

# Geochemistry of ore minerals and evolution of the Port Radium IOCG hydrothermal system, Great Bear Magmatic Zone, NWT, Canada

ALI SOMARIN<sup>1</sup>, HAMID MUMIN<sup>1</sup>, LI ZHOU<sup>2,3</sup>, WEI TERRY CHEN<sup>4</sup> AND AYAT BAIG<sup>1</sup>

<sup>1</sup>Brandon University

<sup>2</sup>Guizhou Normal University

<sup>3</sup>Key Laboratory of High-temperature and High-pressure Study of the Earth's Interior, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550081, China

<sup>4</sup>Institute of Geochemistry, Chinese Academy of Science

Presenting Author: somarina@brandonu.ca

The Port Radium-Echo Bay district, NWT Canada, hosts past producers of U-Ag-Cu ± Ra ± Ni ± Co ± Bi from polymetallic sulfide, arsenide, and uraninite veins which yielded >5100 tonne Cu, >6200 tonne U, and >907 tonne Ag from 1930s till 1982. The Great Bear Magmatic Zone (GBMZ) resulted from a 1.875-1.843 Ga continental-scale Andean-type calc-alkaline magmatism near the western margin of the Archean Slave Craton. At Port Radium, intrusion of the Mystery Island pluton (quartz diorite, quartz monzonite, monzodiorite, and granite in composition) into the Port Radium and Echo Bay formations formed an extensive classic Iron Oxide-Copper-Gold (IOCG) style hydrothermal system within the metasedimentary rocks, volcanoclastic tuff and volcanic lavas of dacite, rhyodacite and andesite. As a result, albitic, magnetite-actinolite-apatite, potassic ± albitic, phyllic, and propylitic alterations were developed in the causative pluton and surrounding volcano-sedimentary sequences.

Minor sulfides (pyrrhotite, pyrite, chalcopyrite, sphalerite, and galena) formed during these stages of hydrothermal activity. The main ore minerals formed during late stage epithermal mineralization which formed several large-scale veins roughly E-NE striking with near vertical dip that show evidence of multiple hydrothermal fracturing and brecciation. The common ore minerals include base metal sulfides plus arsenopyrite (FeAsS), native bismuth, siegenite (Ni,Co)<sub>3</sub>S<sub>4</sub>, niccolite NiAs, rammelsbergite NiAs<sub>2</sub>, gersdorffite NiAsS, skuterrudite (Co,Fe,Ni)As<sub>2-3</sub>, cobaltite (CoFe)AsS, safflorite CoAs<sub>2</sub>, nickeliferous safflorite (Co<sub>0.8</sub>Ni<sub>0.2</sub>)As<sub>2</sub>, gersdorffite NiAsS, hessite Ag<sub>2</sub>Te \*, argentite Ag<sub>2</sub>S \*, stromeyerite AgCuS, aikinite PbCuBiS<sub>3</sub>, emplectite CuBiS<sub>2</sub>, stromeyerite AgCuS. In addition, three unknown sulfarsenides are found: unknown 1 (Co<sub>0.96</sub>Ni<sub>0.45</sub>Fe<sub>0.03</sub>)S<sub>0.27</sub>As<sub>4</sub>, unknown 2 (Ni<sub>2.13</sub>Co<sub>0.38</sub>)S<sub>0.97</sub>As<sub>4</sub> and unknown 3 (Ni<sub>1.83</sub>Co<sub>0.83</sub>)S<sub>1.25</sub>As<sub>4</sub>. Uraninite UO<sub>2</sub>, and its weathering products uranophane Ca(UO<sub>2</sub>)<sub>2</sub>SiO<sub>3</sub>(OH)<sub>2.5</sub>(H<sub>2</sub>O) and Coffinite UO<sub>2</sub>.nH<sub>2</sub>O are common.

Fluid inclusion studies show that at the beginning of magnetite-actinolite-apatite alteration, the hydrothermal fluid had high temperature (>500 °C) and mid-high salinity (35-10 wt% NaCl equi.) likely from a magmatic source. This fluid evolved by

mixing with low-temperature (~200 °C) low-salinity (~5 wt% NaCl equi.) meteoric water which dropped temperature to about 300 °C. After this stage, the hydrothermal fluid evolved by boiling which decreased temperature and increased salinity. This resulted in uranium ± sulfide ± sulfarsenide mineralization at T<280 °C.