

12.14: Vertical Creep and Lateral Stress in Uniaxial Strain Experiments

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ABSTRACT

Uniaxial strain testing of resedimented Gulf of Mexico - Eugene Island smectite-rich material (Fig. 1) revealed that the ratio of horizontal to vertical effective stress (K_0) does not change with time (Fig. 2). In the meantime, the vertical creep (decrease in the void ratio) continues at a log-time decreasing rate (Fig. 2), which is consistent with other observations. I maintained the uniaxial strain condition (constant radius) in my experiments by direct-feedback from a linear variable differential transformer sensor. I kept constant the axial effective stresses of 15 MPa and 30 MPa over 10 days each (Fig. 1). A better understanding of the lateral stress ratio and its evolution will help constrain lateral stress or fracture gradient. The creep impact on porosity decrease will help quantify creep contribution in overpressure generation in the subsurface.

CLICK ON IMAGE FOR LARGER VIEW

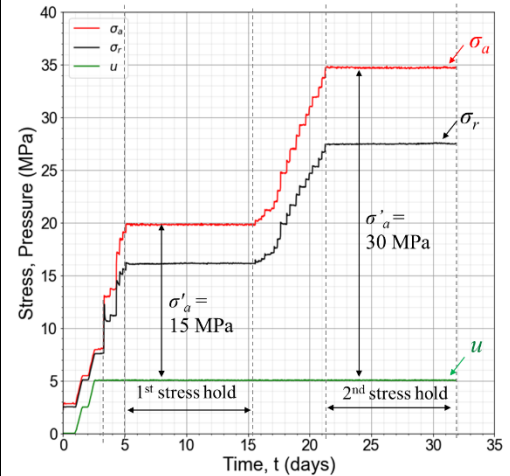


Fig 1: Test program showing stress, pressure versus elapsed time.

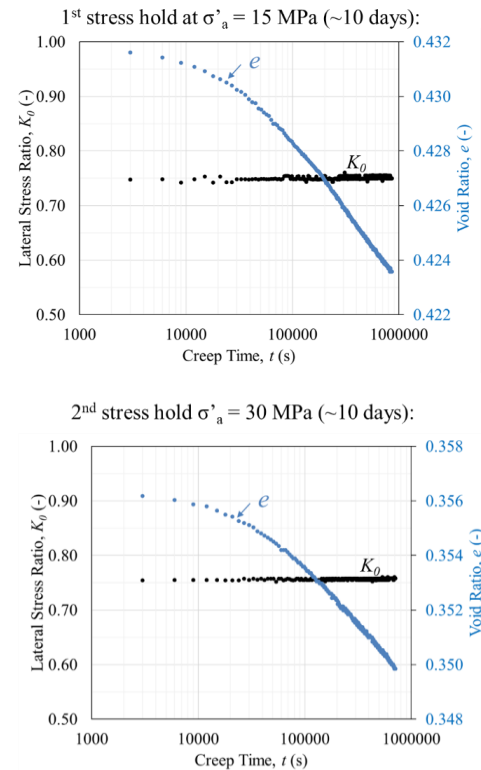


Fig 2: Vertical creep (decrease in the void ratio) and K_0 evolution with time

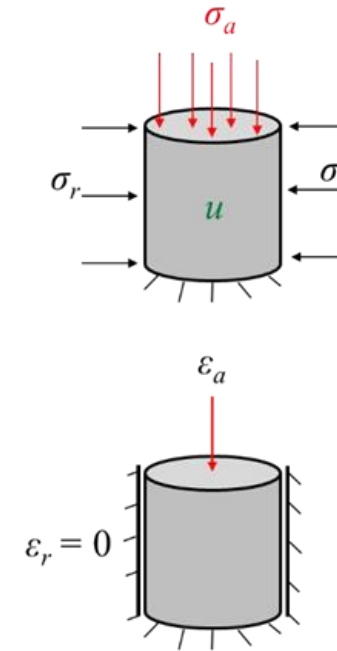
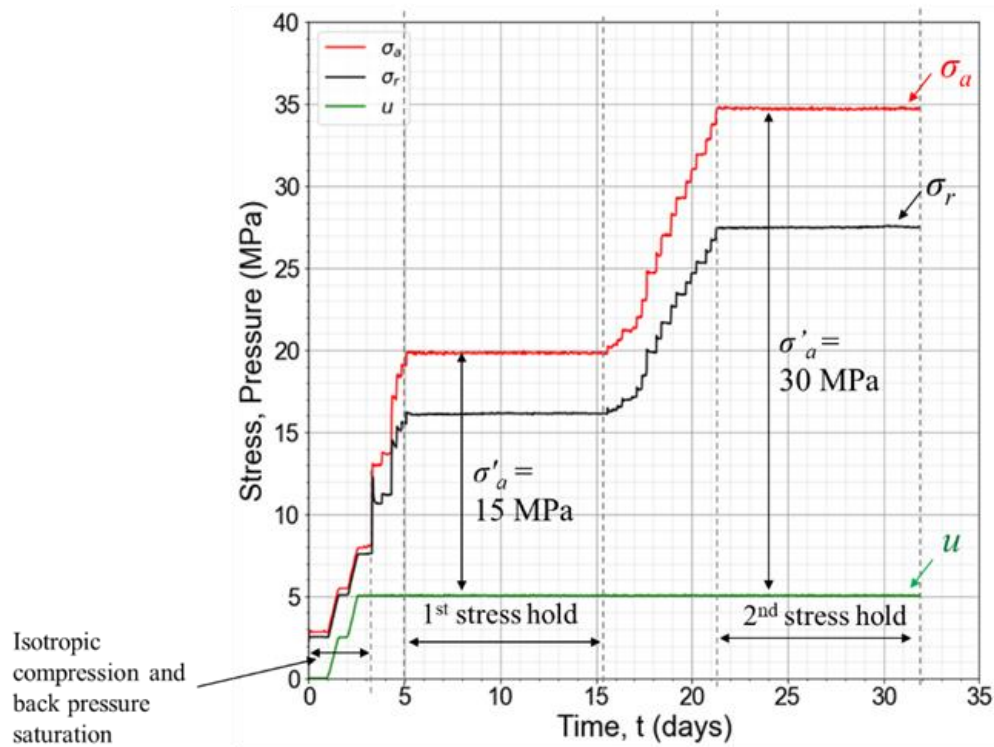


