

ESM1

Lithium and Sr Isotopic composition of salar deposits in the Central Andes across space and time: the Salar de Pozuelos

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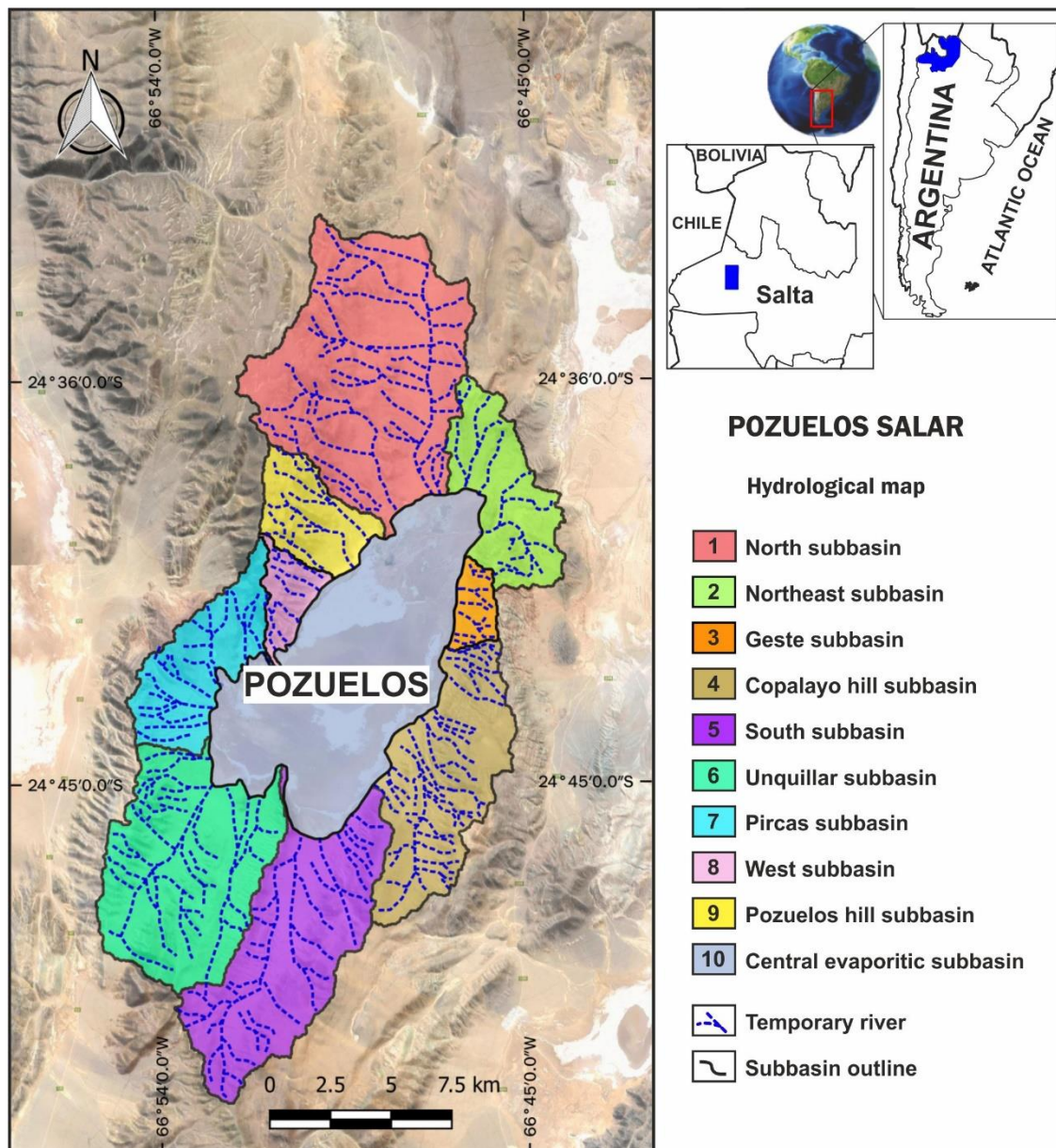


Figure A1 Catchment area for the Salar de Pozuelos. The catchment area is comprised of 10 separate sub-basin drainages (after Hains Engineering Company Limited 2018).



