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Clay mineralogy of wastes from sulphide mining ad metallurgy in Portman Bay, Spain

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Mining and metallurgical activities generates considerably amounts of mine tailings. Most tailings have been left in tailing ponds or mine sites without treatment, generating an environmental risk.
Portman Bay is heavily polluted as a result of historical mining and processing activities, during which time great amounts of wastes were produced, characterized by a high potentially toxic elements (PTE) content, acidic pH and minerals resulting from supergene alteration.
This study belongs to the geochemical and mineralogical characterization in-depth of waste materials from sulphide mining and metallurgy in Portman Bay. The main goal of this work is to analyse the evolution of the clay mineral assemblages, define them and correlate with the geochemical trends that exist in the area. A sampling design was carried out with cores of 10 metres depth. A total of twelve cores were made down, aligned in three rows with respect to the coastline. A sample was obtained for each metre of the profile, thus providing data of texture, and chemical and mineralogical compositions.
The total heavy metal(oid) content is very high, corresponding to materials affected by mining activities, in the following order, Zn>Pb>As>Cu>Cd.
Samples showed a characteristic mineralogical composition of materials that have undergone a grain selection process, being the most abundant quartz, iron minerals (e.g. siderite) and phyllosilicates (chlorite, kaolinite, micas and possibly greenalite). Pyrite and magnetite present a regular distribution in all samples. Anomalous percentages of these minerals have been found in the most surficial part of some cores. The inherited phases from the material that once constituted the wastes discharged into the sea are represented by phyllosilicates, quartz and magnetite, representing the gangue, while pyrite is a residual mineral of the beneficiated ore. Hematite and siderite are partly inherited and partly neoformed as a result of alteration processes. Jarosite has its origin in the oxidation process of pyrites and other sulphides, which has been partially carried out on surface in supergene conditions, being clear the sea influence for being natrojarosite the most representative phase.
The characterization and evolution of the clay mineralogy of the Portman Bay is a key to understand the redistribution of sediments and tailings occurred in the area. Moreover, it is essential to explore the possibility to use a specific phyllosilicate (probably Greenalite) as an indicator of mining character of the sediments.