Contribution ID: **206** Type: **Oral Presentation**

μCT investigation of liquefaction mechanisms at the pore scale

Thursday, 2 June 2022 09:55 (15 minutes)

We investigated in this work liquefaction of an outcrop, the Saltwash South (SWS) poorly consolidated sandstone, due to exposure to different solutions including fresh water, KCl- and NaCl-rich solutions. This sample is composed of 84% quartz, 5% feldspar and rock fragments, around 11% clay. Its porosity is around 30%, its density 1.8 g/cm3. It also has a Young's modulus of 0.3 GPa and an unconfined strength of 1.9 MPa [1, 2]. The exposure experiments included total immersion of samples in the above-mentioned solutions and micro–Computer Tomography (μCT) scans after drop-by-drop fluid exposure. The results show that the SWS sandstone collapses within only few seconds when totally immersed into a fresh water or NaCl-rich solution (Figure 1). The disintegration process is held back when 5 wt% or more KCl is present in fresh water or in NaCl-solution (see Figure 2). Adding few percentages (up to 2%) of KCl into a 3.5% NaCl solution shows an interesting result: it slows down the disintegration process from less than a minute after immersion to 5 minutes before total collapse. The microstructure changes due to these exposures at pore level have been captured by analysing the μCT images. Another procedure was drop-by-drop fluid exposure on the sample's top surface, using a syringe and a paper filter (Figure 3).

Investigation at pore scale with μCT was performed on 7 mm diameter and 15 mm length samples. The procedure consisted in first scanning the sample dry, then repeatedly add fluid drops on the sample's top face and perform fast scanning. Figure 4 and Figure 5 show the resulting disintegration process for fresh water. The sample collapses from the top part while the bottom part remains intact. In Figure 5, it can be seen that the water leads to an expansion of the total volume and is followed by sample collapsing. The change was slow enough to be captured by mCT scanning. Although this work focussed on the collapsing of SWS sandstone, it suggests a methodology to study quick clay activation. This is done through the proxy of a larger-grain sandstone, in order to understand the pore-scale details of how liquefaction starts, develops and spreads in the volume studied. Loss of strength can be seen as similar between SWS and quick clay, with local swelling of clay cement at the matrix grain contacts.

References:

1. Cerasi, P. and L.E. Walle, Investigation of Potential Loss of Injectivity and Formation Integrity Due to Pressure Cycling. Energy Procedia, 2016. 86: p. 420-431.
2. Pradhan, S., et al., Fracturing tests on reservoir rocks: Analysis of AE events and radial strain evolution, in 48th US Rock Mechanics / Geomechanics Symposium. 2017: Minneapolis, MN, USA.

Acceptance of the Terms & Conditions

Click here to agree

MDPI Energies Student Poster Award

No, do not submit my presenation for the student posters award.

Country

Norway

References

1. Cerasi, P. and L.E. Walle, Investigation of Potential Loss of Injectivity and Formation Integrity Due to Pressure Cycling. Energy Procedia, 2016. 86: p. 420-431.
2. Pradhan, S., et al., Fracturing tests on reservoir rocks: Analysis of AE events and radial strain evolution, in 48th US Rock Mechanics / Geomechanics Symposium. 2017: Minneapolis, MN, USA.

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

Primary author: Dr AGOFACK, Nicolaine (SINTEF)

Co-authors: LONG-SANOUILLER, Haili (PoreLab, NTNU); CERASI, Pierre (SINTEF)

Presenter: Dr AGOFACK, Nicolaine (SINTEF)

Session Classification: MS04

Track Classification: (MS04) Swelling and shrinking porous media