14.10: Lateral stress and creep behavior in drained uniaxial strain experiments of Gulf of Guinea – Angola Miocene mudrock

Athma Bhandari, UT Austin - Institute for Geophysics

ABSTRACT

I measured axial creep and lateral stress behavior in drained uniaxial strain experiments on intact and resedimented Gulf of Guinea Miocene kaolinite-rich mudrock specimens (Fig. 1). At axial effective stress of ~10 MPa (comparable to the in-situ vertical effective stress of 7.9 MPa), the uniaxial lateral stress ratio (K_0) is 0.75 for the resedimented material and 0.62 for the intact material. The intact material is over-consolidated because its in-situ stress (7.9 MPa) is less than the corresponding yield stress measured on the resedimented specimen (~20 MPa). The resedimented specimen exhibits an order of magnitude higher compressibility than the intact specimen (Fig. 2). The in-situ void ratio is ~0.15 void ratio units less than the void ratio measured on the resedimented specimen, illustrating creep deformation over geological time. In addition, the creep rate of the resedimented material is an order of magnitude higher than that of the intact material. However, the measured creep rate for the resedimented material provides a reasonable field void ratio. Overall, this talk illuminates the role of creep in the compression process.

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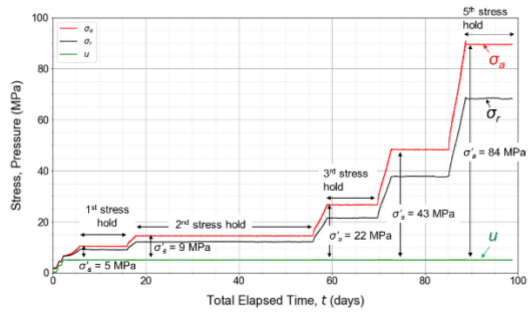

Fig 1: Test program showing stress, back (pore) pressure versus elapsed time.

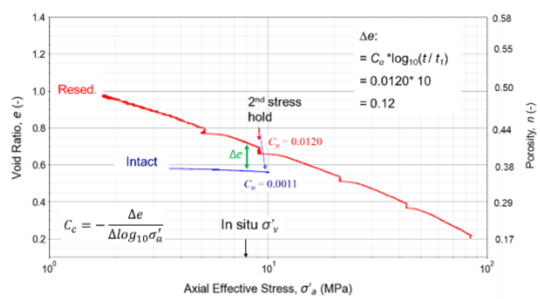

Fig 2: Void ratio evolution with axial effective stress for resedimented specimen (red line) and intact specimen (blue line). At the in-situ stress of 7.9 MPa the intact specimen void ratio is 0.15 units less than the resedimented void ratio, illustrating the presence of creep deformation.

