Mineralogical and Geochemical vectors to ore zones: a case study of the Canadian Malartic gold deposit footprint, Québec

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Canadian Malartic represents an important example of a large-tonnage, low-grade gold deposit in the southern Superior Province. It is located in the Pontiac Subprovince, in contact with, and immediately south of the east-west trending Cadillac-Larder Lake fault zone, marking the contact with the Abitibi Subprovince. Most gold deposits in the Abitibi Greenstone Belt are of orogenic type and are typically associated with quartz-carbonate veins and albite-carbonate alteration. Canadian Malartic contrasts with these deposits in that the gold is disseminated in potassically altered (pyrite-K-feldspar-biotite-calcite) quartz monzodiorite porphyries and adjacent clastic metasedimentary rocks. Mineralization is associated with quartz-biotite-carbonate-microcline±pyrite veinlets with potassic (biotite, K-feldspar) and pyritic alteration haloes, and is distributed as elongated, lens-shaped orebodies, strongly controlled by faults and lithological contacts. Hydrothermal alteration in clastic metasediments was accompanied by mass gains in S, LOI and K, consistent with the mineralogical characteristics of the alteration assemblage. Gold mineralization in metagreywacke is associated with substantial mass gains in Ag-Te-Bi-Mo-Pb-W. These observations can be used to trace the extent of the ore deposit footprint and provide vectors towards mineralization. Core-logging, whole-rock geochemistry as well as variation in gold concentrations show that the intensity of hydrothermal alteration decreases sharply away from the deposit. Biotite compositions are a potentially valuable footprinting tool to identify directional vectors toward mineralization, as they show significant increases in fluorine and magnesium concentrations from distal unaltered rocks toward the ore shell. Preliminary results indicate that the visible alteration halo (*e.g.*, pyritisation, carbonation or potassic alteration) does not extend more than 500 meters from the southern limit of the pit.

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