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 volcanogenic massive sulfide deposit in Black Canyon City, Arizona, is hosted by bimodal volcaniclastic rocks assigned to the 1.79 to 1.76 Ga Townsend Butte Formation of the Black Canyon Creek Group, which forms part of the Proterozoic Yavapai Supergroup. Detailed core logging of the strongly deformed volcanic host rock succession shows that the stratigraphic footwall to the massive sulfides is dominated by fine-grained intermediate to mafic volcaniclastic rocks. The favorable interval is marked by the occurrence of carbonaceous mudstone that occurs immediately below coherent to brecciated rhyolite or rhyodacite. Mudstone matrix monomict rhyolite or rhyodacite breccia interpreted to be peperite is widespread along the contact. Textural evidence suggests that the massive sulfides at the Kay deposit formed primarily through subseafloor infiltration and replacement of the volcaniclastic host rocks. The sulfides are commonly intergrown with nodular dolomite and ankerite. The massive sulfides are underlain by a zone of intense black chlorite alteration hosting chalcopyrite stringers. Sericite is the most common alteration product in the hanging wall that is dominated by mafic-intermediate volcaniclastic rocks, and basalt that forms massive or pillowed flows. Geochemical and mineralogical gradients around the massive sulfides are established through core scanning using a Minalyze continuous X-ray fluorescence core scanner and a short-wave infrared core scanner by Hyspex. Recent software advancements allow for co-registration of the geochemical and mineralogical data sets produced by both instruments. Unraveling alteration vectors through core scanning will assist in future target generation and potential expansion of the historic resources and reserves estimate of 5.8 million tonnes grading 2.2% Cu, 3.03% Zn, 54.9 g/t Ag, and 2.8 g/t Au at a cutoff grade of 2% Cu equivalent.