Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.34810

The role of water-rock interactions on the occurrence of geogenic contaminants in shallow groundwater in the vicinity of the Salar de Uyuni, Bolivia

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One of the largest known global lithium brine resources is the Salar de Uyuni (SDU) in the Bolivian Altiplano, yet presently, lithium exploitation is limited. Large-scale future lithium extraction could impact the regional water resources, which are used by local indigenous communities living in the vicinity of the SDU. Here, we investigate the water quality and inorganic chemistry of shallow groundwater in the watershed of the SDU, aiming to monitor the water quality and evaluate the geochemical factors that control the occurrence of geogenic contaminants. Integrated water quality data of shallow groundwater (n=63) used by communities surrounding the SDU shows that most of the groundwater exceeds the World Health Organization (WHO) drinking water standards for at least one contaminant of chloride, boron, and arsenic. Our geochemical analysis reveals low-saline groundwater associated with basaltic rocks in the western areas of the SDU is associated with distinctively high boron contents, B/Li, Mg/Li, and low $^{87}Sr/^{86}Sr$ ratios while groundwater in the eastern side has a wider salinity and composition ranges with higher $^{87}Sr/^{86}Sr$ ratios, reflecting the role of low-temperature water-rock interactions with the local lithology. Conversely, the occurrence of saline groundwater characterized by low B/Li and Mg/Li ratios indicate mixing with underlying saline as well as arsenic-rich geothermal waters. Future large-scale lithium extraction could likely cause regional groundwater level draw-down and thus further increase the impact of underlying saline geothermal waters that could exacerbate the already impaired quality of the water resources available for the local communities.