Cl isotope fractionation during drying of brine in a porous media

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Coupled physical and chemical processes occur along the injected CO_2 pathway in a reservoir (in CCS or CO_2-based EOR) and may have consequences on its petrophysical properties. Among these processes, in near well-bore regions, the evaporation of the brine in the supercritical dry CO_2 ("drying out") can precipitate the salt present in the reservoir and then lead to the alteration of the transport properties of the porous media. Assessing the extent of these properties variations is crucial regarding injectivity and containment safety issues during massive CO_2 injection into geological formations over decades.

We thus propose to test the possibility that chlorine isotopes could be used as a geochemical tool to assess petrophysical properties evolution in a reservoir over time. Indeed, chlorine is widely assumed to be un-reactive in surface and subsurface aqueous environments, and $\delta^{37}Cl$ is already used as a conservative tracer of mixing processes and solute transport, especially diffusion. However, in the context of a CO_2 injection, other phenomena can occur and may imply a fractionation of chlorine isotopes, leading to a modification of the chlorine isotopic signature of the brine.

In this study, we will focus on the drying out phenomenon which may cause precipitation of salts in the reservoir pores. Peysson *et al*. [1] have studied the static drying of an initially brine-saturated core by RMN, and showed a salt accumulation with a salt concentration gradient (Fick's law) near the evaporation surface. We have carried an experiment on a Lavoux carbonate plug initially saturated with a 100 g/L NaCl brine. The plug was then gently dried in an oven until full desaturation was reached and then sliced. Residual fluids and salts were extracted by adding pure water before centrifugation. Cl concentrations and isotopic composition measurements were made in order to characterize isotopic fractionation during drying of brine in the porous media.

[1] Peysson *et al*. (2011) *Transport in porous media* **90(3)**, 1001-1016.