Applying Geometallurgical Models to Khoemacau Copper Mining's Zone 5 Deposit, Kalahari Copper Belt, North West District, Botswana

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Khoemacau Copper Mining deposits are of economic significance. A feasibility study was recently completed on their Zone 5 high grade copper-silver deposit. The project incorporated six geometallurgical models based on drilling of over 330 diamond core and reverse circulation holes totalling over 135,000 m. Geologic models were compiled from drill logging, recent aeromagnetic data and stratigraphic interpretations. Mineralogical models were built from analytical and metallurgical results and studies. Khoemacau successfully integrated the six separate orebody models to assist in mine planning and help define project costs and revenues.

Regional stratigraphic interpretation and modelling identified the favorable contact between the lower D'Kar and the Ngwako Pan Formation. The lithology model of the lower D'Kar consists of an alternating sequence of reduced facies siltstones, mudstones, sandstones and minor limestones. These units are host to the majority of the economic copper and silver mineralization. Alteration associated with mineralization is predominately silicification, commonly in the form of quartz-calcite veins, quartz flooding within shears and hydrothermal alteration, albitization, and chloritization. Alteration intensity increases with higher grades of mineralization due to increases in shears and veins. Structural layers and fold axes were compiled into two main phases of regional and local scale folding. Dominant structures were modeled sub-parallel to bedding. Flexural slip, sheared quartz veins and crackle breccia is the direct result of progressive deformation. Mineralization is stratigraphically controlled and economic copper (>1% Cu) mineralization is located within structurally controlled trap site environments. These structural variables played an important role in the formation of mineral trap sites, permeability and fluid flow that remobilized and upgraded the copper. The models delineate the continuity and spatial distribution of multiple breccia domains and shear zones.

Analytical samples and metallurgical test results were used to design conventional recovery circuits using milling and flotation processing. Three grade zone models were built to identify sulphide mineralization. Two low grade copper (>0.1% Cu) zones were identified in the hanging wall and footwall and one high grade copper zone (>1% Cu) was identified in the ore zone. Sulphide minerals such as bornite, chalcopyrite, and accompanying chalcocite and silver are present within the sulphide ore zone. High grade mineralization in this ore zone averages approximately 2% Cu and 20 gpt Ag. Metallurgical test work determined that copper and silver recovery and concentrate grade will vary depending on the mineralogy and ore type. A mineralogical model based on visual logging of mineralogy and cyanide soluble copper analysis has aided in predicting the mineral abundance within each grade zone. Oxide copper minerals (malachite, chrysocolla) are also present in an undulating near-surface cap that blankets the deposit with 70 m of oxide plus sulphide minerals in a transition zone.

Each of the above rock properties have an effect on the outcomes of mining and treatment processes of the business. The geometallurgical models were a critical and fundamental component of the exploration program that added significant value to the Khoemacau's Feasibility Study. On-going drilling, detailed analytical sampling and additional metallurgical tests will continue to have a positive effect on predicting and optimizing future mine planning and mineral processing.