Layered mafic-ultramafic intrusives, basal segregations of Ni–Cu–Co

Province Blank
Potential: **Certainty:**

Critical Elements (Assessment Criteria)	Identified	Not Identified, but likely	Unlikely	Weighting
Setting				
• Pre, syn or post orogenic mafic-ultramafic bodies, including large anorthositic plutonic complexes, derived from Proterozoic mantle plumes intersecting an intraplate rift, • Mantle plume activity and rifting may be associated with pre–existing collisional zones, • less significant bodies in Archaean cratons.				
Source (fluid, metal, energy)				
Fluids • Nil • *Metals (including sulphur)* • Mafic ultramafic melts for Ni, Cu • Source of sulphur *Energy* • Multiphase igneous intrusive activity • •				

Fluid pathway				
• Mafic–ultramafic intrusives in vicinity of deep crustal faults • ▪				
Trap (any of the following)				
• Narrowing magma feeder conduits, feeder dykes, especially at the point of entry of conduits into magma chamber. • Depressions or structural embayments of the footwall contact beneath the thickest sequence in mafic or mafic-ultramafic cumulates or in feeder conduits. • Significant part of intrusion is S saturated. • Evidence for S contamination by assimilation of country rocks – S-isotope composition outside normal magmatic values – Sulphides in country rock. – Sulphates and carbonaceous material in country rock – Mixed Sm-Nd and Re-Os isotopes – Different crystal fractionation trends in the same magmatic province •				
Signs of mineralising process (any of the following, but if occurrences have been identified the level of certainty increases) • Massive and disseminated pyrrhotite-pentlandite-chalcopyrite±pyrite±magnetite assemblages with low to moderate concentrations of PGEs (<0.6ppm) near the base of the intrusives. • Sulphides concentrated in conduits at entry point to magma chamber. • Widespread presence of disseminated sulphides				

throughout intrusive. • Evidence for early S saturation of magmas (for basal sulphides) by crustal contamination or falling temperatures of magma. – S saturated parent magma from chilled rock margins, comagmatic dykes, sills. • Chemical/mineralogical evidence for interaction with country rock e.g. – fractionated character of mineralised marginal rocks; – alteration and abundance of xenoliths and xenocryst near base. • Known occurrences of Ni, Cu, PGEs • geochemical anomalies • geophysical anomalies • Large R factor - Evidence for interaction of sulphide melt with large volumes of silicate melt by passage of large volumes of magma or magma mixing. • Ni depletion trends of crystallising silicates and sulphides (variation of Ni with forsterite in olivine: Naldrett 1989)				
Age				
• Archaean to Proterozoic: 2.9-1.3 Ga; Voisey's Bay (1.3 Ga), Vammala (1.8 Ga), Sally Malay (1.8 Ga), Radio Hill (2.9 Ga), Musgrave (1.08 Ga). • Possible younger Phanerozoic extrusives??				
Preservation				
• Need preservation of magma conduits.				