Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37123

The Lithium Triangle of the Central Andes: A view from lithium concentrations and isotopic composition of source rocks and brine deposits.

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The Central Andes host world-class lithium brine deposits in endorheic evaporite basins (salars) and are an important source for the global supply of lithium (Li). The deposits are geographically confined to the so-called Li-Triangle between the southern Bolivian Altiplano, the Argentine Puna, and its western slope in Chile. To understand the reasons for the restriction of the Li-anomaly in the Central Andes to the Li-Triangle, we are analysing the Li concentration and Li (Sr, Nd) isotope composition of the potential source rocks and the salar deposits. We traced the Li from the Palaeozoic basement that dominates the crust of the Puna-Altiplano and Eastern Cordillera through the hybrid Cenozoic volcanic rocks of the Central Volcanic Zone (CVZ) to the typical salar deposits to identify the source of the lithium brine deposits. The CVZ volcanic rocks, which cover vast areas in the studied section of the Andean arc, have a significantly higher Li content than those from the Southern Volcanic Zone (SVZ) and the Northern Volcanic Zone (NVZ). The Li signature and content in the CVZ is related to the assimilation of the Palaeozoic basement rocks. Lithium is mobilised from its host rocks during weathering and hydrothermal leaching driven by arc magmatism, preferentially affecting the CVZ volcanic rocks and, possibly, the Palaeozoic basement. The Li isotopic composition of the host rock changes significantly during weathering and the formation of secondary minerals, so that direct information about the Li source of the brine, can only be obtained in combination with the radiogenic isotopes. The fluids accumulate from restricted catchment areas in endorheic basins and concentrate in the long-term arid climate of the Puna Altiplano plateau. The extent of the Li-triangle is thus limited by the presence of the Palaeozoic basement and the occurrence of hybrid CVZ magmas in conjunction with the arid climate and endorheic basins. Where these conditions are not present, the brines are not enriched with Li (e.g., in the Chilean foothills and coastal cordillera, SVZ, NVZ).