The Chinese University of Hong Kong
Earth System Science Programme

Time-Dependent Failure and Inelastic Compaction in Porous Sandstone

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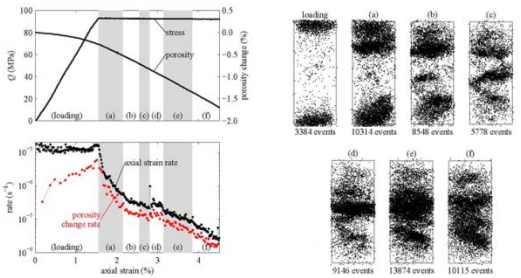
Time: 3:45 pm
Venue: Rm. 330, Science Centre North Block
Registration: Click Here

Abstract

The characterization of time-dependent rock deformation is fundamental to understanding the long-term evolution and dynamics of reservoirs and aquifers. Experiments on single cracks have shown that this process is extremely sensitive to the applied stress and the environmental conditions. In contrast, limited data on the influence of effective pressure (Peff) suggests that the process becomes less sensitive to differential stress at higher Peff. Until recently all data were however obtained in the brittle regime in which rocks failed by shear localization after a period of dilatant deformation. We therefore systematically investigated time-dependent compaction in porous sandstone. Our new data show that time-dependent deformation proceeded at strain rates ranging from 10-9/s to 10-5/s. In all cases, the deformation was compactant and we observed significant time-dependent porosity reduction. The three damage proxies recorded during our experiments, axial strain, porosity change and cumulative acoustic emission energy showed a very obvious correlation, suggesting that the mechanism leading to this time-dependent compaction is stress corrosion cracking. Visual inspection of samples deformed at various levels of differential stress and over periods of time between a few hours and a few days, revealed in most cases the presence of discrete compaction bands. Our new data therefore suggest that compaction bands could develop in laboratory samples at stresses significantly lower than reported in previous studies and hence closer to published estimates based on field observations.



Compaction bands developed during creep at high effective pressure in Bleurswiller sandstone

~ All are Welcome! ~

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