

Pyrite Generations and the Evolution of Gold Mineralization at the Martiniere Gold Deposit, Northern Abitibi, Canada

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The Martiniere deposit is an undercover gold deposit located at the northern extent of the Abitibi greenstone belt, 45 km east of Agnico Eagle's giant Detour Lake mine. The deposit is hosted by northeast-striking, intercalated mafic flows and pillowed flows, mafic to intermediate pyroclastic and pelitic sedimentary units metamorphosed to lower greenschist facies. The objectives of this study are to determine the relative timing of gold and associated sulphide mineralization and reconstruct the geochemical evolution of ore-forming fluids. Review of drill core and thin sections indicate a multi-stage vein and mineralization history. The first hydrothermal event produced dolomite crustiform-colloform veins, developed along structures at high-angle to bedding with some occurring along bedding planes. The textures indicate this is an epizonal event, likely produced by syn-volcanic hydrothermal activity in a shallow setting. Gold mineralization is hosted in steeply dipping quartz-sulphide veins in silicified shear zones, which locally cut the crustiform dolomite veins, and occurs mainly as inclusions in pyrite. Sphalerite, galena, and chalcopyrite commonly accompany high-grade gold mineralization but do not form the principal economic sulphide assemblage. Late sterile bull quartz veins cut all earlier vein generations and likely record a later, deeper stage of hydrothermal evolution. LA-ICP-MS traverse analyses of 24 samples collected from high-grade gold intervals from drill core across the main mineralized zones indicate at least two generations of pyrite. Gold is variably distributed in an early pyrite generation that is rimmed by a later, inclusion-free, gold-poor pyrite. Preliminary trace-element results suggest that the Au-bearing pyrite may be arsenian, consistent with a model in which negatively charged gold bi-sulphide species were adsorbed onto positively charged growing pyrite surfaces. This study helps constrain the temporal and geochemical evolution of gold mineralization at Martiniere and, more broadly, in the northern Abitibi, which is becoming increasingly prospective for gold exploration.