

Geochemical behaviour and potential health risk of mine waste reclaimed for agricultural purposes in “La Preciosa II” Mine (South of Spain)

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La Preciosa II is an abandoned copper-pyrite and chalcopyrite mine in the eastern part of Seville Province (South of Spain). Recently, about 10 ha of mine wastes were covered with carbonated rocks (mainly calcarenite) and building materials, and citric trees are being grown. However, after remediation actions, acid mine water (AMW) is still leaching from the subsoil, discharging into a natural stream that, 2 km downstream, flows into the Guadalquivir river. A preliminary mineralogical and geochemical study of AMW, mine waste and cultivated soil has been carried out to assess the environmental impact, the potential health risk and the real remediation possibilities of the abandoned mine site.

The cultivated soil showed a high content of calcite and traces of gypsum, while the mine waste showed pyrite, jarosite, and gypsum but not calcite, which was dissolved to form gypsum, depleting its neutralizing potential.

Very high concentrations of potentially toxic elements (PTE) were found in the mine waste. Some of them, such as Cu (up to 0.7 %), Zn (up to 0.2 %) and Ag (up to 50 mg/kg) could even be recovered, contributing to the circular economy. Pb (up to 0,8 %) showed the highest content in samples with jarosite, highlighting the role of this mineral in the retention of Pb. Other very toxic elements present were As and Cd. Concerning the cultivated soil, the PTE were below the screening levels, so they can be considered unpolluted, but there is still a potential health risk since the roots of the citrus could reach the underneath mine waste.

The pH of mine waste leachates reached values down to 1.1, and it was maintained between 2.4-3.0 downstream. The main PTE in the stream were Cu and Zn, which concentrations decreased downstream in combination with the precipitation of ochreous minerals such as jarosite and schwertmannite.

Mine waste dumps in la Preciosa II constitute a risk to the environment and the human health. The addition of carbonates and the precipitation of secondary minerals attenuates contamination in mine soils and stream water, but more efforts are necessary to remediate and reclaim the mine site.