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Mineral Chemistry as a Potential Exploration Tool Applied to the Lusale Basin and Fishtie Deposit, Central African Copperbelt (Zambia)

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The Central African Copperbelt (CACB) is the world's largest repository of sediment-hosted copper and cobalt, which are critical metals for the energy transition. A key knowledge gap regarding this mineral system is a lack of detailed understanding of the larger-scale alteration mineral assemblage zonation and major and trace element chemistry patterns that are likely to exist around mineralized domains. A detailed characterization of samples from the CACB can address this gap and also enable the development of tools to guide exploration for technology metals across different sedimentary basins. Here, we report microprobe results on a key alteration mineral (chlorite) from (meta)sedimentary rocks from background areas in the Lusale Basin and from distal to proximal ore zones in the Fishtie deposit. This deposit contains approximately 55 Mt of 1.04% Cu at a 0.5 % cutoff in oxide, sulfide, and mixed oxide-sulfide ores, hosted in Neoproterozoic diamictites and siltstones of the Grand Conglomerat Formation that overlies basement schists and quartzites. Our initial findings show that most chlorites classify as ripidolite, with a few in the pycnochlorite field and one in the clinochlore field. Basement (meta-sandstones and schist) and Grand Conglomerat (diamictite) samples present variable Fe/Fe+Mg ratios depending on location within Lusale and Fishtie. All samples demonstrate a negative correlation between Si and Al, which is attributed to the variable substitution of Si^{IV} and $\text{Mg}^{\text{VI}}/\text{Fe}^{\text{VI}}$ by $\text{Al}^{\text{IV}}+\text{Al}^{\text{VI}}$ via the Tschermak substitution. However, a negative correlation is not observed between Fe+Mg and Mn, which could indicate the presence of other cations in the M^{2+} octahedral site. Future work will expand microprobe and LA-ICP-MS analyses on chlorite from distal to ore-proximal zones in the Fishtie deposit and Lusale Basin, as well as extend analyses to other key alteration (muscovite and biotite) and accessory (apatite, rutile, and zircon) phases in this part of the CACB.