

Source tracing in Li-bearing brines, Salar Pozuelos, NW Argentine

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The source of the spatially restricted Li anomaly and the enrichment processes of Li in the Central Andean salt lakes (salars) are still enigmatic, even though the deposits share common features with other evaporites under arid conditions. A study on chemistry and Li and Sr isotope composition of brines and related salts in a small salar indicates heterogeneous sources of the material ($^{87}\text{Sr}/^{86}\text{Sr} \sim 0.710 - 0.720$), which relates to differences between the principal magmatic, metamorphic and sedimentary rock units. Li contents in brines increases systematically with Mg, K, and Na and is highly variable within the region of NaCl – saturation, where it increases by on-going evaporation and NaCl precipitation. Li isotope variation in the brines is large ($\delta^7\text{Li} \sim +12$ to $+20\text{‰}$), whereas the differences between brine and related salt are $< 1\text{‰}$ with the lower δ - values in the salt. In different sample areas, $\delta^7\text{Li}$ increases with the Li contents, i.e. progressive evaporation. Li concentrations of the brines vary independently of the highly systematic evaporation trend of O and H isotope fractionation, whereas $\delta^7\text{Li}$ shows a general increase with the O and H isotope variation.

A possible path for the Li enrichment in the present salar starts with the dissolution of Li from various rock sources (Sr isotope variability) with low $\delta^7\text{Li}$ (0 to $+6\text{‰}$ for common silicate rocks [1]). These low $\delta^7\text{Li}$ evolve to variably higher values during mineral dissolution and precipitation processes in an aqueous medium. The initially meteoric water changes its O and H isotope signature according to the extent of evaporation on its way from the Li source rock into the salar, e.g., as surface runoff or thermal spring that sample deep sources. Within the salar, the different sources do not mix thoroughly. The dominant process of Li enrichment is evaporation of the brines and halite precipitation. This is accompanied by further but potentially minor fractionation of $\delta^7\text{Li}$, because the ^6Li prefers octahedral coordination in the halite. Complete evaporation leads to layers of high Li halite. Further enrichment of Li by reworking of such layers in dissolution – precipitation cycles, e.g. in pluvial ponds is expected.

[1] Tang *et al.* (2007) *Int. Geology Review* **49**, 374-388

Understanding the impact of Geochemistry: A tribute to Jean Carignan

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Jean Carignan, a key scientist in the world of geoanalysis, passed away aged only 48 on the 12th October 2012. Jean started his scientific career as an undergraduate at the University de Quebec a Montreal. With Clement Gariépy he revisited the Pb-isotope signatures of granitoids from the Canadian Superior province. They pioneered the use of Pb-isotopes in minute quantities of separated feldspars for different suites of granitoids. This work underpinned tectonic models for source regions for these rocks, which were integrated into the Canadian Abitibi Grenville Lithoprobe project. As a tireless analyst, always searching for the next improvement that would allow the field of geochemistry to advance, Jean was hired as director of the Centre de Recherche Petrographiques and Geochimiques (CRPG) in Nancy, Service d'Analyses des roches et Mineraux (SARM) on the retirement of Kuppusami Govindaraju. It was here that he developed a mixed array of elemental and isotope analyses for the science community and is used both in France and internationally. In particular, these involved the use of the new generation of ICP-Multi collector Mass spectrometers that were being developed in the late 1990's. This led to a series of research projects in coupled trace element and isotope tracers in environmental processes ranging from Cu, Zn, Fe etc. to Hg and Pb. Jean and his team introduced a number of analytical improvements and focussed on the environmental impact of atmospheric pollutants using novel approaches with samples such as epiphytic lichens as samplers of atmospheric components of the Kola Peninsula.

In this talk I will investigate some of the impacts of his science.

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