Temperature, chemistry, water-rock interaction and mineralization processes around the Gays River and Jubilee Zn-Pb deposits, basal Windsor Group, Nova Scotia

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The Gays River deposit (2.4 Mt, 8.6% Zn and 6.3% Pb) and the Jubilee deposit (0.9 Mt, 5.2% Zn and 1.4% Pb) are hosted by basal marine carbonates of the Windsor Group (Carboniferous, Visean). The mineralized unit overlies meta-clastic rocks of the Meguma Group (Cambro-Ordovician) unconformably, or continental clastic rocks of the Horton Group (Devonian) conformably, and is covered by evaporites of the Carrolls Corner Formation. The two deposits show a number of differences; in order to compare their mineralizing systems, isotopes and fluid inclusions of the two deposits and their host-rocks were investigated regionally.

On mainland Nova Scotia, the Gays River deposit is hosted by biolithites that are entirely replaced by texture and porosity preserving, pre-ore, dolomites. The high-grade ore part of the deposit occurs as a replacement of the dolostone, whereas low-grade ore infills primary pores. Precipitation of sphalerite and galena is partly coeval with xenomorphic calcite. Isotopic data indicate that hot, metal-rich fluids interacted with radiogenic continental clastic and/or metasedimentary rocks.

On Cape Breton Island, brecciated fine-grained limestone hosts the Jubilee deposit. Brecciation created secondary porosity which facilitated hydrocarbon and metal-rich fluid migra-

tion. The metal-rich fluid was hot and characterized by low $^{87}Sr/^{86}Sr$ and $\delta^{13}C$ due to interaction with non-radiogenic granite and granodiorite, and to oxidation of hydrocarbons.

Fluid inclusion investigations indicate that (1) the regional background temperature around the Jubilee deposit was lower than around the Gays River deposit; (2) hydrocarbons were abundant during mineralization at Jubilee, but rare at Gays River; and (3) both deposits show T_m-T_h trends typical of mixing of two or more fluids, among which, one was heated (≤250°C), saline (≤ 25-30 wt. % eq. NaCl) and had Na/(Na+Ca) ≥0.7-0.8. In both deposits, oxygen and strontium isotope co-variations, and $\delta^{34}S$ suggest mixing of two or more fluids and sulfur of marine affinities. The mineralizing fluids of the Jubilee and Gays River deposits could have had distinct heated sources and could have mixed with background basinal brines.