
Environmental impact of the weathering of Cu-pyrite mineralization and mining waste at the Mathiatis abandoned mine (Cyprus): neutralization tests of acid mine waters

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Abstract

The impressive mining history of Cyprus is partially reflected on the abandoned mines spread all over the Troodos Mt. In the present study, the effect of weathering on Mathiatis mine waste was examined and the potential use of carbonate rock quarried in a neighboring area as an acid mining drainage neutralization agent was tested. Mathiatis provides a typical example of Cyprus-type massive sulfide mineralization comprised mainly of pyrite and chalcopyrite with minor proportions of marcasite and sphalerite. The ore is hosted within the lower-pillow lavas sequence of the Troodos ophiolite complex. Supergene alteration of the sulfide ore and the mine waste led to generation of acid mine drainage and the formation of an acid open pit lake. The pH of the pit lake water is as low as 2.8, sulfate concentrations range between 4600 to 4850 mg/L, whereas concentrations of heavy metals such as Cu, Zn, Cd, Co and Mn exceed the established regulatory limits for potable and irrigation water, rising environmental concerns. A preliminary assessment of the mine waste indicated they cannot be characterized as inert material according to current European legislation underlining the need for sustainable remediation methods. A combination of XRD and SEM-EDS analysis was used for the identification of Mg, Ca and Fe(II)- Fe(III) efflorescence mineral phases that retain heavy metals near the mine waste and the open pit lake shore. Furthermore, neutralization experiments of the acidic waters of the epilimnion gave encouraging results. The best neutralization agents proved to be quicklime and limestone quarried for aggregates in the mining district of Mitsero. The final pH in the experiments exceeded the value of 7, whereas concentrations of heavy metals, except Cd, Co, Mn, as well as sulfate decreased significantly.

Keywords: Acid mine drainage, neutralization tests, Cyprus type mineralization, efflorescences, mining waste

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