## Trace-Element Deportment in Sphalerite Across the Bathurst Mining Camp, New Brunswick, Canada

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The Bathurst Mining Camp (BMC) represents one of the largest volcanogenic massive sulfide (VMS) districts, containing over 600 Mt of massive sulfides from which 180 Mt were developed over 60 years of Zn-Pb-Cu-Ag-Au production. Mineralization is characterised by stratiform massive sulfide deposits occurring along six distinct exhalative horizons hosted by Ordovician volcano-sedimentary rocks deposited in an ensialic back-arc on a Peri-Gondwanan margin. To date, metal deportment studies in the BMC have focussed on the distribution of precious metals and energy critical elements (ECEs) at the deposit scale. This work characterises the trace-element deportment in sphalerite across the entire BMC, comparing exhalative Zn-Pb sulfide horizons of distinct basement crustal blocks. Sphalerite from 45 deposits including past producers such as Caribou, Brunswick No.12, and Heath Steele is assessed for overall trace element signatures as well as ECE potential. The trace element budget of Bathurst sphalerite exhibits significant variability at the camp scale, most notably for Co, Cd, and In. Interestingly, In concentrations in sphalerite exhibit the greatest variability, ranging from 1.00 ppm at the Louvicourt deposit to 1,670 ppm for the Heath Steele HC4 Zone, with samples exhibiting strong variability at the mm scale within Zn-Pb bands. For the most part, Co contents are below detection (LOD <0.1ppm); however, Austin Brook, Louvicourt, and Heath Steele exhibit variable Co signatures with the Heath Steele B zone exhibiting elevated Co concentrations (up to 100 ppm). Low median levels of Sn in sphalerite (1.13 ppm) suggest that bulk Sn signatures (up to 1,900 ppm) are in part controlled by cassiterite present in the ores. Given the capacity of sphalerite to accommodate metals in its mineral structure, identifying the inter-deposit trace element signatures across varied terranes in the BMC may provide insight on metal sources, depositional constraints, and the role of metamorphism in overall metal deportment.