Hydrothermal Characterization of the West Gore Sb-Au Deposit, Meguma Terrane, Nova Scotia, Canada[1]

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The West Gore Sb-Au deposit is anomalous in the Meguma terrane of Nova Scotia because of its enrichment in Sb, a metal that is essentially absent from other Meguma gold deposits. The deposit is hosted by graphitic and sulfide-bearing slates of the lower Paleozoic Halifax Formation that were deformed into a northeast-trending, upright, closed syncline and metamorphosed to the greenschist facies during the regional Acadian orogeny (ca. 400 Ma). Mineralized veins at the deposit define a single structure trending 110° that probably formed the dextral component of a conjugate shear system as part of regional, northwest-directed compression. The veins crosscut a penetrative regional schistosity (S_1) in the host slates and vein formation is constrained by (1) the presence of cleaved wall-rock slates in the veins, (2) vein-related sulfides overgrowing the S_1 fabric in wall-rock fragments, and (3) a 370 Ma $^{40}Ar/^{39}Ar$ plateau age for hydrothermal muscovite. Mineralization occurs as stibnite, native antimony, aurostibnite, Au-Sb alloys, and Au-Sb-O phases in vein quartz with associated Fe, As, Pb, Zn, Cu sulfides and chlorite-carbonate gangue; wall-rock alteration is variably developed as narrow zones peripheral to veins enriched in sericite, calcite, sulfides, tourmaline, and chlorite. Early stages of mineralization are constrained to maximum temperatures of 495°C from arsenopyrite geothermometry; but lower temperatures are recorded by chlorite geothermometry (350°-390°C). Textures of vein quartz include comb and plumose varieties with a bimodal grain size and also a coarser, anhedral quartz. Fluid inclusion studies indicate that the fluid was a mixed H_2O-NaCl-$CaCl_2$-CO_2-CH_4 type and that fluid unmixing occurred, albeit in minor amounts. Thermometric measurements reveal maximum T_h of 375°C and a range of salinities (0.4-28.1 wt% NaCl equiv). The volumetric properties of fluid inclusions reflect cycling of fluid pressures with supralithostatic pressures (to 4-5 kbars P_{fluid}) recorded by the presence of H_2O-CO_2 inclusions (to 20 mole % CO_2) which are interpreted to have resulted from fluid-rock interaction. Subsequent reduction in fluid pressures (to ca. 2 kbars) resulted in decreasing amount of CO_2 (<1-2 mole%) and fluid unmixing that generated higher and lower salinity trends observed in T_h-salinity plots.

Vein-forming fluids are characterized by $\delta^{13}C_{\Sigma C}$ = -19.5 to - 22.6 per mil, $\delta^{18}O_{H_2O}$ = 9 to 15 per mil, δD = -42 to -64 per mil, and $\delta^{34}S_{H_2S}$ = 9.7 to 10.3 per mil based on analysis of calcite, quartz fluid inclusion extracts in quartz and stibnite. Vein tourmaline associated with stibnite has $^{87}Sr/^{86}Sr_{measured}$ of 0.71707 to 0.72284. These data are consistent with a metamorphic origin for the fluid with local inheritance of C and S isotope signatures from interaction of the ore fluid with graphite and sulfide wall-rock slates of the Halifax Formation.

The West Gore deposit originated from infiltration of metamorphic-derived fluids generated during the waning stages of the Acadian orogeny contemporaneous with generation and emplacement of felsic and mafic magmas. The mineralizating fluids were focused to higher crustal levels (P_{fluid} = ca. 2 kbars) where brittle-ductile conditions prevailed and veins were localized to the dextral component of a conjugate shear system related to movement along a major dextral strike-slip fault or shear zone (Cobequid-Chedabucto fault system). Deposition of vein constituents resulted from a decrease in temperature and changes in fluid chemistry (decrease in fs_2 and fo_2) induced by fluid unmixing and interaction with the wall rock. Lithogeochemistry of the local stratigraphy does not indicate any regional enrichment in Sb, Au, or other metals. The occurrence of the stibnite may, therefore, reflect either telescoping of metals in a Au-W-Sb province or enrichment of Sb in the source area or fluid conduit relative to other Meguma gold deposits.

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