matrix of some breccias has an igneous texture, suggesting a melt component in their formation, but the origin of this melt remains unresolved. This study reports on detailed mapping of well-exposed breccias in the immediate footwall (<200 m) of the SIC contact in the southwest corner of the Sudbury impact structure. The outcrop comprises brecciated basaltic and rhyolitic rocks that were metamorphosed to pyroxene hornfels facies conditions, as indicated by the presence of recrystallized pyroxenes with granoblastic textures within metabasaltic rocks containing veinlets of metamorphosed impact-generated Sudbury Breccia. Metarhyolite is extensively brecciated and could be interpreted as Sudbury Breccia or as metamorphosed primary flow-top breccia. Leucocratic amphibole-plagioclase patches and veinlets in the metabasaltic rocks represent textural evidence of anatexis, which further supports high-temperature metamorphic conditions. In the metarhyolite, feldspar-blue quartz patches have distinct boundaries and can also be interpreted as partial melt. These crystallized partial melts surround blocks of the adjacent country rocks and thus enhance the brecciated aspect of both the metabasaltic and metarhyolitic rocks. Discontinuous sub-meter wide dikes intrude the metabasaltic unit, but are seemingly absent from the metarhyolite. These dikes contain subangular to subrounded clasts in a medium-grained igneous matrix dominated by plagioclase, quartz and biotite. These dikes have sharp contacts with well-defined biotite-rich rims and are interconnected with partial melt patches and veinlets in the surrounding rocks, suggesting that they formed from partial melt extracted from the immediate host rocks. Alternatively, they could represent externally derived melt that was injected into the host rock and was subsequently thermally metamorphosed. This study will integrate mapping, petrography, whole rock geochemistry and phase equilibrium modelling to determine the role of metamorphism and anatexis in the formation of the breccias and clast-bearing dikes found in the proximal footwall of the SIC, and will assess the role of breccias in the formation of low-sulphide PGE mineralization (if any). Ultimately, the results of this study will further our understanding of the footwall basement rocks in the South Range that host PGE mineralization.