# Chemical degradation from water injection in critically stressed carbonate rock

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Reinjection of water in geothermal reservoir is an essential process for a sustainability development of geothermal energy. It permits keeping the pore pressure at a level necessary for maintaining the resources during exploitation. However, in most of the cases, the produced water is not sufficient to close the production/injection cycle and, the use of other sources like water from rivers, lakes, underground is needed to ensure a total reinjection.

Nevertheless, this methodology might conduct to issues referred generally as thermal or chemical breakthrough which leads to a cooling down of the reservoir with consequent thermal contraction triggering fracturing and/or to a chemical variation in the reservoir water.
Regarding the latter, the literature produced so far does not provide enough information. Typically, surface deformation is ascribed to thermal effects or variation in effective stresses, however, a chemical weakening might be the cause of deformation observed in some geothermal fields, especially when a water out of equilibrium is reinjected. Such a process is generally known as water-weakening.

In this work, we conducted experimental tests on a microporous carbonate rock, the Obourg Chalk deposited in the Mons Basin (Belgium) during the Campanian age. Water injection tests under triaxial loading showed that water-weakening is well expressed in this chalk and, for a critically loaded sample, the amount of injected water necessary to induce failure is exponentially correlated to the axial stress (with respect to the confining pressure) applied on the sample.
Furthermore, a systematic study of uniaxial tests on chalk samples saturated with deionized water with different dissolved salts showed that the fluid chemistry also exerts a significant influence on the weakening.

Our experimental study suggests that a comprehensive study of reservoir sensitivity to fluid chemistry needs to be considered before planning any reinjection strategy.

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