500 Volcanogenic Massive Sulfide (VMS) Deposits

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Hydrothermal alteration and volcanic stratigraphy at the Paleoproterozoic Kay Mine volcanogenic massive sulfide deposit, Black Canyon City, Arizona, USA

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The Kay Mine volcanogenic massive sulfide deposit is hosted by 1.79 – 1.76 Ga bimodal volcaniclastic rocks of the Black Canyon Creek Group in the southernmost portion of the Central Volcanic Belt of Arizona. The deposit has a historic resource of 6.4 million short tons of massive sulfide grading 2.2% copper, 3.0% zinc, 2.8 g/t gold, and 55 g/t silver, using a cut-off grade of 2% copper-equivalent. The massive sulfides are hosted in an interval of intermediate to felsic volcaniclastic rocks, with textural evidence suggesting that much of the mineralization formed by subseafloor infiltration and replacement. The seafloor position within the volcaniclastic-dominated volcanic succession is marked by carbonaceous mudstone located at the transition from intermediate and felsic volcaniclastic rocks to overlying mafic coherent and volcaniclastic deposits. The massive sulfides are stratigraphically underlain by a zone of intense chlorite alteration that hosts abundant chalcopyrite stringers.

The massive sulfides of the Kay deposits and their volcanic host succession are located within a high-strain zone. Primary volcanic textures are difficult to recognize macroscopically, which complicated reconstruction of the volcanic architecture through core logging. This study employs state-of-the-art core scanning techniques, which includes the use of a Minalyze continuous X-ray fluorescence core scanner to provide chemostratigraphic information and to determine alteration-induced geochemical gradients. In addition, hyperspectral core scanning is conducted using a core scanning system equipped with a HySpex SWIR-384 camera. New advancements now allow for the co-registration of these datasets based on depth. Interpretation of the data has identified geochemical and corresponding mineralogical gradients that can be used to determine proximity to the massive sulfides. Ongoing research will allow for the creation of a more robust exploration model for massive sulfide deposits in central Arizona.

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A Review on Modified Volcanogenic Massive Sulphide Ore Bodies: Scale, Processes, and Implications

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The architecture of ancient volcanogenic massive sulfide (VMS) ore bodies is the result of both initial depositional settings and subsequent metamorphic and deformational events. Given the dynamic nature of the tectonically active settings where VMS deposits form, these massive sulphide ore bodies inevitably undergo modifications through deformation and metamorphism. Volcanogenic Massive Sulphide deposits host significant resources of zinc and copper, with