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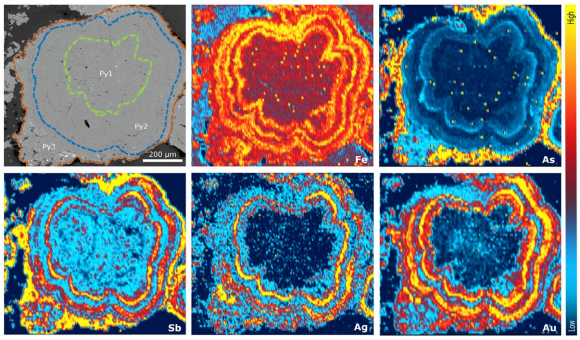

Refining Paragenetic Series for Complexly Deformed VMS: Implications for Metal Deportment at the Caribou Zn-Pb-Ag Mine, Bathurst Mining Camp, Canada

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Volcanogenic massive sulphide (VMS) deposits in the Bathurst Mining Camp are characterized by a multi-phase primary syngenetic-epigenetic depositional history complicated by the overprinting effects of syn-metamorphic (greenschist) deformation (Salinic Orogeny). The Caribou Zn-Pb-Ag deposit is a classically zoned VMS deposit hosted by Middle Ordovician shale and felsic volcaniclastic rocks. Mineralogical and geochemical zonation across the ore deposit can be characterized by three prominent hydrothermal facies: 1) a basal Cu facies associated with footwall stringer-stockwork sulphides, 2) an overlying massive pyrite facies (±magnetite), and 3) a banded Zn-Pb(Ag) facies nearest the stratigraphic hanging wall.

Chemical signatures preserved in pyrite have been integral to revealing a complex paragenesis and overall evolution of the system from deposition to orogenesis. Textural interpretation and laser ablation ICP-MS analyses of pyrite across the zoned hydrothermal architecture reveal three distinct generations of pyrite mineral growth. An early syngenetic pyrite (Py_1) that typically contains abundant fine inclusions of galena and chalcopyrite and exhibits low levels of Au, Ag and Sb. A later generation of pyrite (Py_2) displays colloform banding with variable concentrations of Au, Ag, Sb and As and indicates highly variable hydrothermal conditions during sulphide precipitation. A third generation of pyrite (Py_3) consists of euhedral growths characterized by solitary grains as well as annealed rims on larger masses. These meta-blastic growths are generally poor in Au but they contain elevated Ag, Sb and Pb contents attributed to fine inclusions of galena. Bulk lithogeochemical trends coupled with microanalysis reveal that Au is principally concentrated in the exhalative Zn-Pb facies, occurring as a refractory phase within colloform Py2; whereas, the basal Cu zone and barren pyrite facies do not contain appreciable Au. Results also show that metamorphic recrystallization and cataclasis has not affected the overall gold deportment within the Caribou deposit. The chemical paragenesis of pyrite elucidates the mineralogical balance of Pb, Ag, Sb and Au loss to tailings from pyrite. Zonation of Au in Py_2 suggests that Au may be recovered through secondary processing (Leach) of mill products.