

## Chemical force mapping of clay fractions from sandstones

M. BLAŽANOVIĆ\*, A. R. NIELSEN, J. MATTHIESEN,  
K. N. DALBY, S. JELAVIĆ, T. HASSENKAM AND  
S. L. S. STIPP

Nano-Science Center, Department of Chemistry, University of Copenhagen, Denmark (\*mblazano@nano.ku.dk)

Clay minerals are thought to be the most reactive minerals in rocks and soil and therefore play a large role in solid-fluid interactions. These reactions can provide clues for designing better methods for soil or water remediation. Their interaction with oil and saline water are suspected to be responsible for the low salinity effect for enhancing oil recovery (EOR).

We used X-ray powder diffraction (XRPD) and scanning electron microscopy (SEM) with energy dispersive X-ray spectroscopy (EDXS) to investigate the properties of clays from two sandstones. One sample (Core B) had a considerable proportion of clay minerals, with several mineral species and the particles were large ( $\sim 5 \mu\text{m}$ ) with flaky and platy shapes (Fig. 1). In the other (Core L), particles were  $< 1 \mu\text{m}$  across, with hexagonal morphology.

We explored the adhesion properties on the pore surfaces of the bulk rock and on the separated clay fraction, using atomic force microscopy (AFM) and chemical force mapping (CFM) with a hydrophobic probe that was functionalised by 1-undecanethiol ( $\text{HS}(\text{CH}_2)_{10}\text{CH}_3$ ). Surfaces from the bulk of Core L behaved as expected; adhesion decreased with decreased salinity. However, adhesion on surfaces from Core B was high, even when ionic strength decreased. Preliminary results from the solvent cleaned extracted clay showed no change in adhesion with change in salinity. This suggests that it is not the clay mineral surfaces that are responsible for adhesion change, but something associated with them.

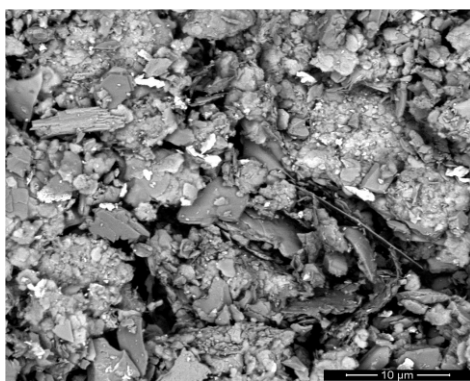


Fig. 1: SEM image of the Core B clay fraction, showing several types of clay