

Conference Proceedings

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Title: **Hydrothermal Alteration and Volcanic Stratigraphy at the Paleoproterozoic Kay Mine
Volcanogenic Massive Sulfide Deposit, Black Canyon City, Arizona USA**

Theme: Innovative Technology Developments in Mineral Deposit Science

Presentation Type: Oral

Session: Innovative Technology Developments in Mineral Deposit Science II
Saturday September 28, 16:00 - 17:30
Room: Omatako 1 and 2

Program #: S04.02

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Abstract Text: The Kay mine is a past-producing volcanogenic massive sulfide deposit located 70 km north of Phoenix Arizona. A historic estimate of resources and reserves totals 5.8 million tonnes grading 2.2% Cu, 3.03% Zn, 54.9 g/t Ag, and 2.8 g/t Au at a cut-off grade of 2% Cu equivalent. Kay is hosted in a bimodal volcanic and volcanoclastic succession of the 1750 Ma Black Canyon Creek Group. The massive sulfides are located along a favorable stratigraphic position that is marked by a change from mafic to felsic-intermediate volcanic rocks. A mudstone-matrix monomict rhyolitic to rhyodacitic breccia interpreted to be a peperite marks the paleoseafloor position. Massive sulfides at Kay formed through subseafloor infiltration and replacement of permeable volcanoclastic rocks beneath this breccia unit. Utilization of continuous core scanning X-ray fluorescence with a Malyzer CS and hyperspectral core scanning with a HySpex SWIR-384 camera revealed the chemostratigraphy at Kay and uncovered the mineralogy of the hydrothermal alteration halo. Downhole geochemistry shows Na depletion surrounding the mineralization, a halo of K enrichment in the proximal hanging wall and distal footwall, and a zone of Mg enrichment beneath the mineralization. Hyperspectral imaging demonstrated that the enrichments in K and Mg correspond to strong muscovite and chlorite alteration. This was confirmed by thin section petrography, SEM-EDS analyses, and automated mineralogy scans. The observed alteration zonation reflects variations in the temperature of alteration with the high-temperature hydrothermal feeder zone being characterized by chlorite alteration and the surrounding lower-temperature alteration being dominated by muscovite. In addition, carbonate alteration dominated by ankerite is widespread at Kay. The combination of geochemistry and mineralogy determined by coregistered XRF and hyperspectral core scanning provides a means of precisely mapping the alteration zonation where deformation and metamorphism have obscured the primary textures.