

Responsible Mining – the Pyrite Challenge

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The concept of “responsible mining” is used widely both as an aspirational goal and a guide to best practices. In reality, it is poorly defined particularly in the context of ore deposit types and mining methods that are most likely to produce positive outcomes. The concept of environmental models for mineral deposits, linked to geological deposit models, is not new, but the application of these concepts in exploration, resource assessment and responsible mining is limited.

Pyrite is a common mineral in many ore systems, varying from a minor component of ore to a major constituent in millions or billions of tonnes of wall rock, much of which becomes waste. Oxidation and weathering of pyrite contribute significantly to acid generation and release of metals requiring costly management. In the case of copper, increasing demand will be met significantly by mining low grade (<0.2% Cu) porphyry mineralization predominantly in clay-dominant alteration with limited buffering capacity. Volcanic-hosted base and precious metal systems also contain abundant pyrite although the volumes involved in mining are less extreme, while magmatic Cu-Ni sulfide, IOCG, and sediment-hosted Cu deposits can have low to virtually no pyrite.

Reducing the amount of pyrite mined requires an increasing focus on low pyrite systems, more selective mining, and ultimately in-situ recovery. Given that these approaches may not be sufficient to meet demand, new ways to process pyrite concentrates efficiently need to be developed including variations on traditional roasting as well as bio- and enhanced chemical leaching. In all cases, the production of sulfuric acid and other valuable sulfate products must be matched with recovery of all critical metals that occur in pyrite as products that can enter supply chains. The industry can not pretend to be responsible without addressing pyrite and as a result translating a challenge into a major opportunity.