



X-ray CT scanning imaging of capillary imbibition processes in intact and damaged rock samples

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X-ray CT scanning techniques have been widely used to image porous materials either under static conditions or to characterize dynamic systems. In this study we used an industrial scanner to image capillary imbibition in reservoir rocks, in order to get some insight into the kinetics of the imbibition processes as well as the geometry of the water front. The experiments have been done on Bentheim sandstone and Saint-Maximin limestone. Both intact and damaged samples were tested. The damaging process resulted from creep experiments at increasing stress levels, with a continuous recording of acoustic emissions during the mechanical tests. The images obtained under the scanner have been analyzed and correlated using image analysis tools, in order to infer relevant parameters of the water imbibition process as well as to map the deformation by comparing images before and after the mechanical tests. Special care was taken in studying how the mechanical deformation alters the fluid displacement patterns. Localizing the acoustic emissions was extremely useful in identifying clusters where damage was concentrated, which were of primary importance in the distortion of the fluid flow patterns. As the selected rocks have significantly different microstructural attributes, we discuss how these affect the fluid flow processes as well as the damage induced in the mechanical tests.