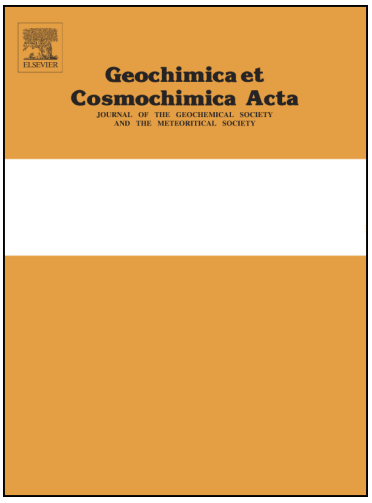

Evidence of upgrading of gold tenor in an orogenic quartz-carbonate vein system by late magmatic-hydrothermal fluids at the Madrid Deposit, Hope Bay Greenstone Belt, Nunavut, Canada

Mitchell J. Kerr, Jacob J. Hanley, Daniel J. Kontak, Gordon G. Morrison, Joseph Petrus, Mostafa Fayek

PII: S0016-7037(18)30474-5
DOI: https://doi.org/10.1016/j.gca.2018.08.030
Reference: GCA 10903

To appear in: *Geochimica et Cosmochimica Acta*

Received Date: 17 April 2018
Revised Date: 13 August 2018
Accepted Date: 17 August 2018

Please cite this article as: Kerr, M.J., Hanley, J.J., Kontak, D.J., Morrison, G.G., Petrus, J., Fayek, M., Evidence of upgrading of gold tenor in an orogenic quartz-carbonate vein system by late magmatic-hydrothermal fluids at the Madrid Deposit, Hope Bay Greenstone Belt, Nunavut, Canada, *Geochimica et Cosmochimica Acta* (2018), doi: https://doi.org/10.1016/j.gca.2018.08.030

Evidence of upgrading of gold tenor in an orogenic quartz-carbonate vein system by late magmatic-hydrothermal fluids at the Madrid Deposit, Hope Bay Greenstone Belt, Nunavut, Canada

Mitchell J. Kerr[1,2]*, Jacob J. Hanley[1], Daniel J. Kontak[2], Gordon G. Morrison[3†], Joseph Petrus[2], Mostafa Fayek[4]

[1]Department of Geology, Saint Mary's University, 923 Robie Street, Halifax, Nova Scotia, Canada, B3H3C3
[2]Harquail School of Earth Science, Laurentian University, 935 Ramsey Lake Rd, Sudbury, Ontario, Canada, P3E2C6
[3]TMAC Resources Incorporated, Toronto, Ontario, Canada
[4]Department of Geological Sciences, University of Manitoba, 125 Dysart Rd., Winnipeg, Manitoba, Canada, R3T2N2
**Corresponding author: mitchell.kerr@smu.ca*
[†]Now at gord.g.morrison@gmail.com

1. ABSTRACT

Evidence of secondary gold enrichment due to the addition of new gold onto an earlier orogenic quartz-carbonate vein deposit by magmatic-hydrothermal fluids is strongly suggested for the Madrid Deposit, hosted in the Hope Bay Greenstone Belt in Nunavut, Canada. The conclusion is based on an extensive in situ microanalytical protocol (SEM, confocal Raman microspectroscopy, microthermometry, decrepitate mound analysis, LA-ICP-MS, cathodoluminescence, SIMS) not previously applied to gold systems. This approach was used to characterize the mineralogy and fluid inclusion systematics associated with the upgrading event.

Mineralization comprised of only Ag-bearing gold ("electrum"; 89.8 at. % Au avg.; n = 8) is present throughout all investigated laminated and brecciated orogenic quartz veins. However, in high-grade vein intersections where gold grades are locally elevated (up to 122 g/t), assemblages containing tennantite-tetrahedrite + chalcopyrite + electrum (80.7 at. % Au avg.; n = 15) ± Ag-Pb-Au tellurides occur that are texturally late-stage relative to electrum-only mineralization. Subdomains of quartz coeval with this later assemblage are optically- and texturally-distinct from earlier orogenic quartz. This late mineral assemblage is absent in all low-grade vein intersections (~1 g/t Au avg.) examined where only electrum is identified. Quartz-hosted fluid inclusions (H_2O-NaCl±CO_2) of intermediate salinity (16.7 ± 1.2 wt. % NaCl equiv.; n = 93) were identified only in the high-grade vein samples and are present along healed planes associated with tennantite-tetrahedrite + chalcopyrite + electrum ± Ag-Pb-Au telluride