Process Mineralogy for Virtual Flowsheeting

As part of a recent flowsheet development program, XPS took a new approach to using QEMSCAN generated process mineralogy data to improve upon an existing and complex baseline flowsheet. The approach resulted in significant improvements in concentrate grade and recovery performance, simplified the process and reduced the capital and operating costs. The use of these novel process mineralogy tools streamlined the flowsheet develop effort and reduced the testing cost with a shorter schedule to completion.

The original flowsheet was based on a complex MF2 arrangement with stage grind and flotation in two steps. XPS was challenged to replace this high capital and operating cost flowsheet with one which was equally effective in recovery of all primary and secondary Cu sulphides to one final concentrate while reducing coarse locked Cu sulphide losses to tailings and SiO_2 dilution to the Cu concentrate.

To achieve this, kinetic flotation tests were completed on a composite representative of the first 5 years of mine production at various primary grinds. The composite sample selection was based on the XPS approach of matching lithologies, mineral types and grade distributions from the mine block model to the sample (*see* article page 4, XPS Bulletin Issue 13). Size-by-size mineralogy was then performed on all kinetic concentrates and tailings on the three best performing grinds. From there, the Cu sulphide kinetics based on liberation and particle and mineral grain size were used to design a flowsheet.

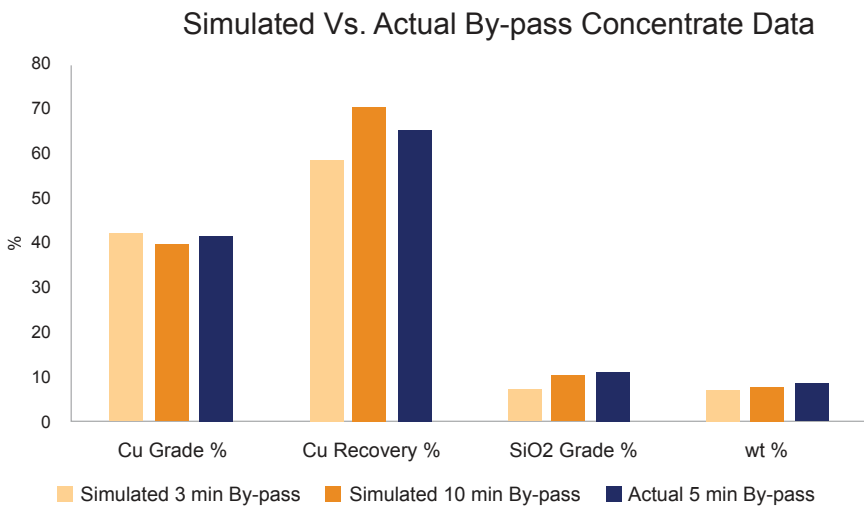
The Cu orebody is known to have mineralogy of a very fine grained nature (8-10µm) sufficient liberated Cu sulphides were present at a coarser grind to warrant a bypass cleaning circuit to minimize entrainment of SiO_2 to final concentrate. Tailings Cu losses was achieved by minimising fine grained, coarse locked losses, through a particle size scalp avoiding unnecessary regrinding.

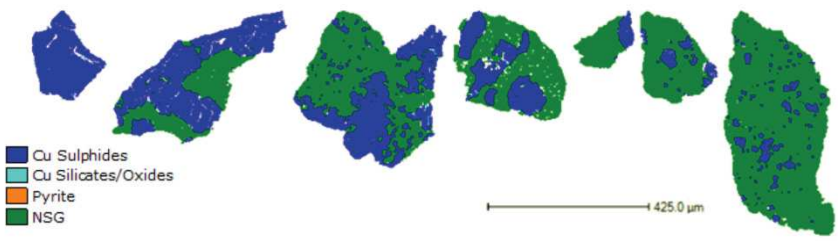
Prior to any testwork, flowsheet options were modeled using Excel and the QEMSCAN mineralogy data. The QEMSCAN data quantifies mass and liberation class of each particle size increment and measures the grain sizes of minerals to target primary and regrind sizes. This quantitative data lends itself to simple mass and mineral balances and makes simulation of various process responses simple and low cost when compared to full testing and trial and error approach. Once established, testwork can be more focused and cost effective.

Since 1998, XPS has institutionalized the use of process mineralogy data to aid in flowsheet development efficiency and robustness. This exciting highly quantitative and predictive approach has further improved efficiency of the process development effort and will continue to be used at XPS to reduce cost and time to final frozen flowsheets.

The figure below shows the simulated flowsheet performance of the ore with optimum grind size and flotation time selected from the mineralogical measurements in comparison with the physical confirmation lab tests. This shows that process mineralogy can be used as a predictive tool for flowsheet development and represents another step towards reducing cost and time in the lab testing on a trial and error basis. The particle images are an example of the range of liberation observed in the sulphides.

For more information contact
Elizabeth Whiteman, Senior Geoscientist
elizabeth.whiteman@xps.ca





Particles images from +106µm fraction sorted by decreasing Cu sulphide liberation.