SEG 2024 Conference: Sustainable Mineral Exploration and Development

Petrography and Geochemistry of the Okohongo Copper-Silver Deposit, Kaoko Belt, Kunene Region, Namibia

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The Okohongo copper and silver deposit has estimated resources of 10.2 million tonnes, with grades of 1.12% Cu and 17.7 g/t Ag. The deposit is located in the Opuwo district, Kunene region of Namibia, and is hosted by the ca. 760 Ma Devede and Beesvlakte Formations of the Ombombo Subgroup in the Kaoko Belt. An orebody is composed of secondary copper oxide and sulfide mineralization located along N-S disharmonic folds and NW-trending shear zones. The mineralization occurred as (1) bedding-parallel quartz-calcite veins containing chrysocolla, malachite, shattuckite, and chalcocite, which are concordantly hosted by shale; (2) semi-massive chrysocolla, malachite, shattuckite, and chalcocite; and (3) chalcocite-bearing quartz-calcite-albite stockworks, hosted in the brecciated, interbedded dolostone and shale with hematite and goethite cement. Bedding-parallel quartz-calcite veins have been observed from the surface to 50 m, semi-massive ore from 114 to 131 m, and stockwork ores occur at 200 m depth. Post-Archean Australian Shale (PAAS)-normalized REE and Y patterns of the quartz-calcite veins show a flat trend, while those of the semi-massive and stockwork ores are depleted of light REEs. Sulfur isotope ratios ($\delta^{34}S_{CDT}$) of chalcocite from the semi-massive and stockwork ores are +5.6‰ and +8.3‰, respectively. The quartz from quartz-calcite veins and the semi-massive ores hosts primary liquid and vapor inclusions with homogenization temperatures and salinity ranging from 95 to 147°C, 8.0 to 18.7 wt % NaCl eq., and 118 to 214°C, 9.1 to 17.9 wt% NaCl eq., respectively. Weighted mean of bulk gas compositions of the fluid inclusions in quartz in the quartz-calcite vein is 98.98 mol% H_2O, 0.75 mol% N_2, 0.25 mol% CO_2, 0.02 mol% CH_4, and traces of Ar, H_2S, and He. The fluid inclusion gas compositions indicate transitional shallow meteoric and magmatic signatures.