

Host rock setting and timing of high-grade gold mineralization in the Neoproterozoic Central Hearne Domain, Whale Cove, Nunavut, Canada

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Abstract

The Neoproterozoic Kaminak Greenstone Belt (2.7 – 2.6 Ga) located in the Whale Cove area of western Hudson's Bay is in the Central Hearne Domain of the Western Churchill Province. It has great lode gold potential and hosts several known gold deposits. The rocks record both Neoproterozoic 'Kenoran' (2.6-2.5Ga) and Paleoproterozoic 'Hudsonian' (2.0-1.85 Ga) orogenic events. The genesis of the lode gold mineralization is hotly debated as to whether Au is concentrated in the Kaminak belt during older Neoproterozoic metamorphism and plutonism or remobilized during the Paleoproterozoic (1.85Ga) tectonothermal events or yet a combination of older and younger events. The objectives of our research are to answer critical exploration questions regarding the nature and timing of mineralization. The investigation includes, (i) identifying the igneous lineage of ferrodiorite and quartz feldspar porphyry host rocks, (ii) establishing the absolute age of host intrusions and the relative timing of gold mineralization, and (iii) documenting the nature of secondary hydrothermal alteration related to gold mineralization. Detailed petrographic work demonstrates strong chloritic ± silicic alteration of diorite and albite + sericite-carbonate alteration of felsic quartz feldspar porphyry proximal to ore zones. Geochronology (U-Pb on zircons) has been completed on pre-mineralization granitic plutons (2683±4Ma), felsic porphyry stocks (2695±7Ma) and diorite plugs (2668±6Ma), providing a maximum age of the gold mineralization. Ar-Ar multiple step heating analysis of biotite in an unaltered lamprophyric dyke crosscutting mineralized rocks (1812±2 Ma) was also completed establishing a minimum age for the gold mineralization. The composition of primary igneous and secondary hydrothermal mineral assemblages is currently being documented by microprobe analysis of carbonate, chlorite and amphibole. Mass loss and gains from fresh host rocks to hydrothermally altered rock are being assessed with whole rock and trace element geochemical analyses. The final goal of this project is to place the gold mineralization within the complex regional tectonic framework.