Using La-Icp-Ms Trace-element Sulphide Mapping to Delineate Multiphase Co-Cu Mineralization in the Kakanda Deposits, Central African Copperbelt DRC

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The Neoproterozoic Central African Copperbelt located in southern Democratic Republic of Congo (DRC) and the northwestern Zambia contains ~50% of the world's cobalt reserves and significant resources of copper, zinc, nickel, and gold. These energy critical elements are hosted in the Katanga Supergroup carbonate and siliciclastic metasedimentary rocks which were deposited in an epicontinental basin formed during the break-up of Rhodinia. Multiphase hypogene mineralization in the Katangan basin occurred over a time frame of >300 million years linked to basin rift and inversion events which also encompassed salt evacuation and dissolution.

The multiple phases of mineralization have been distinguished with the aid of LA-ICP-MS trace element mapping of sulfide minerals and SEM-EDX mapping of associated alteration phases. Early stage carrollite (Car I) exhibits multiple growth stages with Sb-Mo depleted cores overgrown with elevated Sb-Mo overgrowths. Car I has multiple morphologies; it can be inclusion rich or poor and can form anhedral masses or euhedral crystals. Copper sulphide minerals: chalcocite, bornite and chalcopyrite do not exhibit growth zones. They intergrow with and overgrow Car I. Copper sulphide minerals which overgrow fractured Car I are often associated with dolomite-quartz veins and are intergrown with phyllosilicates, talc in carbonate rocks and chlorite or muscovite in siliciclastic host rocks. Locally, a second phase of carrollite (Car II) with a vuggy texture overgrows the previous sulfide minerals. Car II is enriched in Ni-Mo, has an elevated Co:Cu ratio, and is depleted in Sb and Bi relative to Car I. Vugs within Car II are variably filled with sphalerite. Pyrite outboard of the Cu-Co zone in the deposit displays multiple growth zones defined by elevated concentrations of As, Bi, Mo, Ni, Sb and Se. Rhenium values are significantly higher in Car II compared to earlier sulfide phases which suggests potential issues with mixed phase Re-Os dating.