Polymetallic Ni-Co-As-Bi-Ag-U veins with co-precipitating bitumen at Copper Pass, southern Slave Province, Northwest Territories, Canada

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Polymetallic veins have a distinctive history of precipitation in stages. Nickel-cobalt arsenides are ubiquitous in their mineralogy while other elements such as uranium may be lacking due to absent stages. Similar polymetallic veins have been identified in few locations across North America and Europe. Historically economic varieties of these veins were mined in the Thunder Bay and Cobalt districts of Ontario and the Great Bear Lake region of Northwest Territories. The latter was mined for native silver and uraninite. Veins at Copper Pass, near Great Slave Lake, do not contain economic volumes of either resource but do host an interesting relationship between a subdued uraninite stage and solid bitumen. Mineral and fluid inclusions are examined within vein quartz from Copper Pass. The uraninite stage, along with solid bitumen and Ni-Co arsenides, is hosted wholly within a specific layer of quartz growth. This study focuses on constraining the mechanisms for the co-precipitation of these elements and characterizing their fluid source using various petrographic techniques. Microscope-cathodoluminescence (CL) was used to identify growth patterns within individual quartz grains, which were subsequently analysed with secondary ion mass spectrometry (SIMS; University of Manitoba) to identify their isotopic oxygen ratios. These ratios range from 3.9 to 21.8 ‰ $\delta^{18}O$ V-SMOW, increasing from core to rim with variations along specific growth zones, implicating a major physical or chemical shift during vein formation (e.g., fluid mixing or cooling). Micro-thermometry of fluid inclusions will compliment this data by reconstructing salinity and homogenization temperatures of source fluids for the different quartz growth zones. Compositional and textural features within the uranium bearing growth zone were identified using SEM and Raman spectrometry. The Raman spectrometer was also used to compare the chemistry of included organics with hydrocarbons from other deposits. This may provide insight into the role of organics in polymetallic deposits. Continuation of this study will focus on determining the nature of fluid mixing that triggered the co-precipitation of these phases.

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