Fig. 1: Test program showing stress and pressure versus elapsed time. After initial isotropic compression and back pressure saturation, I incrementally loaded the specimen axially in small stress increments (red curve) until I reached the axial effective stress of 15 MPa. I held the stress constant at 15 MPa for 10 days. I then increased the axial effective stress to 30 MPa and held it constant for 10 days. I held the pore pressure (green curve) constant at 5 MPa during the stress increments and two stress holds.

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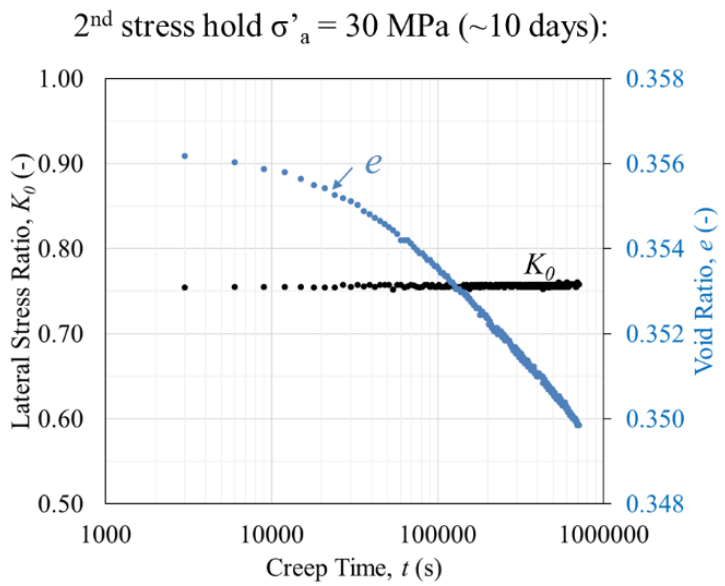
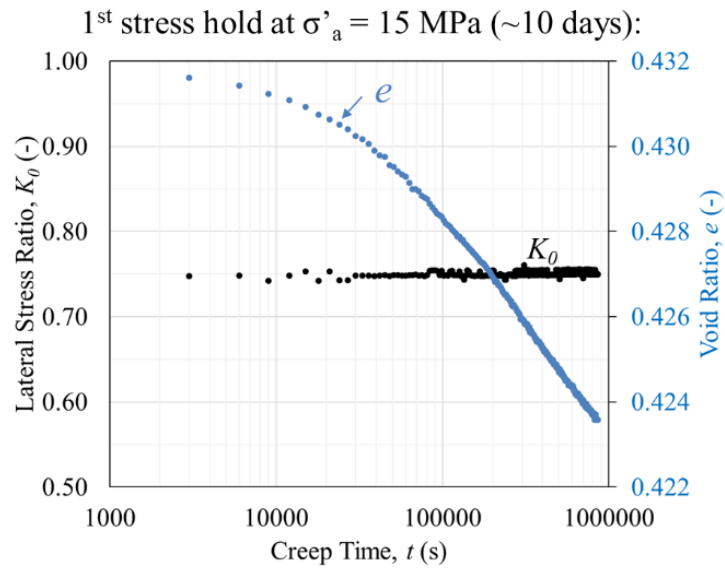


Fig. 2: Vertical creep (decrease in the void ratio) and K_0 evolution with time. The lateral stress ratio (K_0) remains constant with time while I continue to measure void ratio decrease.

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