Isotopic Constraints on the Genesis of the Gays River Pb-Zn Deposit*

C. Ravenhurst, P. Reynolds, M. Zentilli
Department of Geology, Dalhousie University
Halifax, Nova Scotia B3H 3J5
and S. Akande, University of Ilorin, Ilorin, Nigeria

The Gays River deposit is the largest carbonate-hosted lead-zinc deposit known in the Mississippian Windsor Group of Atlantic Canada. Isotopic data pose constraints on the possible genetic models that can be applied to the basin and elsewhere.

Ore-stage calcites are characterized by very uniform $\delta^{18}O$ and $\delta^{13}C$ values. The $\delta^{18}O_{SMOW}$ of water in equilibrium with these calcites at 170°C (the fluid inclusion homogenization temperature) was +3.3 °/oo. The oD of the fluid inclusion fluids is -39 °/oo. The fluid isotopic composition indicates a basinal brine very close to the field representing typical Mississippi Valley Type deposits.

The ore fluid was probably completely reduced at the depositional site by organic compounds present. The isotopic composition of carbon in ore-stage calcites suggests that the carbon budget was dominated by this organic material. As expected in a reducing environment, ore-stage sphalerite and galena have $\delta^{34}S$ values which mimic the nearby (assumed source) sulfate rocks (= +14 °/oo).

Strontium and lead isotopic analyses were done on gangue minerals and galena respectively. Cambro-Ordivician Meguma Group metasediments possibly mixed with Devonian granites, or derivatives of these - the Horton Group clastics, appear to be the likely source rock(s) on the basis of the strontium and lead data.

Our data so far suggest that the Gays River deposit formed epigenetically due to the influx of a hot sulfate bearing, Pb-Zn rich fluid from a clastic source, that was subject to reducing conditions of diminishing or fluctuating strength at the depositional site.

*Supported by NSERC, Petrocanada, and G.S.C. Econ. Geol. Div., (contract no. OST-00052) under the Canada-Nova Scotia Mineral Development Agreement.