

Studies of mineralogical changes for the understanding of enhanced oil recovery mechanisms at porescale

MONA WETRUS MINDE^{123*}, UDO
ZIMMERMANN¹², MERETE VADLA MADLAND¹²,
REIDAR INGE KORSNES¹²

¹ University of Stavanger, Norway, 4036 Stavanger,
Norway (*correspondence:
mona.w.minde@uis.no,
udo.zimmermann@uis.no)

² The National IOR Centre of Norway, UiS, 4036
Stavanger, Norway

³ IRIS AS, International Research Institute of
Stavanger, P.O. Box 8046, 4068 Stavanger,
Norway

Injection of seawater is one of the methods used with great success to increase hydrocarbon (HC) recovery rate and maintaining formation-pressure in HC reservoirs on the Norwegian Continental Shelf (NCS). To maximize the effect of injection, studies of rock-fluid interaction on a micro- and nano-scale are paramount in identifying the most appropriate fluid(s), when monitoring at the same time changes of mechanical properties of the rock. Our experiments are carried out at reservoir conditions for the NCS and are unique in this regard. Methods used are whole-rock and stable isotope geochemistry, XRD, field emission gun scanning electron microscopy (FEG-SEM), Mineral Liberation Analyzer (MLA), transmission electron microscopy (TEM), nanoRaman and Nano Secondary Ion Mass Spectrometry (NanoSIMS). All methods point to a significant change in the form of loss in calcium and an increase of magnesium content when flooding chalk with MgCl₂-brine explained by mineralogical changes on a nano-scale with the new growth of high magnesium carbonates or even magnesite together with dissolution of calcite. We will identify the amount of magnesium in the new grown minerals and quantify the amount of mineralogical changes after flooding for further modelling on core and even larger scales.

The change of densities and volumes affects subsequently and significantly the mechanical parameters and the surface properties of the rock. Last but not least, these processes control specific surface area, pore-geometry and wettability, which enhances or decreases the recovery of hydrocarbons.