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Hydro Geochemistry and Water Quality in a River Affected by Lead Mining in Southern Spain

Authors : Rosendo Mendoza, María Carmen Hidalgo, María José Campos-Suñol, Julián Martínez, Javier Rey

Abstract : The impact of mining environmental liabilities and mine drainage on surface water quality has been investigated in the hydrographic basin of the La Carolina mining district (southern Spain). This abandoned mining district is characterized by the existence of important mineralizations of sulfoantimonides of Pb - Ag, and sulfides of Cu - Fe. All surface waters reach the main river of this mining area, the Grande River, which ends its course in the Rumblar reservoir. This waterbody is intended to supply 89,000 inhabitants, as well as irrigation and livestock. Therefore, the analysis and control of the metal(loid) concentration that exists in these surface waters is an important issue because of the potential pollution derived from metallic mining. A hydrogeochemical campaign consisting of 20 water sampling points was carried out in the hydrographic network of the Grande River, as well as two sampling points in the Rumbler reservoir and at the main tailings impoundment draining to the river. Although acid mine drainage (pH below 4) is discharged into the Grande river from some mine adits, the pH values in the river water are always neutral or slightly alkaline. This is mainly the result of a dilution process of the small volumes of mine waters by net alkaline waters of the river. However, during the dry season, the surface waters present high mineralization due to a constant discharge from the abandoned flooded mines and a decrease in the contribution of surface runoff. The concentrations of dissolved Cd and Pb in the water reach values of 2 and 81 µg/l, respectively, exceeding the limit established by the Environmental Quality Standard for surface water. In addition, the concentrations of dissolved As, Cu, and Pb in the waters of the Rumblar reservoir reached values of 10, 20, and 11 µg/l, respectively. These values are higher than the maximum allowable concentration for human consumption, a circumstance that is especially alarming.

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