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Fault-Controlled Stratigraphic Architecture of the Fishtie Cu-Co Deposit in Zambia

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Cu-Co deposits of the Central African Copper Belt are hosted in rocks of the Neoproterozoic Katangan Supergroup, which comprises a rift-phase clastic sequence (Lower Roan Group), a platformal carbonate-rich sequence (Upper Roan Group), and a shallow marine-origin clastic sequence (Mwasha Subgroup, Nguba, and Kundelungu groups). In the Fishtie area, to the southeast of the Zambian Copperbelt, the Lower Roan and Upper Roan sequences are, at least locally, absent, and Cu-Co sulfides are hosted in a ~300-m-thick succession of Nguba Group rocks. The stratigraphy consists of Grand Conglomérat, which is interpreted as a Sturtian-age glacial diamictite, overlying Kaponda Formation siltstone, and Kakontwe Formation dolostone. The area has undergone significant deep weathering.

The Grand Conglomérat (Mwale Formation) at Fishtie is comprised of five diamictite lithofacies that show distinct clast sizes and two siltstone lithofacies with distinctive sedimentary textures. These lithofacies are in turn classified into five facies associations (FAs) based on stratigraphic location, occurrence of iron formation, and Ti-Zr geochemical facies. These five FAs are interpreted as five discrete flow units of diamictite, each of which is capped by a siltstone layer. The two lowermost flow units (GC1 and GC2) are present only in the northeastern portion of the current drilling area. The stratigraphically higher units (GC3, GC4, and GC5) occur across the drilled Fishtie area. The Grand Conglomérat commonly grades into overlying calcareous Kaponda Formation siltstone. The Kaponda Formation siltstone is typically <5 m thick and carbonaceous. The Kaponda Formation siltstone grades upwards into the bedded silty dolostone of the lowermost Kakontwe Formation dolostone. The Kakontwe Formation at Fishtie is comprised of four lithofacies including silty dolostone, massive dolostone, carbonaceous siltstone, and laminated dolostone.

Individual units of the Mwale and Kakontwe formations display significant thickness variations across the Fishtie area. Thickness variations suggest that deposition of the Mwale and Kakontwe formations occurred within accommodation space formed locally in the hanging walls of three E-W-trending, segmented, high-angle, syn-sedimentary normal fault arrays and a NE-SW-trending normal fault.

Sulfides occur within the basement rocks, the Mwale Formation, and the overlying Nguba Group rocks. Chalcopyrite and bornite are the dominant sulfides and occur as disseminations and in dolomite-quartz veins. Minor chalcocite, pyrite, and sphalerite are also present. Higher Cu grades occur in proximity to the interpreted faults and in carbonaceous units of the Kaponda and Kakontwe formations. Authigenic pyrite in carbonaceous units was replaced and overgrown by the Cu sulfides. Biotite, chlorite, and iron carbonate are spatially associated with the Cu sulfides. Cobalt occurs in cobaltite as disseminations and in characteristic mosaic-textured dolomite-quartz veins. The fact that the highest grade zones of Cu and Co do not occur together suggests Cu and Co mineralization were not coincidental. Although no systematic change in alteration mineral assemblage is currently recognized with respect to distance from the faults, the observations suggest that the syn-sedimentary faults served as conduits for the Cu-Co mineralizing fluids and the carbonaceous units served as reductants.