Geochemical Characterization of Hydrothermal Fluids, Alterations and Mineralization at Hardrock Orogenic Gold Deposit, Geraldton, Ontario, Canada

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The BIF-hosted Hardrock orogenic gold deposit, Geraldton, Ontario, is located in the Superior Province at the contact between the Eastern Wabigoon and the Quetico subprovinces and was recently demonstrated to contain at least 123 tons of gold. The gold mineralization is associated with compressional deformation caused by multiple Archean tectonomagmatic and tectonometamorphic events and thus has a polyphase mineralization history. Neoarchean subduction magmatism initiated regional geothermal gradients which kept developing during regional metamorphism and deformation. The close association of mineralization with quartz-feldspar porphyry (QFP), intermediate tonalite and monzonite intrusions point towards the contribution of magmatic-hydrothermal fluids whereas greenschist-facies metamorphism led to devolatilization and hydrothermalism which also contributed to mineralization. Hydrothermal alterations studied in Algoma-type BIF, siltstones and mudstones, QFP, monzonite, tonalite, lamprophyre and quartz / quartz-tourmaline veins with and without visible gold include iron oxide alteration, sericitization, carbonatation, sulfidation, biotitization and chloritization. Preliminary results on fluid inclusion work show the presence of liquid-rich and vapor-rich inclusions and suggest that boiling has occurred. Further freezing-heating experiments may allow distinguishing magmatic and metamorphic fluid salinities and temperatures. Approximately 15 grains of visible gold are being analyzed by laser ablation ICP-MS and their trace element content may or may not support multiple sources for the gold. Whole rock analyses allowed establishing correlation of gold concentration with K_2O, TiO_2, Li, Cd and REE supporting the role of alkali metasomatism in the mineralization process. Furthermore, the whole rock analyses also suggest that gold was partly remobilized by groundwater during the 2.7 Ga that followed its emplacement and may now be adsorbed to clay minerals such as halloysite or smectite-group minerals in addition to the its presence as a native element and with pyrite.