Do magnetite layers in Algoma-type BIF preserve their primary geochemical signature: A case study from three Archean BIF-hosted gold deposits?

B Gourcerol[1], DJ Kontak[1], PC Thurston[1], Q Duparc[2]

[1] Mineral Exploration Research Centre, Laurentian University, Sudbury, Ontario; [2] Université du Québec à Chicoutimi, Chicoutimi, Québec

The geochemistry of chert layers in Algoma-type banded iron formation (BIF) has been used to constrain the depositional setting of the BIFs, as rare earth element (REE) and yttrium (Y) systematics are a function of their chemical environment of formation. In contrast, the chemistry of the interbedded oxide-rich layers (i.e., magnetite) has not been analyzed for this purpose because of the presumed potential effects related to diagenetic changes during conversion from primary iron-bearing mineralogy to magnetite. Here, we explore the validity of this latter hypothesis by using the results of LA ICP-MS analysis of iron-oxide layers at three Canadian BIF-hosted gold deposit settings (i.e., Meadowbank, Meliadine, Musselwhite) to assess whether the primary REE+Y systematics of the oxide layers are preserved and, if so, what are the implications. The results indicate that, regardless of their diagenetic and later metamorphic and hydrothermal histories, the chemistry of the iron-oxides retains a primary signal in all cases with the following indicated: (1) interaction of the primary Fe-oxyhydroxide phases with seawater, as reflected by heavy REE enrichment relative to light REE depletion that is coupled with variable La and Y enrichment; and (2) some input of high-temperature (>250 ºC) hydrothermal vent fluids, as suggested by positive Eu anomalies. The chemical data are also applied to evaluate currently used classification diagrams for ore deposits based on magnetite chemistry. Our new data indicate that the geochemical fields documented in the literature for BIF are too restricted or lead to misclassification of sample origins. In the case of the latter, it may be that interaction of fluids with the immediate substrate influences the chemical signature of samples. Therefore, caution is suggested in using these diagrams where hydrothermal fluids are involved in magnetite formation.