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Syntectonic Copper Mineralisation in a Back-Thrust Duplex at Pangeni, NW Zambia

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The Pangeni copper project in the Central African Copperbelt of northwest Zambia is almost entirely concealed beneath Cenozoic sedimentary cover. Nevertheless, by integrating information available from sparse outcrops in drainages over a project-wide area of ~700 km² with geophysical data interpretation and drilling, it has been possible to deduce the fundamental controls on copper mineralization, specifically in the Central prospect area.

Structural analysis of data from the limited outcrops reveals that the main deformation involved subhorizontal, NW-SE compression, which formed shallowly to moderately plunging fold axes with axial planes dipping shallowly to moderately northwest and southeast. These structures are also observed in oriented drill core, showing shear zones in which fold asymmetry and kinematic indicators have a dominantly top-to-SE sense of movement. Interpretation of the geophysics data, in particular the first vertical derivative of the reduced-to-pole magnetic survey, shows a pattern indicative of duplex thrust structures involving late Proterozoic Katangan units and their basement.

The copper mineralization in the project area is clearly structurally controlled. At the Central prospect, it generally occurs as chalcopyrite- and subordinate bornite-bearing veins, which are both deformed with and by the shear fabric as well as cutting it. The former two are considered to have formed by fluids migrating along active thrust zones, whereas the latter represent mineralization postdating main thrust movement. These later-stage veins occur as an orthogonal conjugate set developed during oblate strain imposed by vertical loading.

This evidence indicates that the copper mineralization at the Central prospect occurred during development of a top-to-SE thrust duplex, which is a back-thrust in terms of the overall tectonic transport direction of the Upper Proterozoic to Lower Cambrian Lufilian orogeny.