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Geological Characterisation, Stratigraphic Correlation and 3D Modelling of the Musinga Copper Exploration Play, Northeast Kabompo Dome, Democratic Republic of Congo

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Musinga is a greenfield exploration licence located in the Democratic Republic of Congo, adjacent to the border with Zambia. The area is masked by laterite, saprolite, and Kalahari sand with limited rock exposure, hampering mapping. Ivanhoe mines explored the area between 2012 and 2019 with a combination of geophysical surveys and diamond drilling. Eight of fourteen holes were re-logged and sampled for polished thin sections to characterize the lithologies and build a lithostratigraphic framework. The lithostratigraphy comprises Pre-Katanga basement gneissic schists unconformably overlain by Proterozoic Mwashya of the Katanga Supergroup. Mwashya is locally characterised by pale grey phyllites and altered micaceous siltstones, fine-grained sandstones, and some thin, strongly pyritic black shales. The black shales could provide excellent sulfur reservoirs for copper reduction. Intense alteration, metamorphism, deformation, and gradational lithology changes complicate hole correlation. Identification of distinct pyritic black shales that appear in three of the deep Musinga holes acted as key marker horizons for correlation. The Musinga rocks have been moderately deformed by folding, faulting, and zones of intense quartz, calcite, and dolomite veining which sometimes contain strong pyrite, trace chalcopyrite, and pyrrhotite.

The Sentinel Copper and Enterprise Nickel mines located on the Zambian side of the Kabompo Dome provide useful geological analogues to Musinga. Both deposits show that structural deformation and host-rock facies are key factors controlling mineralisation along the edge of the Kabompo Dome. This could be due to structures enhancing permeability in the naturally low-permeability phyllites. Brittle deformation such as dilational strike-slip fault jogs and related fracturing could have allowed copper brines to migrate to reductant pyritic shales around the Kabompo Dome, inducing deposition of copper sulfides. Exploration in the Musinga area should target pyritic black shales proximal to steeply dipping faults identified from magnetic discontinuities, which could act as higher-permeability conduits for mineralising brine migration.