

Overview of Gulf-of-Mexico Mudstone Material Properties

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ABSTRACT

The material properties of Gulf-of-Mexico mudstones exhibit a significant dependency on stress level. The friction angle, ϕ , decreases from 30° at the seafloor to 10° within a few km of depth (Figure 1). The undrained strength, S_u , decreases by about 50% over the same depth range. On the other hand, we observe a steady increase of the effective stress ratio, K_0 , with depth (Figure 2). These variations do not favor borehole stability, as they lead to a reduction of the range of stable mud-weights with depth. Furthermore, the decrease in friction angle indicates extensional failures that become less steep with depth, and thrust failure planes that become steeper with depth. We summarize our experimental program on Eugene-Island cores, consolidated to up to 40MPa (5800psi), and provide relationships that enable the estimation of porosity, permeability, stress ratio, friction angle, and undrained strength with stress level (depth).

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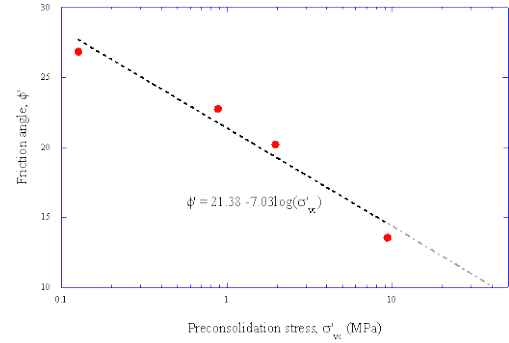


Figure 1: Variation of the friction angle with stress level. Data points show measurements on Eugene Island core, and dashed line provides the equation predicting friction angle as a function of stress level.

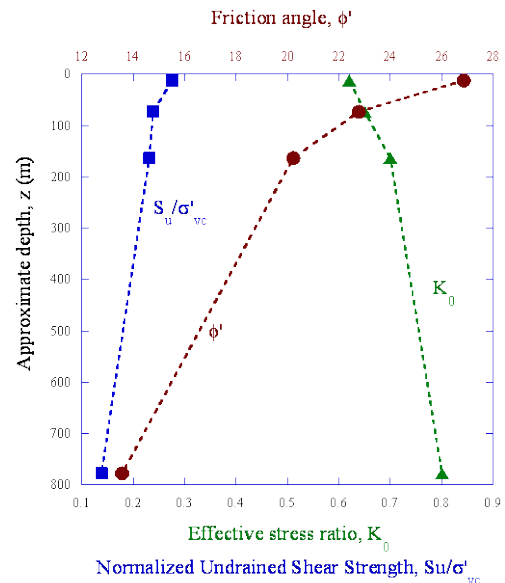


Figure 2: Variation of stress ratio, friction angle, and undrained strength with depth (assuming an average density of 2.2gr/cc). Data points show measurements on Eugene Island core.

