Remobilization of dissolved metals from a coastal mine tailing deposit driven by groundwater discharge and porewater exchange

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Mine impacted coastal environments have been rather extensively studied around the world. However, the role of Submarine Groundwater Discharge (SGD) and Porewater Exchange (PEX) as pathways delivering mine-derived pollutants into seawater column have been largely overlooked.

Portmán Bay is located in the Cartagena-La Unión Pb-Zn sulphur mining district in Murcia, SE of Spain. The disposal of about 60 million tons of metal-rich mine tailings since 1957 to 1990 led to the infill of most of the bay (i.e. 750,000 m^2) and to the formation of a coastal prism that extends seaward. Although the effects of metals on indicator species has been shown previously, there is still a lack of knowledge about the release of dissolved metals from the emerged tailing deposit into the sea, more than 25 years after the closure of the mining activities.

This study shows how there is still a continuous release of dissolved metals into the sea driven by both PEX and SGD. Most of dissolved metals (Ag, Cd, Co, Pb, Zn) are remobilized and injected in the water column driven by PEX, which is an ubiquitous mechanism acting along the shoreline. Although SGD only represents a 13% of the water flow, it acts as the main driver of dissolved Fe into the sea, which is likely restricted to the west side of the bay. These large amounts of dissolved Fe^{2+} from the anoxic tailings trigger a massive precipitation of iron hydroxides that enables the removal of most dissolved metals from the water column. This study demonstrates and compares the role of PEX and SGD as permanent and significant mechanisms for the land to ocean transfer of dissolved metals.