

## Sources of lithium in brine deposits of the Atacama Desert, northern Chile

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The Atacama region in northern Chile hosts the driest desert on Earth and is the world's second Li production province, where the occurrence of elevated Li concentration is restricted to brine deposits, such as the Salar de Atacama. The presence of Li in brine deposits is enigmatic and little information is available about the source(s) of Li in Atacama and only a few studies have reported data about the geochemistry and isotopic composition of Li in these deposits. In this study, we analyze new geochemical and isotopic data in different Li reservoirs (natural waters, sediments and rocks) in the Atacama Desert.

The lowest Li concentrations are reported in surficial waters (< 1 ppm). Groundwaters and salt lakes present similar values, which vary from 1 ppm to 250 ppm. Geothermal fluids show little variability, averaging 39 ppm. Regarding rocks, ignimbrites located to the east of the Salar de Atacama present the lowest Li concentrations (between 20 ppm and 80 ppm) and non consolidated sediments over groundwaters show higher values (from 170 ppm to 590 ppm).

We analyzed  $\delta^7\text{Li}$  in different reservoirs. In natural waters  $\delta^7\text{Li}$  show a wide range of values (from -0.3 to 11.9). The lowest values are found to the north (geothermal fluids), whereas the highest are reported to the south of the Salar de Atacama (groundwaters and salt lakes). To the east,  $\delta^7\text{Li}$  present a narrow range of values around  $\sim 5.0$  in salt lakes. Ignimbrites show a wide range of  $\delta^7\text{Li}$  values (from -12.0 to 12.8), while sediments show a narrow one (from -5.2 to 4.0).

These results (coupling with  $\delta^{18}\text{O}$  analysis) suggest that at least two processes are controlling the Li fractionation in the different reservoirs. Low-temperature weathering dominates in surficial waters and groundwaters, whereas secondary phase precipitation seems to be a more important factor in salt lakes. We propose that ignimbrites interacting with surficial waters and groundwaters are the main source of Li, while Li values of sediments over groundwaters reflect a later concentration process occurring in brines.