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## Alteration Assemblages and Quantitative Mineralogy of the Boundary Zone Zn-Pb ± Ag Deposit, Yukon, Canada

Haruna M. Grema<sup>1,2</sup>, Joseph M. Magnall<sup>1</sup>, Sarah A. Gleeson<sup>1,2</sup>, Jack E. Milton<sup>3</sup>, Anja M. Schleicher<sup>1</sup>, Alicja Wudarska<sup>1,4</sup>, Hans-Martin Schulz<sup>1</sup>

1. GFZ German Research Centre for Geosciences, Potsdam, Germany, 2. Institute of Geological Sciences, Freie Universität Berlin, Berlin, Germany, 3. Fireweed Metals Corp., British Columbia, BC, Canada, 4. Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Poland

The Boundary Zone Zn-Pb ± Ag deposit, Selwyn Basin, Canada, is a recently discovered clastic-dominated (CD-type) occurrence with two distinct ore mineralization stages within the Late Ordovician-Early Silurian Duo Lake and Middle-Late Devonian Portrait Lake Formations. Understanding the intricacies of the alteration assemblages allows for developing vectors toward the base metals that are essential for meeting net-zero targets and renewable energy generation. Seventy-three drill core samples from nine drill holes were analyzed using quantitative X-ray diffraction (QXRD), electron probe microanalysis (EPMA), and U-Pb secondary ion mass spectrometry (SIMS) to examine alteration assemblages linked to the sulfide mineralization.

Sulfide formation at the Boundary Zone occurs with quartz, pyrite, barian-mica, fluorapatite, and siderite, with specific assemblages associated with different host rocks (biosiliceous mudstones, conglomerates, and volcanoclastics). Stratabound ore-stage I mineralization in the Duo Lake and Portrait Lake Formations involves the replacement of radiolarian-rich mudstone beds. This mineralization is coeval with the transformation of Opal-A to chalcedony and microquartz in and around the mineralized intervals. Additionally, in the Portrait Lake Formation, authigenic barite replacement by pyrite and barian-mica is observed. The dissolution-precipitation of quartz, likely preserved porosity and coupled with barite dissolution, generated permeability facilitating metal-bearing fluid flow.

Ore-stage II sulfides formed via hydrothermal fluid-induced brecciation and veining of the host rocks with stylolitic margins and are accompanied by fluorapatite, megaquartz, and pyrobitumen. Mg-siderite formed together with early vein sphalerite and as late cavity fillings contemporaneous with bladed megaquartz in the Portrait Lake Formation. Fluorapatite in one vein that crosscut ore-stage I records a Middle Jurassic U-Pb age; however, timing related to ore-stage II is undetermined. Collectively, the multiple mineralizing events at the Boundary Zone indicate a protracted history of ore formation and host rock alterations, likely spanning from diagenetic stages to periods of Cordilleran-related deformation within the Selwyn Basin.