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The Discovery and Geology of the Boundary Zone Zn-Pb-Ag Deposit, Yukon, Canada: New Perspectives on Mineralizing Processes in Sediment-Hosted Base Metals Deposits

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Fireweed Metals' new discovery, the Boundary Zone Zn-Pb-Ag deposit within the Selwyn Basin, Yukon Canada, a classic area for Economic Geology because it is the birthplace of the Selwyn SEDEX model for clastic dominated, or sediment hosted massive sulphide deposits. New insights are possible from Macmillan Pass where over 45,000 m drilling has been done between the Boundary Zone discovery and the Tom and Jason deposits.

Boundary Zone was originally discovered in the 1980s as low-grade zinc in veins and breccias. A significant new zone of stratiform laminated to massive sulphide was discovered in 2020, under cover of 5-10 metres of tills, using geological modeling, soil geochemistry, and gravity. A new resource has been defined, establishing the Macmillan Pass project as one of the world's largest undeveloped zinc deposits.

At Boundary Zone, stratiform mineralization is present at several stratigraphic intervals, spanning the late Ordovician to late Devonian. Stratiform mineralization occurred early within diagenesis as the replacement of diagenetic barite layers and biosiliceous mudstones. Stratiform mineralization is associated with rapid lateral thickness and facies changes and abundant, poorly sorted, mud-rich diamictites, interpreted as synsedimentary fault scarp slumps. Observations of sphalerite and pyrite pseudomorphs after barite support the subsurface replacement model for zinc mineralization that has challenged the SEDEX paradigm of syngenetic mineralization.

Stage two zinc mineralization at Boundary Zone occurred post-lithification, as late as the Cretaceous, Cordilleran deformation. This phase is characterized by coarse sphalerite-siderite-pyrite in veins and breccias, and also as replacement of the clasts and matrix of coarse clastic rocks. A large proportion of veins show evidence for the opening of veins within pre-existing tectonic stylolites, exploiting fracture permeability. Stage two vein mineralization accounts for a significant volume of mineralization at Boundary Zone and appears more abundant adjacent to late faults that cross-cut folding.