The transition from resource definition to mining: Adding value to production with geological data, a case study from the Sentinel deposit, NW Zambia

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The transition from a geologically focused resource project to a mining project is commonly difficult. First Quantum Minerals recently employed a campaign-style project involving 27 geologists, who over 18 days worked together to develop geological parameters that could be directly used in early mining and processing of the Sentinel copper orebody in northwest Zambia. 55 diamond drill holes (18km of core) were structurally relogged to produce 7 new detailed cross sections across the deposit. This work identified a major drag fold as the host structure to the deposit, with several internal detachment surfaces that correlate with the margins of mineralized domains within the current resource model. These detachment surfaces also correlate with sharp boundaries in trace element data. The newly identified detachments will be incorporated as hard boundaries in the resource model, and linear data from the curved hinge of the drag fold will be used to better constrain the shape of high-grade copper domains within this fold hinge.

Geometallurgical data for processing of the new deposit was developed from whole-rock, four acid digest multi element geochemical data from drill core. These data were used to define geochemical proxies for rock hardness and silicate gangue species, organic carbon content, sulfide gangue species and acid buffering capacity. The proxies can be applied to a block model and used in mine planning to help predict mining costs associated with blasting, crushing, and milling. Production geologists should be able to notify the plant of the timing of changes in carbon percent, gangue silicate mineralogy, and gangue sulfide species and ratio with respect to chalcopyrite during production. Plant metallurgists can use the geochemical information to optimize the sulfide concentrate with respect to smelter requirements, in particular for deleterious elements such as carbon and magnesium. The campaign-style approach utilized exploration and resource geological data to produce results focused on mining-critical parameters that should allow a smoother hand over of the project from the geological team to the mining team.