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The FP7 ULTimateCO_2 project: a study of the long term fate of CO_2

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The objectives of the European FP7 ULTimateCO_2 project are to study specific processes that could influence the long-term fate of geologically stored CO_2, mainly: the trapping mechanisms occurring in the storage reservoir, the influence of fluid-rock interactions on mechanical integrity of caprock and well vicinity, and also the modifications induced at the regional scale (brine displacement, fault reactivation, hydrogeology changes...). A comprehensive approach combining laboratory experiments, numerical modeling and natural analogue studies is developed to assess all the processes mentioned above. A collection of data has been generated from natural and industrial (oil industry) analogues on the fluid flow and mechanical properties, structure, and mineralogy of faults and fractures that could affect the long-term storage capacity of underground CO_2 storage sites. To address geochemical trapping at reservoir scale, an experimental approach is developed using sandstone core materials in batch reactive mode with CO_2 and impurities at reservoir pressure and temperature conditions. Three inter-related lines of laboratory experiments investigate the long-term evolution of the mechanical properties and sealing integrity of fractured and faulted caprocks using Opalinus clay of Mont Terri Gallery (Switzerland), an analogue for caprock well investigated in the past for nuclear waste disposal purpose. To evaluate the interactions between CO_2 (and formation fluid) and the well environment (formation, cement, casing) and to assess the consequences of these interactions on the transport properties of well materials, a 1 to 1 scale experiment has been set in the Mont Terri Gallery Opalinus clay to reproduce classical well objects (cemented annulus, casing and cement plug) perforating caprock formations. An extensive program of numerical modeling is also developed to calibrate, to reproduce and to extrapolate the experimental results at longer time scales including uncertainty assessment methods.
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