Figure A2 Top: Surface examples of the Salar de Pozuelos. Hard and rough salt crust from the central part of the salar (left) and smooth salt crust from the margin (right). Bottom: Halite and red clay to fine sandstones from the drill core.

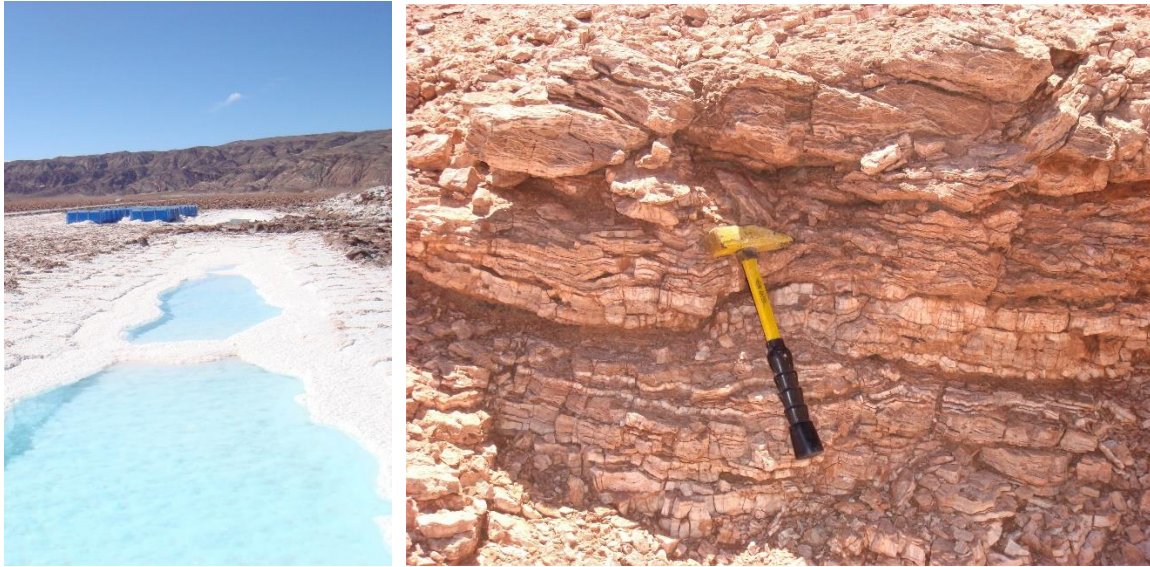


Figure A3 Left: mechanically dug exploration test pit and artificial evaporation pools. Right: Travertine from San Mateo paleo thermal springs in the northeastern border of the Salar de Pozuelos in the main fault between Paleozoic rocks (Copalayo Fm, Ordovician) and Geste Formation (Late Eocene). Location 14 on the geological map Fig.1.

