Grain Morphology and Hosting Characteristics as Determining Factors in Micron to Sub-micron Gold Recoverability

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ABSTRACT

Discrepancies between assay and recovered gold may be due to mineralogical factors, such as the presence of refractory gold, grain size and shape, host associations, liberation, or due to issues with the metallurgical process. Modern microscopy techniques can afford exacting quantification of gold presence as well as a description of its environment and 3D morphology. The dispersion of non-liberated, sub-micron (down to a few nanometres) gold phases within a host or hosts can now be measured, as can the effects of grain morphology on recoverability in a circuit.

Traditionally, light microscopy and SEM based automated mineralogy techniques have been used to characterise gold ores and estimate recovery. Despite their widespread application there have been limitations to the information that could be obtained. In the case of automated mineralogy analyses, there has been an inability to account for sub-micron grains in a consistent or quantifiable manner, even though these may form a significant proportion of the grade. Furthermore, application of SEM techniques to low grade ores has been hampered by the complexity of sample preparation. Low grade ores often require the preparation of a large number of blocks for a statistically viable analysis. An issue that is complicated further by the nugget effect and high tenor nature of gold mineralisation.

In this paper we will present advances in SEM based automated mineralogy analysis of gold ores that quantifiably and consistently account for the presence of nanometre sized gold grains. We will also elaborate on the application of 3D (XRM) techniques that offer several advantages over 2D techniques when analysing the cause of gold losses to tailings, overcoming the stereological bias that requires a multitude of samples for 2D analyses, and in the detection of phases present in trace proportions (i.e. low grade gold).