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Pore space quantification of carbonate rocks before-after supercritical CO_2 interaction by optical image analysis

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The aim of this research is to show an experimental application of an automated quantification process of optical porosity in thin sections. Petrographic studies using scanning electronic microscopy, optical microscopy (OpM) and optical image analysis (OIA) could provide a reproducible pore characterization of carbonate rocks in applications related to the geological storage of CO_2. This research is focused on i) the quantification of optical pores in a carbonate rock before and after supercritical CO_2-rich brine (P $\approx$ 7.5 MPa and T $\approx$ 35 ºC) and ii) the description of the process followed to guarantee the reproducibility of the OIA method on images acquired with high-resolution scanner. Mineral images were acquired from thin sections using a high-resolution scanner (HRS). Digital images were geo-referenced by using geographic information system to ensure correct spatial correlation and superposition. The optical measures of porosity by image analysis on the carbonates thin sections showed an effective pore segmentation considering different cross-polarized light conditions (90º/0º; 120º/30º) and plane-polarized light conditions (90º/-) of the same petrographic scene. The pore characterization by OpM and OIA-HRS has allowed a preliminary approximation of pore evolution in carbonate rocks under the supercritical CO_2-rich brine. This study shows a fast, effective and reproducible methodology that allowed a preliminary characterization (changes in the pore network) of the samples studied. The procedure carried out could be applied to similar experimental injection tests.