Mineralogy, Metal Zoning and Genesis of the Cambrian-Ordovician Zn-Pb-Cu-Au-Ag Lemarchant Volcanogenic Massive Sulfide (VMS) deposit, Newfoundland

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Abstract

The Lemarchant deposit is a bimodal felsic volcanogenic massive sulfide (VMS) deposit with anomalous precious and epithermal trace element contents (i.e. Ag, Au, As, Sb, Ge) located in the Tally Pond group, central Newfoundland. Currently, the deposit has a geological resource of 2.58 Mt at 0.49% Cu, 4.51% Zn, 1.01% Pb, 54.62g/t Ag, and 1.00 g/t Au. The stratiform, barite-rich massive sulfide zone and underlying stringer sulfide zone are hosted in footwall rhyolite flows, breccias and felsic volcaniclastic rocks, and are capped by an exhalative pyritic mudstone. Four types of mineralization define the Lemarchant deposit. The upper Type 1 mineralization consists of massive barite, red to white sphalerite, recrystallized fine-grained pyrite, galena and chalcopyrite. Type 2 mineralization is composed of Type 2a consisting of thick bladed barite-coarse-grained tetrahedrite-galena-colusite-electrum stringers, and Type 2b consisting of thin bornite-galena-stromeyerite stringers. Both Type 2 assemblages cross-cut the Type 1 assemblage. Type 3 mineralization consists of orange sphalerite-chalcopyrite-euhedral pyrite stringers that underlie Type 1 and 2 assemblages. The barite-rich sulfides associated with white sphalerite (<1 mole % Fe) are more trace element-rich and have lower $\delta^{34}S$ than those associated with massive red and orange stringer sphalerite (4-8 mole % Fe) at the top and base of the deposit. Lead isotopes in galena indicate the hydrothermal fluid contained a mixture of eroded continental crust and depleted mantle material. Mineral assemblages suggest that the hydrothermal fluids responsible for deposition of Type 1 and 2 sulfides were likely low temperature (<250°C), oxidized, mildly acidic and had high sulfur activity. Type 3 sulfides were later deposited from higher temperature (>300°C) fluids. A direct magmatic contribution to the hydrothermal fluid may have been responsible for enrichment of precious and trace metals in the Type 2 sulfides and might explain the lower d34S values found in this assemblage.