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CO_2-rich brine injection through Heletz site sandstone samples: role of the flow rate injection on chemical and hydrodynamical properties.

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The Heletz structure has been selected as a test site for a prospective CO_2 reservoir and for the MUSTANG European project injection experiment based on the analysis of the available geological, geophysical and borehole data from various areas of Israel. The Heletz area is located in the Southern part of the Mediterranean Coastal Plain, about 7km from the sea shore. The target layer is composed of sandstone, has a thickness of $\sim$20 meters and is located at a depth of $\sim$1500 m.

Flow-through laboratory experiments of CO_2-rich brine were realized to evaluate the chemical processes occurring in the Heletz site.
The Heletz sandstone rock is poorly consolidated and has a high porosity (around 23%) and connectivity. Consequently, it was impossible to core the rock into small core rock sample of 9 mm diameter and 18 mm length. We decided to reproduce artificial core rock samples using inox core folder of external sizes 9 x 18 mm and internal size of 7 x 14 mm. We placed in both side one sintered inox sample of 7 mm diameter and 2 mm long and we pressed the Heletz sandstone grains rock sample into the inox folder and sintered discs. The mineralogy, mineral grains sizes and porosity of natural Heletz rock sample were reproduced to mimic the chemical and structural properties of Heletz reservoir.
We performed four flow-through experiments at in situ storage conditions (T = 60 ºC, P = 15 MPa, PCO_2 = 1.8 MPa). The flow rates injection were 0.05 and 0.30 mL.min-1. Two different brine solutions were used, both representative of the Heletz reservoir native water. The first one was a synthetic brine of the Heletz reservoir (closed to seawater). The second one was the first one equilibrated with gypsum.

The results show an increase in permeability and porosity for all the percolation experiment whatever the flow rate and the brine solution. This is explained by the dissolution of calcite, dolomite and feldspar. We observed that the permeability increase is higher and faster for high flow rate injection than for low flow rate.