Genesis of barite associated with the Lemarchant Zn-Pb-Cu-Ag-Au-rich volcanogenic massive sulphide deposit, Newfoundland, Canada

Marie-Ève Lajoie[1], Stephen J. Piercey[1], James Conliffe[2], and Daniel Layton-Matthews[3]

1. Department of Earth Sciences, Memorial University of Newfoundland, 300 Prince Philip Drive, St. John's, Newfoundland and Labrador A1B 3X5, Canada

2. Geological Survey, Newfoundland and Labrador Department of Natural Resources, PO Box 8700, St. John's, Newfoundland and Labrador A1B 4J6, Canada

3. Department of Geological Sciences and Geological Engineering, Queen's University, Kingston, Ontario K7L 3N6, Canada

The Zn-Pb-Cu-Ag-Au-Ba Lemarchant volcanogenic massive sulphide (VMS) deposit contains massive sulfide intimately associated with barite, and hosted within the Cambrian Tally Pond belt. Barite is massive to locally bladed, and is remarkably homogeneous chemically regardless of texture. Sulphur isotope ($\delta^{34}S$) results on bladed and massive barite are similar (24.7–28.1‰), and have a mean value of 27‰, which is similar to Cambrian seawater sulphate (~26– 30‰). Whole-rock strontium isotope ratios ($^{87}Sr/^{86}Sr$) of barite range from 0.706993 to 0.707510. Fluid inclusion petrography in bladed barite shows three types of fluid inclusions with low-salinity, carbonic-rich inclusions being the most abundant. Homogenization temperatures (Th) determined on carbonic-rich inclusions range from 211°C and 276°C, with most of the temperatures measured between 245°C and 250°C with an average calculated salinity of 1.6 wt.% NaCl equivalent. The estimated minimum trapping pressures of carbonic-rich fluid inclusions range from ~1.7 kbars to ~2.0 kbars (~6–7 km depth).

The results of this study indicate a complex origin for the barites. Sulfur isotopic data are consistent with barite forming via the mixing of VMS-hydrothermal fluids with Cambrian seawater sulphate. In contrast, the Sr isotope values are lower than mid-Cambrian marine $^{87}Sr/^{86}Sr$ and suggest that some of the Sr was derived from older continental basement (e.g., underlying Neoproterozoic Crippleback Intrusive Suite and Sandy Brook Group). Calculated fluid inclusion isochores (on a P-T plot) from homogenization temperatures and pressures in the bladed barite are consistent with regional greenschist facies metamorphic conditions and represent metamorphic re-equilibration. Moreover, it illustrates that while barite may preserve original textures akin to modern barites, the fluid inclusion results are reset and do not reflect primary conditions of formation.

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