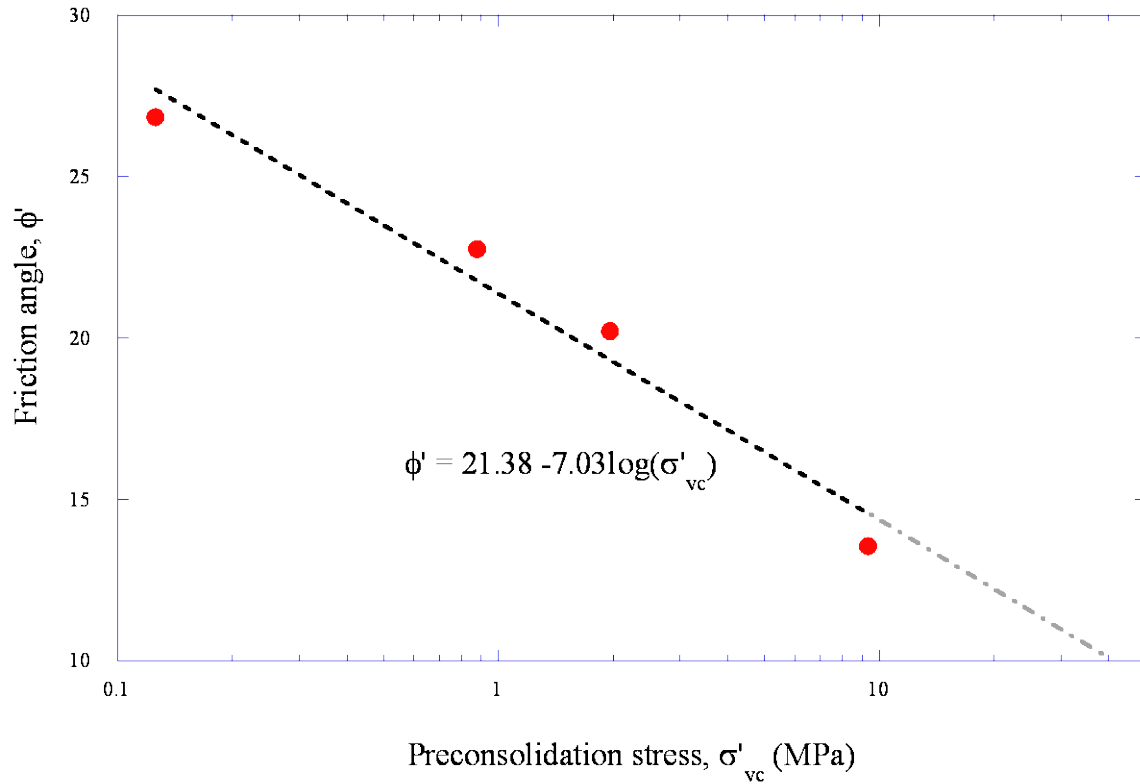


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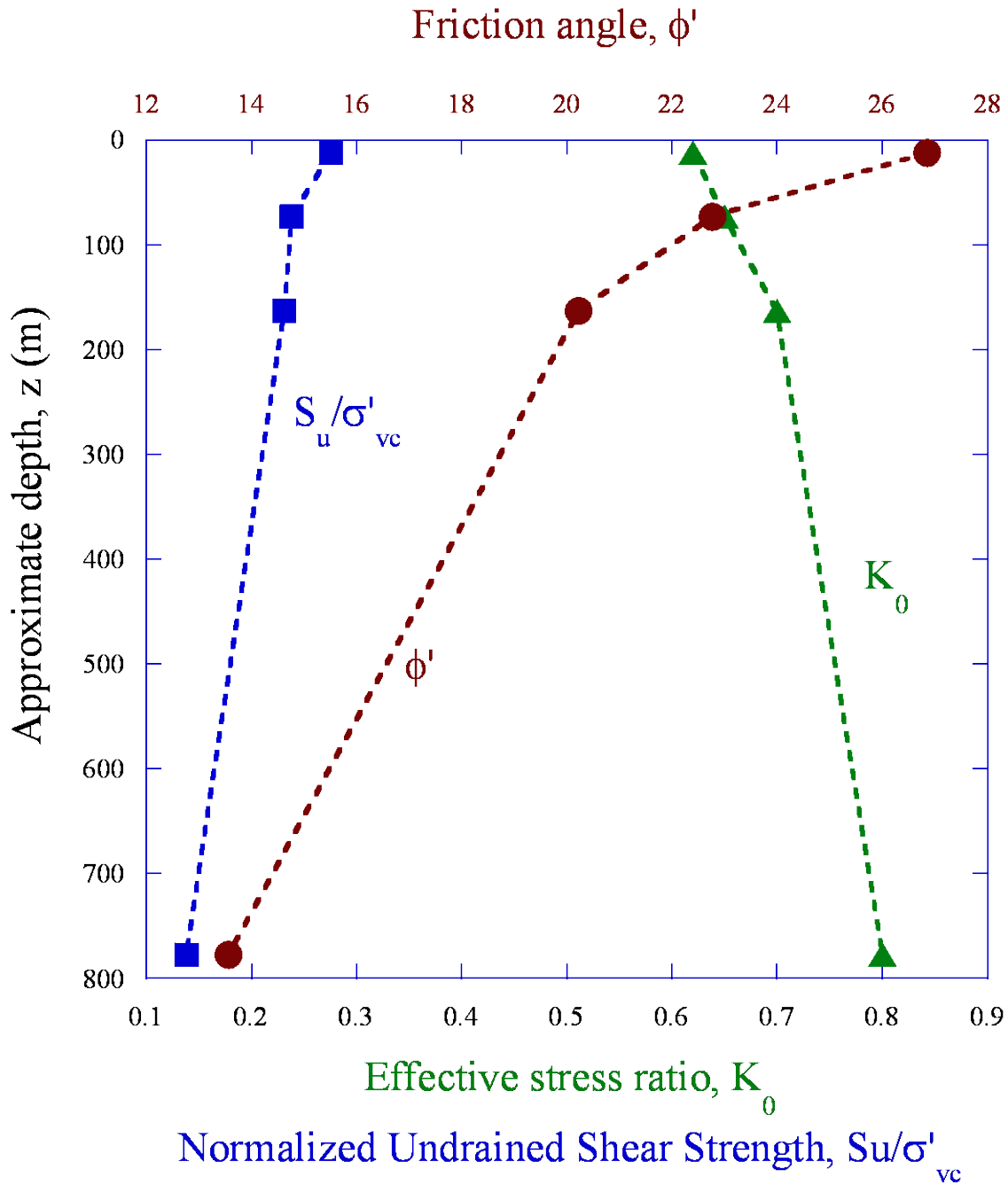


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