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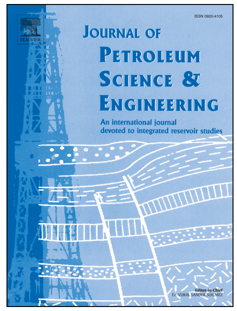

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ACCEPTED MANUSCRIPT

Temperature effects on rock engineering properties and rock-fluid chemistry in opal-CT-bearing chalk

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Abstract

In this study, eight tri-axial tests on Cretaceous age outcrop chalk from Aalborg have been performed systematically by injecting $MgCl_2$ for the first time at different temperatures (25, 60, 92, 110 and 130 °C) and for comparison, NaCl at 130 °C. Whole-rock geochemistry, stable isotope measurements, pycnometry, Field Emission Gun Scanning Electron Microscopy with Energy-Dispersive X-ray Spectroscopy, X-Ray Diffraction (XRD) and measurements of Specific Surface Area (Brunauer-Emmett-Teller theory (N_2)) were applied to analyse unflooded and flooded cores. Based on analyses of changes in brine composition, mineralogy, specific surface area, solid density, porosity and permeability some conclusions can be drawn on temperature effects on rock engineering properties and rock-fluid chemistry.

The $MgCl_2$ flooded cores show systematically higher creep rates at higher temperature and the cores tested at 25 and 60 °C show similar creep rates as the two NaCl flooded cores at 130 °C. All fluid-rock interactions were more pronounced at higher temperature. After flooding with $MgCl_2$ at 110 and 130 °C newly formed magnesite is observed. In the cores tested at 25, 60 and 92 °C magnesite crystals have not been positively identified, but minute increases in MgO in whole-rock geochemistry analyses are seen. Si^{4+} originating from the dissolution of silica bearing phases (mainly diagenetic opal-CT), has taken part in the re-precipitation of Si-Mg-bearing minerals during $MgCl_2$ injection from 25 to 130 °C, leading to an increase of the

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