Predicting processing domain response using hyperspectral mineralogy: Applications for coarse waste separation

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The tendency for ore phases to preferentially fractionate into finer size fractions during early comminution stages is referred to as natural deportment and allows potential to separate coarse, low grade material from an upgraded mill feed stream. This processing response is rarely ubiquitous across an ore body and is inherently driven by the underlying mineralogical and textural heterogeneity within the rock mass. This study evaluates the relationship between physical rock properties (e.g., impact hardness), mineralogy and ore textures at the Gramalote gold prospect, Colombia to better understand the drivers for gold fractionation during breakage. Equotip is an impact hardness device used in geometallurgical studies for estimating comminution performance of ore domains. This study evaluates the relationship between impact hardness and mineralogical variability determined using hyperspectral core scanning technologies. Equotip measurements were collected at fixed intervals of 2.4 cm along the drill core to directly correspond to hyperspectral mineralogical data and line scan imagery collected using the CSIRO HyLogger. Alteration domains characterised by chlorite and muscovite forming selvages around mineralised veins were identified in the hyperspectral data and correspond to domains with lower Equotip hardness measurements. In contrast, least altered domains comprise un-veined tonolite and are dominated by feldspar and quartz with lower relative abundance of muscovite and chlorite. These zones have distinctly higher corresponding hardness measurements. This emphasises the capability of hyperspectral mineralogical characterisation techniques to be used as a proxy for geometallurgical hardness tests. Softer domains tend to preferentially fractionate into finer size fractions during early comminution stages (e.g., blasting and crushing) whereas harder domains may deport to coarser size fractions. This suggests that indices to better predict amenability of ores to coarse waste rejection can be derived by evaluating mineralogical and textural heterogeneity in drill cores.