
**Constraining the origin of metals and mechanisms
of metal precipitation in the Bushveld Complex,
South Africa: a fluid and melt inclusion study
of pegmatites below the Merensky reef.**

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There are two commonly referenced models describing the origin of metals and mechanisms of metal precipitation in magmatic Ni-Cu-PGE (platinum-group element) reef-type deposits: (i) magmatic mixing and sulfide liquid settling, whereby sulphide liquid saturation and PGE enrichment of the sulphide liquid occurs by silicate melt and sulphide liquid mingling, followed by sulphide mineral settling and (ii) volatile fluid percolation, whereby saline fluids or vapour migrate upward through the lower units of the complex, extracting metals and sulphur, and re-precipitating them higher in the sequence. Hydrous silicate minerals, hydrous silicate melt inclusions, and saline aqueous fluids in the Merensky reef pegmatites are spatially associated with PGE-rich base metal sulphide minerals. Characterization of this association is imperative in constraining the mechanism for precious metal transportation and precipitation. The motivation for this study is to constrain (i) the chemical conditions and timing of formation of silicate pegmatite and associated volatiles contained within them as fluid inclusions; and, (ii) the amount of metal transported by fluids at the time of pegmatite formation. A revised model for the formation of the reef horizons and their associated PGE tenor is proposed that integrates the magmatic and hydrothermal models.

Data for the study are being collected via (i) microthermometric study of fluid inclusions in accessory primary (magmatic) and secondary (post-cumulus) quartz in the pegmatite; (ii) argon-argon dating of biotite; (iii) SEM analysis of accessory and precious metal (PGE) phases occurring as inclusions in the base metal sulphide minerals within the pegmatite; (iv) LA-ICPMS data of ore metals within fluid and melt inclusions; (v) Cl and O isotope data for magmatic minerals that grew in the pegmatite.