



Isotope geochemistry of waters affected by acid mine drainage in old labour sites (SE, Spain).

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The ore deposits of this zone have iron, lead and zinc as the main metal components. Iron is present in oxides, hydroxides, sulfides, sulfates, carbonates, and silicates; lead and zinc occur in sulfides (galena and sphalerite, respectively), carbonates, sulfates, and lead or zinc-bearing (manganese, iron) oxides. Mining started with the Romans and activity peaked in the second half of the 19th century and throughout the 20th century until the 1980's. From 1940 to 1957, mineral concentration was made by froth flotation and, prior to this, by gravimetric techniques. The mining wastes, or tailings, with a very fine particle size were deposited inland (tailings dams) and, since 1957, huge releases were made in directly the sea coast.

The objective of this work was to evaluate processes affecting waters from abandoned mine sites by way of stable isotopic analysis, particularly H and O stable isotopes from water and S and O from dissolved sulfates. Several common chemical and physical processes, such as evaporation, water-rock interaction and mixing could alter water isotopic composition. Evaporation, which causes an enrichment in δD and $\delta^{18}O$ in the residual water, is an important process in semiarid areas.

The results obtained indicate that, for sites near the coast, waters are meteoric, and marine infiltration only takes place in the deepest layers near the shore or if water remains stagnated in sediments with low permeability. The main source of sulfate was the oxidation of sulfides, resulting in the liberation of acid, sulfate and metals.

In order to assess the mechanism responsible for sulfide oxidation, the stoichiometric isotope balance model and the general isotope balance model were tested, suggesting that the oxidation via Fe^{3+} was predominant in the surface, and controlled by *A. ferrooxidans*, while at depth, sulfate reduction occurred.