Sulphur Isotopic Composition of Sulphides in Meguma Gold Deposits: Implications for Genetic Models

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Base metal sulphides (Fe, Cu, Zn, Pb) are a persistent, although volumetrically minor phase in auriferous quartz veins hosted by the Cambro-Ordovician Meguma Group metasediments of southern Nova Scotia. The paragenesis of the sulphides is such that they bracket the gold mineralizing event, providing therefore an opportunity to examine the ambient physiochemical conditions of the ore fluid during mineralization. In this study, 45 sulphides (16 py, 4 po, 1 galena, 24 arspy) from eight deposits in the eastern Meguma Terrane have been analyzed for $\delta^{34}S$, with 32 analyses for the Beaver Dam deposit (3 million tons, 0.29 oz/ton).

$\delta^{34}S$ values for sulphides from Beaver Dam are as follows: py (N=16) = 9.9±1.1°/oo; po (N=4) = 9.9±0.2°/oo; arspy (N=11) = 10.5±0.4°/oo; galena = 9.4°/oo. No systematic variation of $\delta^{34}S$ was noted for any sulphide regardless of paragentic stage or morphology. For the remaining 7 deposits, 13 arspy analyses range from 9.8 to 25.0°/oo with small intra-deposit variations (e.g., Fifteen Mile Stream 12-14.8°/oo for 3 analyses). Additional analyses by Sangster (1987) for a further 3 deposits shows a similar provinciality for $\delta^{34}S$ values for sulphide mineralization.

The sulphide assemblages of the gold deposits, in addition to organic C in the wall rocks and CO_2-bearing fluid inclusions hosted by quartz, indicate ambient oxidation conditions below the H_2S/SO_2 boundary prevailed. Thus, $\delta^{34}S_{mineral}$ is a good approximation of $\delta^{34}S_{fluid}$. The tight intra-deposit clustering of data indicates fO_2 remained below this boundary condition and excursions related to changing Eh, pH and/or T°C were either short lived or nonexistent.

The $\delta^{34}S$ fluid (9-25°/oo, average 15°/oo) for the Meguma gold deposits and provinciality of the data provides constraints for potential source reservoirs and, therefore, genetic models. The syngenetic, exhalative model is considered unlikely and direct magmatic emanations can be eliminated as the dominant source of sulphur; the latter conclusion being similar to that reported earlier by Sangster (ibid.). A model involving incorporation of variable proportions of greywacke- and shale-derived sulphur from Meguma sediments is preferred with greywacke sulphur more abundant. The small intra-deposit variability of $\delta^{34}S_{fluid}$ is interpreted to reflect high fluid/rock ratios, a feature also suggested by extensive alteration haloes. This latter feature may favour a non-Meguma Group reservoir as the ultimate source of the fluids.