and contain only low salinity fluid inclusions (average 7.4 wt% $NaCl_{eq.}$). Thermobarometry constrains the minimum conditions of sulfide entrapment (amphibole crystallization) to ~8 kbar and ~700°C. LA-ICP-MS analyses of 22 sulfide melt inclusions show that it was highly enriched in Au (53 ± 21 ppm, 1σ), Ag (143 ± 74 ppm, 1σ), and Ni (5219 ± 3176 ppm, 1σ). Ratios of Cu/Au (7495 ± 2482, 1σ) and Au/Ag (0.45 ± 0.24, 1σ) overlap very closely with those metal ratios in mineralized porphyry veins, demonstrating that the metal ratios in magmatic sulfide liquids are preserved in the bulk ore, and that metals were not fractionated from one another during volatile exsolution, metal partitioning into fluid phases, and subsequent transport and precipitation of ore metals. The extremely Au-rich composition of the sulfide melt may reflect the exsolution of a small volume of sulfide liquid compared to the associated volume of silicate liquid and fractional crystallization of the sulfide liquid prior to entrapment in the amphibole.

Rare, high Mg, alkali basalt enclaves hosted in the intrusive phases of the Mount Milligan system are depleted in Co, Ni, and Cu, reflecting the sequestering of the base metals into a sulfide liquid in a mid-crustal magma chamber in which amphibole was a saturated phase. Amphibole xenocrysts containing the sulfide melt inclusions also show depletions in these elements, linking the xenoliths and xenocrysts to a common, Co, Ni, and Cu-depleted source magma. An additional compositional link is shown by a significant depletion of Cr, Th, and U in the xenocrysts and a corresponding enrichment of these trace elements in the xenoliths. This reflects the retention of Cr, Th, and U in spinel, oxides, and apatite in the source region, a suggestion confirmed by the presence of these minerals in the xenoliths.

The results of this study show that a Cu-Au-rich sulfide melt coexisted with a water-rich alkalic basaltic liquid in the mid-crustal magma chamber prior to the emplacement of the main intrusions and porphyry-stage mineralization at Mount Milligan. Identification and analysis of ore metals in sulfide melt inclusions in relatively common xenocryst phases may serve as a useful exploration tool for predicting the metal ratio of undiscovered Cu-Au porphyry deposits in the western Cordillera.

Extremely gold-rich sulfide melt inclusions preserved in magnesiohastingsite xenocrysts from the Mount Milligan porphyry deposit, Quesnel Terrane, British Columbia

J.J. Hanley[1] and C.A. Heinrich[2]

1. Magmatic Ore Fluids Laboratory, Dept. of Geology, Saint Mary's University, 923 Robie Street, Halifax, NS, Canada B3H 3C3 <jacob.hanley@smu.ca> ¶ 2. Isotope Geochemistry and Mineral Resources, ETH Zurich, Clausiusstrasse 25, Zürich, Switzerland, 8092

Amphibole xenocrysts (potassian magnesiohastingsite) from an early, weakly mineralized, trachyandesitic dyke at the Mount Milligan Cu-Au porphyry deposit, British Columbia, contain coeval sulfide and silicate melt inclusions of primary origin along early growth zones. The sulfide melt inclusions have a bulk composition comparable to Cu-rich ISS. Late growth zones in the amphibole are devoid of sulfide inclusions

Atlantic Geology, 2009, Volume 45, Number 1