A Growing Case for the Utilization of Automated Mineralogy and Geometallurgical Principles During Mineral Exploration

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Automated mineralogy (AM) systems using scanning electron microscopes (SEM) with energy dispersive spectrometer (EDS) have been employed for a diverse range of geological applications where there has been a need for sample characterization. The most popular and successful field has been in examining ore recovery circuits where the technique is employed as a routine analysis engine, characterizing samples with the aim of optimizing efficiency and recovery. Despite the success of these instruments, technological and methodical development has been limited over recent years until the release of ZEISS Mineralogic Mining.

The ongoing slump within the mining industry has resulted in much discussion regarding the challenges of; increased depth of discovery, decrease in grade, increase in mineralogical variability and complexity, increase in deleterious elements/phases and in the ever present drive to reduce exploration/production costs. These trends suggest the mines of the future will not be decided solely on grade and tonnage, but also on the early characterization and understanding of the above issues, and thus, the geometallurgical model of the deposit will become key.

Typically, a whole host of data is gathered from outcrop, but as the trends suggest, these outcrops are becoming increasingly rare. This will result in an increased emphasis on drilling during exploration with drill core becoming an increasingly expensive and valued commodity. These drill cores provide a window into the prospect where valuable information on mineralogy, ore variability, textures, associations, target element deportment etc. is present which can all be extracted through the utilization of AM.

In this paper we examine two key recent advances in AM; the advent of quantitative EDS and the development of portable SEM-EDS systems for use in the field.

Quantitative EDS for AM adds value to the exploration process by providing early knowledge on (for example) copper-bearing mineralogy, deportment and associated deleterious phases. This is key in understanding the economic viability of a prospect. Furthermore, such information has the potential to provide an earlier geometallurgical understanding to give confidence to investment decisions. Indeed, such data can even be applied for the early prediction of metallurgical response of ore and thereby guide flowsheet development.

Recent technological advances have also seen the first ruggedized and mobile automated mineralogy systems been used during exploration within the oil and gas industry on well sites, where fast and accurate sample characterization is helping guide drilling programs. This means the potential now exists for such mobile systems to be used in the field in such exploration projects, giving easier and quicker access to mineralogical data that was otherwise only accessible through specialist laboratories.