Mineralogy and Paragenesis of the Boundary Zone Clastic-Dominated Zn Deposit (Macmillan Pass, Yukon)

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In the Selwyn Basin (Yukon, Canada), clastic-dominant (CD-type) Zn-mineralized rocks are located across three broad stratigraphic intervals representing metallogenesis during the Cambrian, Ordovician-Silurian, and Late Devonian. The Boundary Zone prospect in the Macmillan Pass district is the most recent Zn-Pb discovery in the Selwyn Basin. The mineralized rocks at Boundary Zone are hosted by the Mid-Late Devonian Portrait Lake Formation and Late Ordovician-Early Silurian Duo Lake Formation, which provides a unique opportunity to investigate metallogenetic processes at different stratigraphic levels. This study provides a petrographic investigation of the mineralogy and paragenesis of the mineralized rocks, with sphalerite trace element chemistry (LA-ICP-MS) and fluid inclusion microthermometry.

Hydrothermal sulfides in the Duo Lake Formation comprise stratiform spherical grey sphalerite (Sp-I) locally overgrown by metallic pink coarse-grained euhedral sphalerite (Sp-II). Late pale-yellow sphalerite (Sp-III) occurs in veins associated with cavity-filling quartz and apatite with pyrobitumen. In the Portrait Lake Formation, very fine grained laminated sphalerite (Sp-I) is hosted in mudstone of the Fuller Lake Member in an assemblage with barite and barium feldspar. A second stage of sphalerite (Sp-II) forms in veins and breccias, associated with pyrite, galena, chalcopyrite, siderite, and Ba-mica. Similar to the occurrence in the Duo Lake Formation, straw yellow coarse-grained sphalerite (Sp-III) occurs, and is associated with very coarse grained quartz, pyrobitumen, and siderite. Preliminary fluid inclusion homogenization temperatures in Portrait Lake Sp-II sphalerite are between 194° and 225°C, within the range of estimated Ga, Ge, In, Mn, and Fe (GGIMFis) sphalerite geothermometry constraints (163°–279°C). Textural and trace element variations suggest variable fluid conditions, with the moderate to high temperature of the hydrothermal fluids consistent with the temperature range for the nearby Tom and Jason deposits of the Macmillan Pass district. Further work is being undertaken to constrain the fluid characteristics, metal zonation, and deposit age(s).