Isotope geochemistry in waters affected by mining activities in Portman bay (Spain).

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The objective of this work was to characterize processes affecting waters from Portman bay by way of isotopic analysis, particularly H and O stable isotopes from water molecule and S and O from dissolved sulfates were studied.
Portman bay is situated close to the mining region of La Unión and was subject to mining from the time of the Roman Empire to 1991, when the activity ceased. From 1957 to 1991, the Peñarroya Mining and Metallurgical Society performed ore extraction on a large scale. From Lavadero Roberto, the waste materials were discharged directly into the sea in the inner part of the bay, and later they were also discharged to sea at a distance of the shore. These wastes mainly consisted in ore materials (sulfides as galena, pyrite and sphalerite), phyllosilicates in addition to siderite, iron oxides and sometimes alteration products such as jarosite, alunite, kaolinite and greenalite.

Mining activities have produced great amount of wastes, characterized by high trace elements content, acidic pH and minerals from weathering processes. According to the isotopic analysis, the origin of waters from Portman Bay is not marine, they are meteoric waters subjected to evaporation except for two superficial samples from Portman Bay, where seawater remained stagnated in impermeable sediments. The possible marine infiltrations only take place in the deepest layers (>17 m) because below this depth materials showed low permeability. Superficial waters from Portman bay have undergone evaporation while deep waters showed no evidence of this process. The isotopic results suggested that the sulfates mainly come from sulfide oxidation and transport of produced sulfosalts. The oxygen isotopes of water and sulfates were used to indicate the mechanisms of this oxidation, being Fe^{3+} the principal oxidant of pyrite. Moreover, there is evidence showing that sulfate oxygen is derived from water under aerobic and anaerobic conditions. Isotopic data also suggested that a reduction process is taking place under anaerobic conditions, favored by the depth.

Limestone-based technosols. A remediation technique for sediments contaminated by heavy metals.

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The aim of this work was to assess the suitability of limestone-based technosols for decreasing the toxicity of the leachates caused by rain in sites contaminated by heavy metals. For such a purpose, 64 technosols were prepared in containers of $0.75m^3$, filled with 4 types of sediments collected from Portman Bay and subjected to different stabilizer proportions (limestone filler), different thickness of a drainage layer and presence/absence of a topsoil cover. The technosols were then submitted to different humidity/dryness cycles simulating the usual rain conditions in the zone and percolates were analyzed using a bettery of bioassays.

Portman bay is situated close to the mining region of La Unión. The entire area around the bay was subject to mining from the time of the Roman Empire to 1991. Since 1957, the wastes from mining operations were discharged directly into the sea in the inner part of the bay, while later on, they were also discharged to sea at a distance of the shore. These wastes mainly consisted in ore materials (galena, pyrite and sphalerite), phyllosilicates, in addition to siderite, iron oxides and sometimes alteration products such as jarosite, alunite, kaolinite and greenalite. These materials have suffered a concentration process by floatation with sea water and as a result of the discharge, the whole of the bay has filled up with wastes which also extend into the Mediterranean Sea.

The obtained results suggest that selected remediation technique reduces significantly the toxicological effect of the percolate to the tested organisms. The ecotoxicological testing may be a useful approach for assessing the toxicity as a complement to chemical analysis. In addition, the use of a battery of bioassays allows diminishing problems related to false positive results. The use of limestone filler constitutes an excellent option in sediments polluted by trace elements, because of risk for human health or ecosystems does not exist after the intervention. in addition, the designed experience allow to optimize stabilizer quantities, and may suppose a big cost-saving project in areas affected by mining activities.

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