

New Constraints on the Age and Origin of the Dunbrack Pb-Cu-Zn-Ag Deposit, Musquodoboit Batholith, Southern Nova Scotia¹

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Mineralization at the Dunbrack Pb-Zn-Cu-Ag deposit occurs within a ca. 1 m wide quartz vein characterized by comb, cockade, crustiform, and breccia textures. The mineralized vein, NW-trending and steeply dipping, has a medium- to coarse-grained, biotite-muscovite±cordierite monzogranite phase of the 370 Ma Musquodoboit batholith as its hanging wall and a fine-grained felsic dyke rock as its footwall. Silicate mineralogy in the vein is dominated by quartz with trace amounts of K-feldspar (Or₈₆₋₁₀₀), muscovite (<2 wt. % FeO, <0.8 wt. % F), chlorite, and kaolinite, whereas sulphides include Fe-poor sphalerite (<4 wt. % Fe), galena, chalcopyrite, and a variety of secondary Cu sulphides. Dating (⁴⁰Ar/³⁹Ar) of vein muscovite and the footwall dyke rock indicate similar ages of 370 Ma; therefore, vein formation and dyke injection are interpreted to be coincident with emplacement of the 370 Ma Musquodoboit Batholith.

Fluid inclusion studies of aqueous, L-V inclusions indicate homogenization temperatures of ca. 140 ± 5°C and salinities of 20 ± 2 wt. % eq. NaCl, but minor amounts of inclusions with higher (24 to 27 wt. %) and lower (8-16 wt. %) salinities occur. First melting temperatures and analysis of decrepitate mounds indicate two fluid types, a more abundant NaCl-H₂O fluid and a less abundant NaCl-CaCl₂-KCl-H₂O fluid.

Sulphur isotopes for hypogene galena, chalcopyrite, and sphalerite are uniform and equate to δ³⁴S_{H₂S} of +4.2 to +6.6‰ (at 300°C), which is similar to data for other granite-related sulphide mineralization in the Meguma Zone. Vein quartz has an δ¹⁸O value of +15.3 ± 1.2‰ (n=10), which equates to δ¹⁸O_{water} of +9 to +11.5‰ at 300°C, whereas fluid inclusion extracts indicate δD values of -90 to -113‰ (n=6).

Collectively, the timing of mineralization (i.e., 370 Ma) and the dominantly magmatic isotopic and geochemical signature for the vein-forming fluid suggest a genetic association with the Musquodoboit Batholith. However, the Ca-rich nature of some fluid inclusions and low δD values of fluid extracts suggest involvement of another reservoir, possibly reflecting a fluid that equilibrated with the country rock of the Meguma Group.

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