

Effect of Gangue Mineralogy on Flowsheet Design and Plant Operation

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ABSTRACT

Copper-(Fe)-sulfide ore deposits typically have Cu grades varying from 0.5-5 wt%. This equates to approximately 1.5-15 wt% sulfide minerals, hence 85-98.5 wt% of the remaining ore mass is comprised of gangue minerals. Each different Cu-deposit type (e.g. Fe-oxide Cu-Au±U (IOCG), porphyry Cu, skarns, sediment hosted Cu, volcanogenic massive sulfide, etc) has a suite of gangue minerals which typify the deposit type. However, the common gangue minerals include, but are not limited to, Fe-oxides (hematite and magnetite), Fe-oxyhydroxides, quartz, micas (muscovite and biotite), chlorite, feldspars, sulphates (barite, anhydrite, gypsum), carbonates (siderite, ankerite, dolomite, calcite), fluorite, phosphates (apatite, monazite), amphiboles, pyroxenes, garnets, tourmalines, talc, serpentine and the clay minerals (kaolinite, illite, vermiculite, smectite).

Most, but not all, of the gangue minerals are benign during mineral processing and subsequent hydrometallurgical and/or pyrometallurgical processing. Gangue minerals with layered silicate structures (i.e. micas, chlorite, clay minerals) are universally problematic during materials handling due to their propensity to absorb water, easily slime during grinding/milling, can depress physical-chemical-thermal separation of ore from gangue minerals, and finally inhibit separation of fluids from residues leading up to final disposal. Acid reactive minerals such as micas, chlorite, carbonates also impact on reagent consumption rates during leaching. Bill Johnson and Peter Munro (personal communication) are famous for simplifying the purpose of each unit of operation during mineral processing as ***liberate, separate or dispose***. This concept can also be extended to units of operation in hydrometallurgical and pyrometallurgical circuits. When developing flowsheets and operating a plant, the impact of each gangue mineral present needs to be quantified and assessed in terms of ***liberate-separate-dispose***.

The behaviour, and impact, of gangue minerals during mineral processing, and hydrometallurgical and pyrometallurgical treatment at Olympic Dam will be described in this paper.