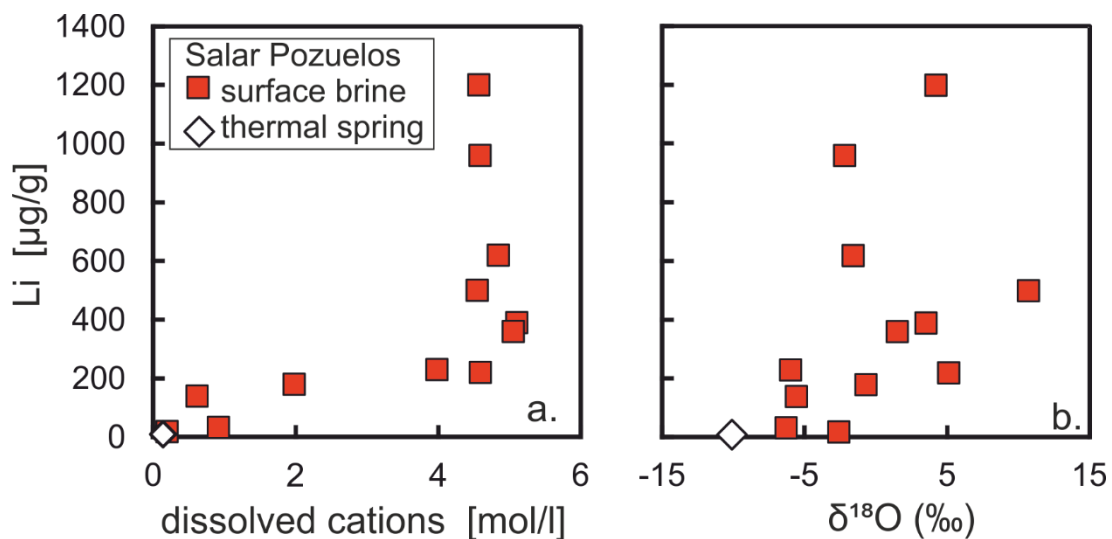


Figure A4 Li contents and indicators of evaporation. a. Li concentration still increases after cation-saturation (mainly NaCl) is reached in the brine. b. Li contents shows no covariation with the oxygen isotope composition of the brine.

