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Characterization of CO_2 reservoir rock in Switzerland

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Anthropogenic emissions of Carbon Dioxide (CO_2) are one of the key drivers regarding global climate change (IPCC, 2007). Carbon Dioxide Capture and Storage (CCS) is one valuable technology to mitigate current climate change with an immediate impact. The IPCC special report on CCS predicted a potential capture range of 4.7 to 37.5 Gt of CO_2 by 2050. Among several countries, Switzerland has started to investigate its potential for CO_2 storage (Chevalier et al., 2010) and is currently performing research on the characterization of the most promising reservoir/seal rocks for CO_2 sequestration. For Switzerland, the most feasible option is to store CO_2 in saline aquifers, sealed by impermeable formations.

One aquifer of regional scale in the Swiss Molasse Basin is a carbonate sequence consisting of reworked shallow marine limestones and accumulations of shell fragments. The upper part of the formation presents the most promising permeability values and storage properties. The storage potential has been estimated of 706 Mt of CO_2, based on the specific ranking scheme proposed by Chevalier et al. 2010.

In this study, key parameters such as porosity, permeability and acoustic velocities in compressional and shear mode have been measured in laboratory at pressures and temperatures simulating in situ conditions. Reservoir rock samples have been investigated. Permeability has been estimated before and after CO_2 injection in supercritical state. The simulation of typical reservoir conditions allows us to go one step further towards a significant evaluation of the reservoir's true capacities for CO_2 sequestration.

It seems of major importance to notice that the permeability crucially depends on confining pressure, temperature and pore pressure conditions of the sample. Especially at in situ conditions with CO_2 being at supercritical state, a substantial loss in permeability have to be taken into consideration when it comes to the calculation of potential injection rates. The correlation between the permeability and confining pressure, temperature and pore pressure conditions of the sample is a first important result of the study.