Depositional Setting of Algoma-type Banded Iron Formation from the Meadowbank, Meliadine and Musselwhite gold deposits

B. Gourcerol[1], P.C. Thurston[1], D.J. Kontak[1], O. Côté-Mantha[2] and J. Biczok[3]

[1]Mineral Exploration Research Centre, Laurentian University, Sudbury, ON, Canada; [2]Agnico Eagle Mines Ltd – Division Exploration, Val d'Or, QC, Canada; [3]Goldcorp Canada Ltd., Musselwhite Mine, Thunder Bay, ON, Canada

Algoma-type Banded Iron Formations (BIFs) are chemical sedimentary rocks comprised of alternating layers of iron-rich minerals and chert interstratified with bimodal submarine volcanic rocks in Archean greenstone belts. However, the geologic setting for Algoma-type BIF deposition remains equivocal due to the overprinting effects of post- depositional deformation and metamorphism and the absence of modern analogues for comparative studies. Recent studies suggest the abundance of REE+Y in chert bands may reflect the primary BIF geochemical signature and therefore may constrain geological settings favourable for BIF deposition. In this study, the results of LA ICP-MS on chert at three BIF-hosted gold deposits are presented to assess whether epigenetic gold mineralization is preferentially developed within a particular geochemical type of BIF. The three deposits studied were: (1) Meadowbank deposit (Churchill Province); (2) Meliadine gold district (Churchill Province); and, (3) Musselwhite deposit (Superior Province). The results of this study, which explore rare earth elements (REE) and yttrium as tracers of depositional processes for Algoma-type BIF, suggest that chert bands record: (1) interaction of seawater with Fe-oxyhydroxides, as suggested by heavy rare earth element enrichment coupled with La and Y enrichment; (2) high-temperature (>250 ºC) hydrothermal fluids, as suggested by positive Eu excursions; and (3) hydrogeneous contamination, which is suggested by relatively consistent REE concentrations and a chondritic Y/Ho ratio. Moreover, the pH conditions of the water column at the time of BIF deposition are evaluated using Ce/Ce* as a pH proxy, which suggest acidic seawater conditions associated with positive Ce/Ce* anomalies. This data set does not suggest there is a preferred chemical type of BIF for epigenetic gold mineralization.