Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.17504

Potential Toxic Elements (PTEs) enrichment in drainage canals' sediments from a low-lying coastal area affected by saltwater intrusion.

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Complex drainage systems combining artificial channels and reclaim water pumps are worldwide used to control water table and water excess in low-lying coastal areas, allowing human activities. Drainage activities in these areas, however, promote vertical seepage and groundwater salinization, decreasing freshwater availability. The drainage network of canals is the interface among surface water from terrestrial agro-ecosystems and local groundwater, and their sediments may register and reflect peculiar enrichments in PTEs originated from both environments. This study investigates the enrichments of Potential Toxic Elements (PTEs) in sediments from a land reclamation drainage network of canals and argue the involved mechanisms. The investigated area is located in the south-eastern part of the Po River plain in Italy (surrounding of the Ravenna city). This area is at or below mean sea level, highly oriented to tourism, industry and agriculture activities, as well as frequently exposed to inundation, groundwater and soil salinization.

A geochemical database of 203 sediment samples collected at the drains bottom, along with drainage water and groundwater samples, were analysed for major and trace elements.

The distribution of PTEs was assessed in relation to the local depositional environment in order to discern between background concentration and enrichment phenomena due to drainage and other human activities. Concentrations of As, Co, Pb, and Zn exceed the National regulations for sediments. The As and Co enrichments were especially found in the low-lying canals that collect upward seepage of anoxic saline groundwater from the salinized coastal aquifer. The precipitation of Fe- and Mn- hydroxides appear to control As and Co distribution and enrichment in the canal' sediments. The Principal Component Analysis (PCA) results confirmed the dependency of the As and Co enrichments by the distance from the sea and elevation, which are both directly related to groundwater salinization, while indicated the use of fertilizers as responsible for the enrichments of Cu, Pb, and U.

This study posed the attention on natural and anthropic mechanisms leading to the enrichment of PTEs in sediments from the drainage canals revealing the involved geochemical processes for this relevant infrastructure at the terrestrial-aquatic interface.