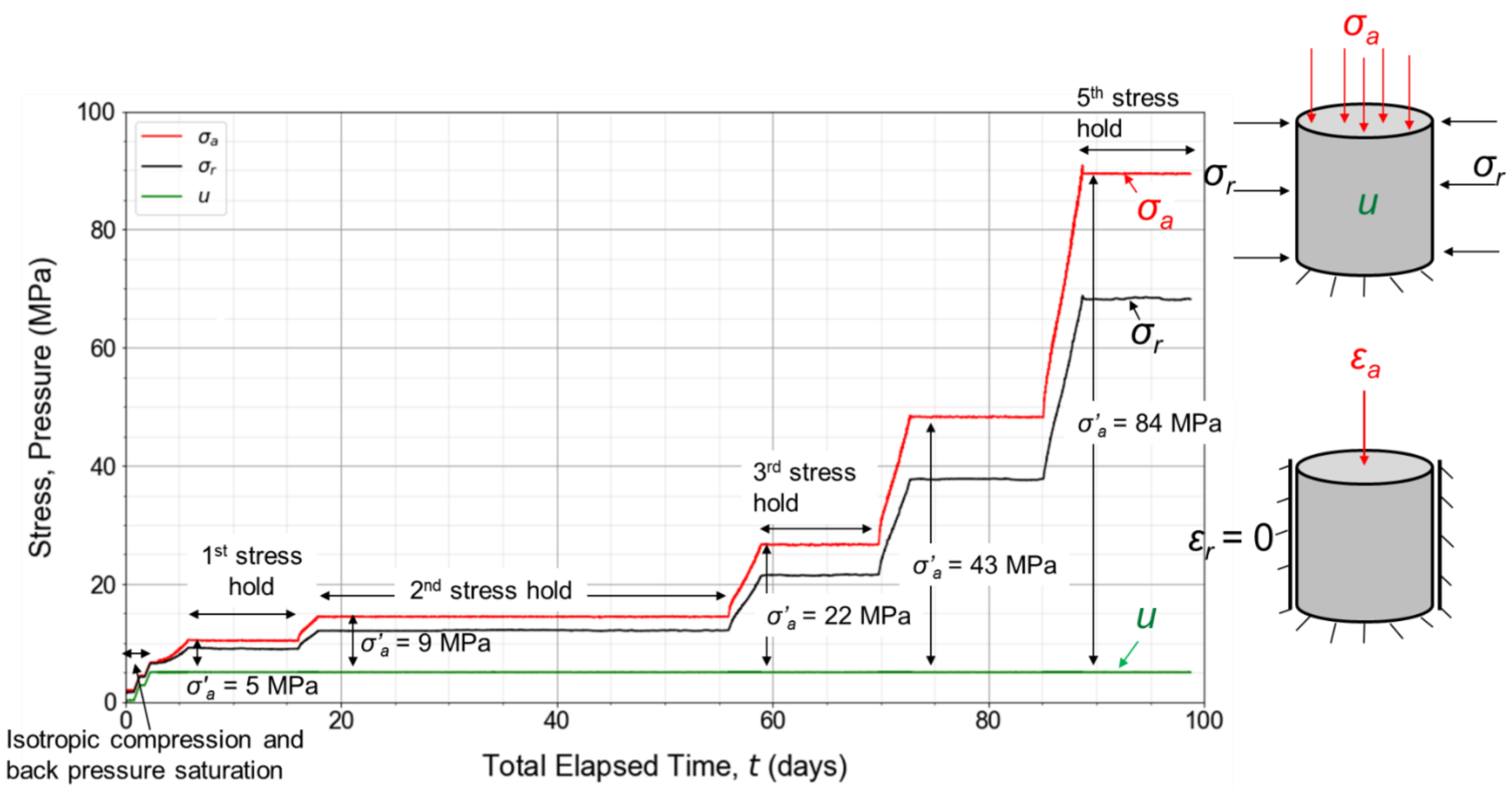

Fig. 1: Test program for the resedimented specimen showing stress and pressure versus elapsed time. After initial isotropic compression and back pressure saturation, I incrementally loaded the specimen axially in small stress increments (red curve) until I reached the axial effective stress of 5 MPa. I held the stress constant at 5 MPa for ~10 days. I then increased the axial effective stress to 9 MPa and held it constant for ~40 days. I increased the axial effective stress to 22 and 43 MPa and held it constant for ~10 days each. Finally, I increased the axial effective stress to 84 MPa and held it constant for ~10 days. I held the pore pressure (green curve) constant at 5 MPa during the stress increments and five stress holds.

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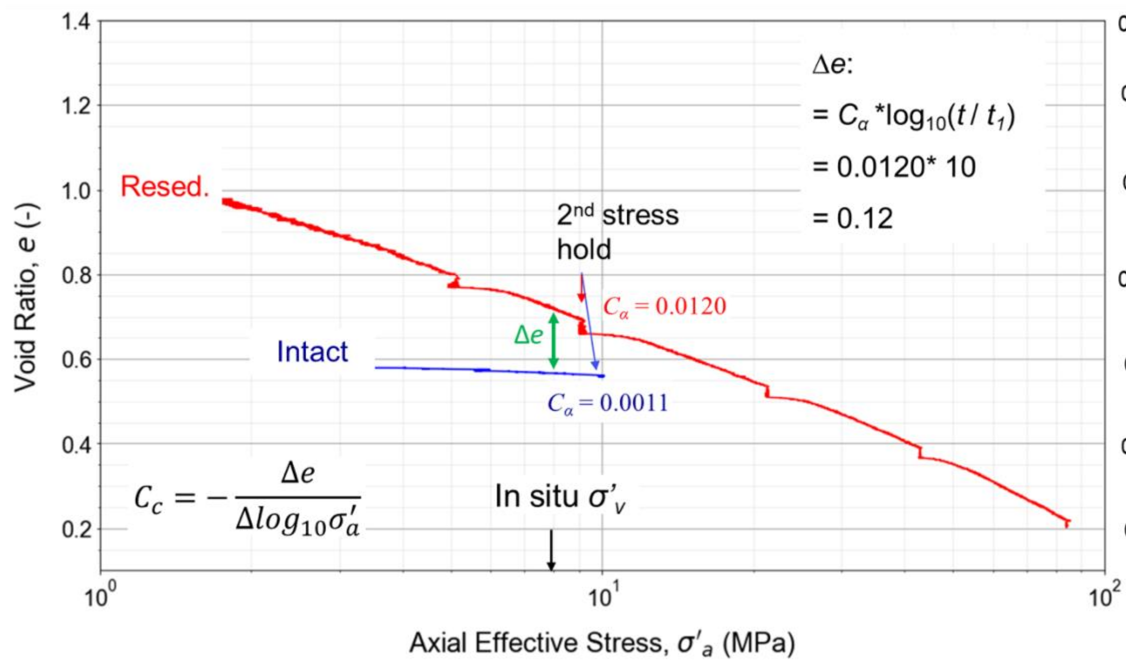

Fig. 2: Void ratio evolution with axial effective stress for resedimented specimen (red line) and intact specimen (blue line). At the in-situ stress of 7.9 MPa the intact specimen void ratio is 0.15 units less than the resedimented void ratio, illustrating the presence of creep deformation. The creep rate of the resedimented material is also an order of magnitude higher than the intact material.

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