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Schicksal, Wechselwirkungen und Wirkung von bodenfremden Stoffen im Boden

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Titel
Arsenic in soils and waters around the Kori Kollo gold mine on the Bolivian Altiplano: redox-induced speciation and mobilization

Abstract
Mining activities in the Bolivian Altiplano have caused considerable negative environmental consequences on the water, soils, vegetation resources, biodiversity, and the atmosphere over the years. In this study, samples of soils, sediments, river water, water from drinking pools, and groundwater were collected from the area around the Kori Kollo gold mine, located near the city of Oruro on the Bolivian Altiplano to investigate the concentrations of arsenic (As) as an important contaminant associated with the mining activities in this area. Moreover, the redox-induced speciation, mobilization, and release dynamics, of As in soil/sediment samples was studied under controlled reducing and oxidizing conditions using an automated biogeochemical microcosm apparatus. The total As concentrations in the soils ranged between 10 and 81 mg kg^{-1} and exceeded the international trigger action values (10-65 mg kg^{-1}) of As in agricultural soils. Arsenic concentrations (µg L^{-1}) reached values up to 2,688, 952, and 300 in the groundwater, drinking pools, and surface water, respectively and exceeded the current WHO provisional guideline value of 10 µg L^{-1}. The total dissolved concentrations of As varied from 368 to 3,130 µg L^{-1}. The dissolved concentrations of As increased under oxidizing conditions and decreased under reducing conditions. Data of As speciation showed that the As (III) accounted from 0.0 to 79% of the total dissolved As and increased under reducing conditions, while the As (V) accounted from 21-100% of the total dissolved As and increased under oxidizing conditions.
The results conclude that i) although the total concentrations of As in the soils around the mine are not very high, the concentrations of As in the waters were very high, 2) the concentrations of total dissolved As were very high which might indicate the high mobilization of As and support the anthropogenic source of As in theses soils, 3) the release and mobilization of As increased under oxidizing conditions as compared to the reducing conditions, and 4) the As (III) accounted values up to 79% of total dissolved As, which might increase the toxicity and risk of As in the soils and waters especially under reducing conditions. These results highlight the environment risk of As which might be a main reason for the gradual death of goats and cows, the biodiversity and the decline of fishing and agricultural sources in this area.