Acid mine drainage prediction using a combined chemical-mineralogical and textural characterization approach on mine tailings samples

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Acid Mine Drainage (AMD) occur by meteorization of sulphide minerals when mining waste is exposed to oxidizing conditions. To provide a more reliable prediction of AMD, this work integrates classic AMD tests with mineralogical, textural and geochemical analyzes of 8 tailings samples from different ore deposits: massive sulphides (Iberian pyrite belt, Spain), Cu-carbonatites (Palabora Igneous Complex, South Africa) and Cu-porphyry (Andes, Chile).

Samples were studied by petrographic microscope, SEM-EDAX, XRD, X-ray fluorescence and ICP-MS. The chemical tests applied were: Modified Acid Base Account [1], Net Acid Generation [2] and Acid Buffering Characteristic Curve [2]. Based on these results, tailings were classified in three categories: (i) AMD generating samples, composed by very fine free sulphide crystals, with high surface exposition; (ii) Non AMD generating samples, comprised of silicates, oxides, hydroxides and sulphides appearing as very fine free grains, exposing also high surface areas, and (iii) AMD neutralizing samples, composed by carbonates, silicates, oxides and hydroxides with medium granulometry, promoting a medium to low exposition of grain surfaces.

Interpretation of classical predictive chemical tests requires consideration of mineralogical and textural properties, as its application by itself can lead to innacurate results. This study propose a new methodology for chemical and mineralogical characterization of tailings samples, that can lead to a better evaluation of the potential risk of AMD generation in this type of deposits.

[1] Lawrence & Scheske (1997) Environ. Geol **32**, 100-106.
[2] AMIRA International (2002) Project P387A report.