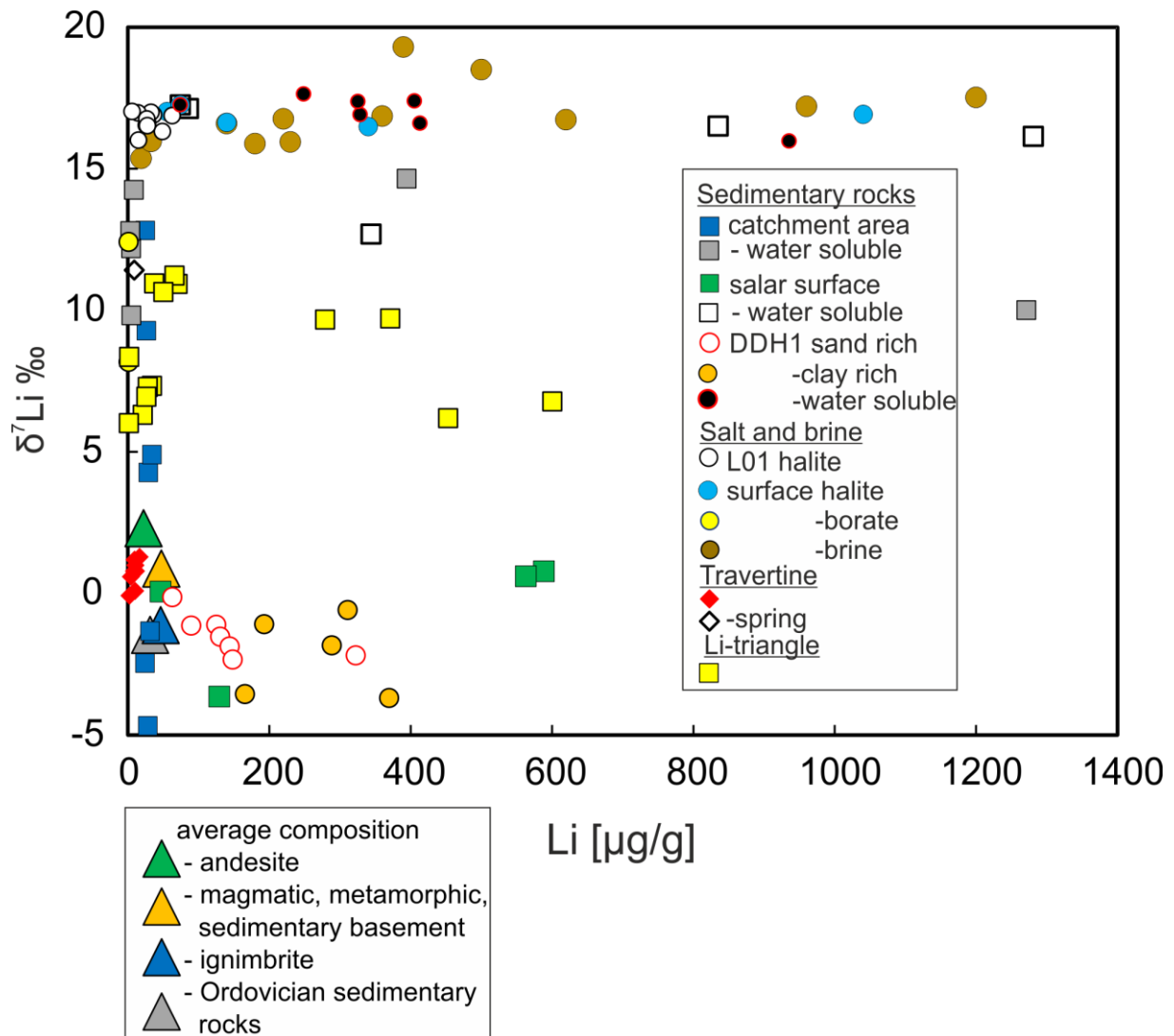


Figure A5 Li contents show no correlation with $\delta^7\text{Li}$ values, i.e. no obvious mixing relations. Average composition of regionally (Altiplano-Puna Plateau) important source rocks as given in Fig. 3 main text.

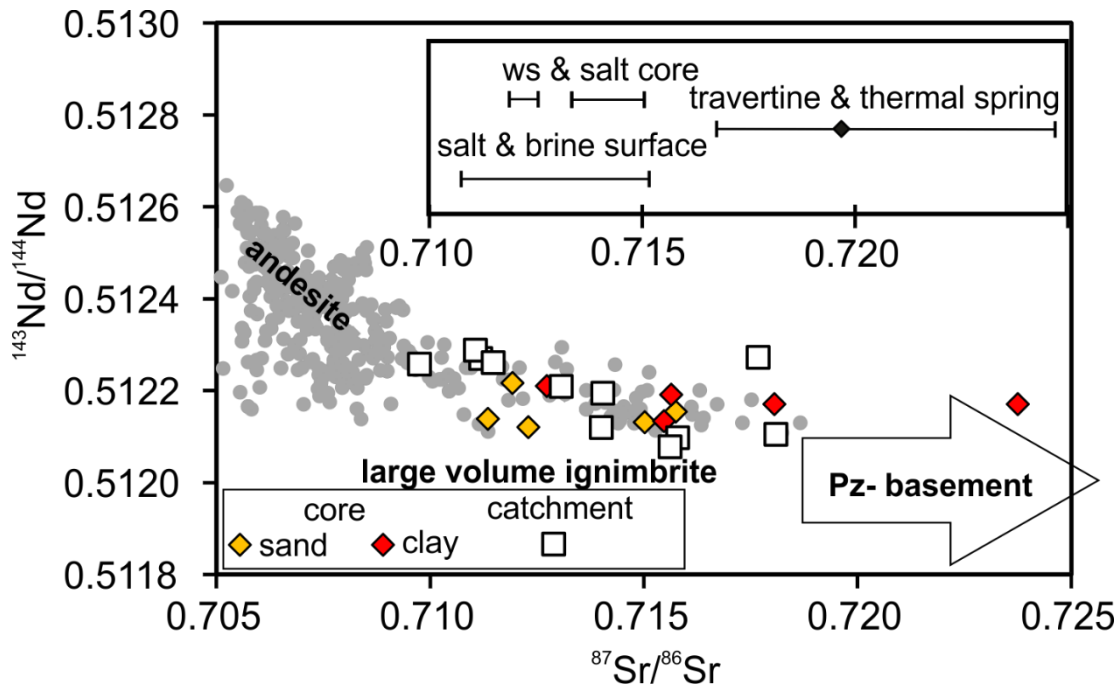


Figure A6 Nd and Sr isotope signatures of the siliciclastic sedimentary rocks from the Salar de Pozuelos basin and catchment area, and of the regional lithological background (potential source rocks; the $^{87}\text{Sr}/^{86}\text{Sr}$ of the Palaeozoic (Pz) basement extends to 0.8 with an average of ~ 0.75). The inset shows the strontium isotope composition of the salar deposits: salt and brine from the surface; water soluble fraction (ws) and salt from the core; spring fluid (black diamond) and related travertine deposit. Figure modified from Meixner et al. (2019).

