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Petrographic characterization of low-permeable to tight turbidite sandstone from Eocene Shahejie Formation using micro-CT.

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Pore scale flow simulations in reservoir rocks heavily depend on characterizing and modeling of the pore space. Single scale and multiscale pore network extraction from micro-CT images are going through extensive development. However, the choice of pore network extractions method is sensitive to the rock nature (homogenous, complex or microporous). Additionally, the success of the pore network to predict flow properties relies on image quality and image segmentation. In this study, we characterized four samples from a low permeable to tight sandstone reservoir using micro-CT at the expertise Centre for X-ray Tomography at Ghent University (www.ugct.ugent.be) to assess the impact of microporosity on the rock model. All samples were scanned at a resolution of 1.5 to 1.7 micron. As the samples can be categorized as illite rich and kaolinite rich, attention towards the clay minerals were given as they play a vital role to influence microporosity. (pore size < 1.7 micron) Image segmentation analysis from micro-CT images indicated that 5-6 % of microporous regions were present in kaolinite rich sandstone, while illite rich sandstone displayed 1.7-1.8 % microporous regions. Correlation of mineral phase data from micro-CT and XRD revealed that the microporosity consisted mainly out of dissoluted feldspar grains and clay mixed cement. In kaolinite rich, macropore system does not percolate without micropores, while in illite rich sandstone the pore system percolates without micropores. In illite rich sandstone, the total MICP porosity is equal to the macroporosity (pore diameter >1.7 micron) determined on the 3D micro-CT, this means that the macropores are well connected and microspores do not play any role in the flow process. However, in kaolinite rich sandstone, the macroporosity determined from the 3D X-ray micro-CT images is far less (almost 50 %) than the total MICP porosity which means that almost 50 % of the porosity consisted out of pores that were not detected by the micro-CT scan. In these kinds of rocks, the pore system does not percolate without the micropores and a multiscale approach is needed to characterize such complex rock.

References

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