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Significance of Metal Tenor Variations in Cu-PGE deposits of the Coldwell Alkaline Complex, Canada: an Exploration Tool

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The spatial and compositional relationships for 15,000 assays from 11 mineralized zones within 5 deposits are compared to assess the significance of local tenor fluctuations as an exploration tool in the Coldwell Alkaline Complex. Four of the deposits, including the Marathon deposit [1], occur within thin, tabular or irregularly-shaped intrusions that cut a sequence of mafic meta-volcanic rocks along the northern and eastern margins of the complex, at or just above the contact with Archean rocks. The fifth deposit is located closer to the middle of the complex. The deposits are proposed to be co-genetic and were cut by cycle I syenitic intrusions of the Coldwell formation event. The host rocks for the deposits consist of ophitic gabbro and pegmatite; apatitic clinopyroxenite; and augite troctolite. Mineralization consists predominantly of disseminated assemblages of chalcopyrite ± pyrrhotite ± bornite. The abundance of PGE at each deposit increases with increasing proportions of chalcopyrite or bornite relative to pyrrhotite.

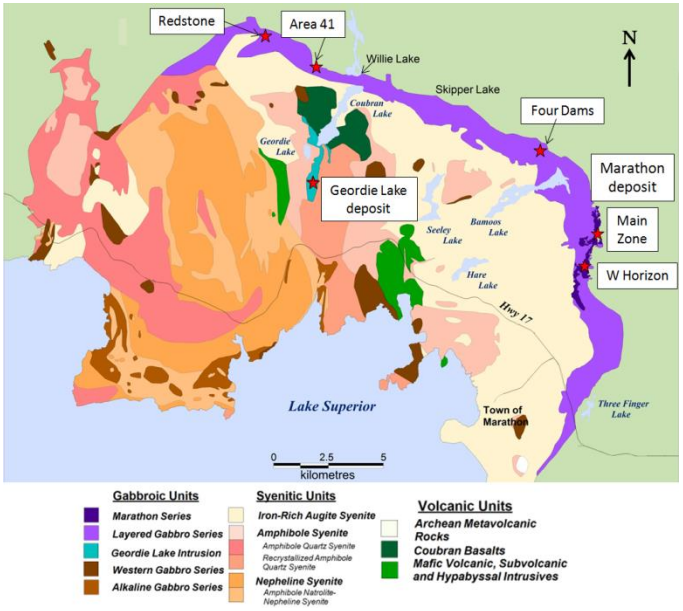

Figure 1: Geology of the Coldwell Alkaline Complex [4]

Trends for metal abundances across mineralized intervals in all zones, except for the W Horizon at Marathon, show a correlation between Cu, Pd, Pt and S. But metal tenor (metal/S) and/or Cu/Pd in these sections commonly exhibit saw-tooth patterns that change gradually up through intrusions with sharp steps occurring within and between individual zones. Mineralized intervals that exhibit increasing Cu, S and Pd with decreasing Cu/Pd are consistent with models for accumulation of sulphides from magma at a fixed R-factor (cf. Barnes et al. [3]). Step-like changes in Cu/Pd or Cu/S within a zone are interpreted to represent individual pulses of sulphide-bearing magma with an inherent R-factor attribute.

Taken together, the range of Cu/Pd for all samples in a mineralized zone represents the cumulative history of individual magma pulses. Contouring the data for each zone by point density defines a characteristic shape and trend line for the zone, the slope of which is dependent on the total range of R-factors for the accumulated magma pulses. Shallow-dipping trend lines indicate a simple intrusive history with magma pulses having a limited range of R-factors. Steeply negative trend lines extending

from the Cu-depleted to the Pd-enriched fields represent magma pulses with a very broad range of R-factors and indicate a very dynamic intrusive history. The W horizon and top zones at Area 41 exhibit the latter style and contain the highest Pd abundances in the Coldwell Complex.

References:

[1] Good DJ et al. (2015) Econ Geol 110: 983-1008

[2] Ruthart R (2012) MSc thesis, University of Waterloo, 145p

[3] Barnes S-J et al. (1993) Econ Geol 88:1402-1418

[4] Walker et al. (1993) Ontario Geological Survey, OFR 5868