

# A Geochemical and Geophysical Characterization of Sulfide Mine Ponds at the Iberian Pyrite Belt (Spain)

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**Abstract** This work presents the results of a geochemical and geophysical characterization of the Monte Romero and La Naya mine ponds, belonging to the Cueva de la Mora and Riotinto mine districts, respectively, based on mineralogical, geochemical and geophysical techniques. In order to obtain a representative environmental characterization, two deposits showing different mineralogies, physico-chemical parameters, chemical compositions of tailings and pond conditions were selected. Monte Romero mine tailings showed an upper level mainly composed of silicates and a deeper level mainly composed of

sulfides and barite. The toxic metal content was different in both levels but high enough to exceed the regional legal concentration limits for agricultural soils. An electrical resistivity tomography survey revealed a homogeneous upper unit (3 m thickness), which displayed low resistivity values, corresponding to water-saturated silt and clay materials with an abundance of sulfides which was interpreted as the pond infilling. The La Naya mine pond presented a homogeneous mineralogical composition made up of quartz as the main mineral and chlorite-smectite and jarosite as accessory phases. The absence of sulfide phases and the low contents of metal elements are directly related to the reworking processes of the sludge dumped in this pond. The geophysical survey revealed that the pond infilling did not have a constant thickness, but ranged between 15 and 20 m. An inner groundwater flow in the infilling was recognized. The low resistivity values allowed the presence of acid waters and related subsurface flows to be identified in both mine ponds, but no acid water drainage occurred across their vessels. When compared to the Aznalcóllar tailings spill, the La Naya pond is large enough to release a similar amount of sludge, but of a very low metal content. The Monte Romero sludge displays a similar, potentially toxic metal content to the Aznalcóllar sludge, but its size is significantly smaller.

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