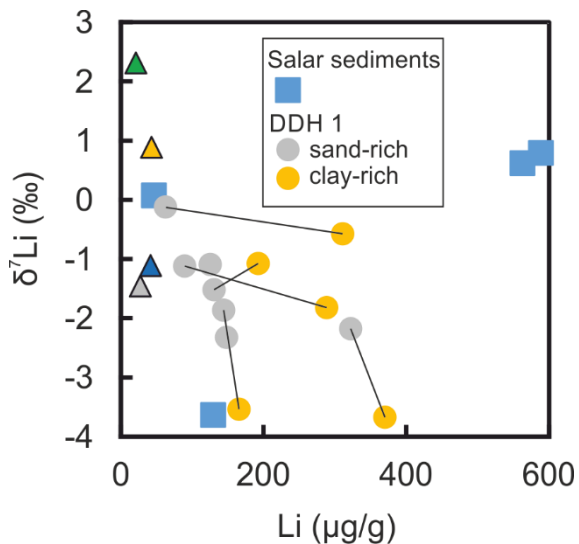


Figure A7 Sand- and clay-rich fractions of core DDH1(including SP-11-7) and salar surface sediments: all samples show high Li contents compared with potential source rocks (Meixner et al. 2019): Average regional andesite (green-), ignimbrite (grey-), Ordovician sedimentary rocks (blue-), and Palaeozoic metamorphic rocks (orange triangle). Clay-rich fractions show higher Li concentrations and 4 out of five show

lower $\delta^7\text{Li}$ values than their sand-rich counterparts (tie lines delimit sample pairs) in DDH1.

References

Garcia M.G, Borda LG, Godfrey LV, López Steinmetz RL, Losada-Calderon A (2020) Characterization of lithium cycling in the Salar De Olaroz, Central Andes, using a geochemical and isotopic approach. *Chem Geol* 531:119-340

Godfrey LV, Chan L-H, Alonso RN, Lowenstein TK, McDonough WF, Houston J, Li J, Bobst A, Jordan TE (2013) The role of climate in the accumulation of lithium-rich brine in the Central Andes. *Appl Geochem* 38:92–102

Godfrey LV, Herrera C, Gamboa C, Mathur R (2019) Chemical and isotopic evolution of groundwater through the active Andean arc of Northern Chile. *Chem Geol* 518:32–44

Godfrey L, Álvarez-Amado F (2020) Volcanic and saline lithium inputs to the Salar de Atacama. *Minerals* 10. doi:10.3390/min10020201

Hains Engineering Company Limited (2018) Mineral Resource Estimate & Technical Report on the salar de Pozuelos Project, Salta Province, Argentina. Report for LSC Lithium Corporation February 2018.
<https://www.lscilithium.com/properties/Pozuelos/default.aspx> (assessed 4/2020)

Meixner A, Sarchi C, Lucassen F, Becchio R, Caffè P, Lindsay J, Rosner M, Kasemann SA (2019) Lithium concentrations and isotope signatures of Palaeozoic basement rocks and Cenozoic volcanic rocks from the Central Andean arc and back-arc. *Miner Depos.* <https://doi.org/10.1007/s00126-019-00915-2>

Munk LA, Boutt DF, Hynek SA, Moran BJ (2018) Hydrogeochemical fluxes and processes contributing to the formation of lithium-enriched brines in a hyper-arid continental basin. *Chem Geol* 493:37-57

Orberger B, Rojas W, Millot R, Flehoc C (2015) Stable isotopes (Li, O, H) combined with brine chemistry: powerful tracers for Li origins in Salar deposits from the Puna region, Argentina. *Procedia Earth Planet Sci* 13:307 – 311