Noble gas stable isotope reconstruction of background climatological water table depths: An indicator of lithium mining impacts

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The Lithium Triangle at the intersection of Chile, Argentina, and Bolivia contains more than half of the world's lithium reserves.[1] While lithium has been mined here for decades, production has increased exponentially in recent years with the expanding market for lithium batteries—the storage power behind personal electronics and electric vehicles. Local communities are concerned about socio-environmental impacts, as the extraction process involves evaporating pools of mineral-rich groundwater, a non-renewable resource[2] in this hyper-arid region.

We apply a recently developed tool to reconstruct past water table depths using the isotopic composition of noble gases dissolved in groundwater in the Salar de Atacama, Chile, and Salinas Grandes, Argentina. Gravitational settling in the unsaturated zone of soils causes the heavy-to-light ratio of xenon and krypton isotopes to increase linearly with depth.[3] Gases dissolved in groundwater thus reflect the depth-dependent isotopic composition of the unsaturated zone air just above the water table, recording the signal of the water table depth.

This project has been developed in collaboration with local indigenous communities with the goal of evaluating conflicting hydrological models[4,5] of basins in the Lithium Triangle and ultimately assessing potential lithium mining impacts to groundwater.

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