Evaluating the Undrained Shear Iso-Velocity Hypothesis

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ABSTRACT

The Full Effective Stress (FES) method developed for pore pressure prediction assumes that compressional wave velocity is uniquely related to porosity. The Iso-Velocity hypothesis is evaluated in the laboratory during undrained shear triaxial tests. The effective stress paths followed during an undrained shear test is an iso-porosity contour. Having a proper understanding of wave velocity behavior during undrained shearing provides insight into the stiffness behavior and possibly the stress state relative to failure. I have conducted undrained shearing tests on resedimented mudrock (GoM-EI) specimens and measured V_p and V_s throughout the shearing process. Test results show that V_p is mainly controlled by porosity and relatively insensitive to undrained shear. V_s reduces significantly with shear, suggesting a softening of the mudrock shear modulus. As a result, the velocity ratio (V_p/V_s) and the poission's ratio are dependent on shear stress level. In the later stages of shearing, there seems to be a change in material behavior.

CLICK ON IMAGE FOR LARGER VIEW

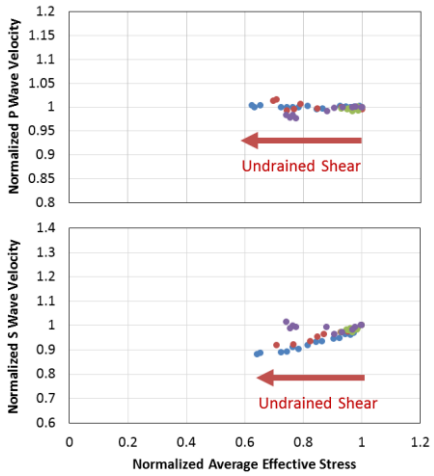

Fig 1: Normalized P and S velocities For RGoM-EI plotted against normalized average stress during undrained shear

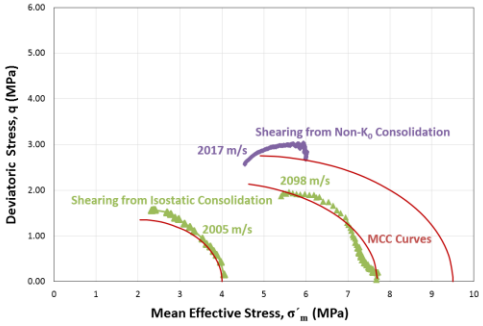

Fig 2: Undrained stress paths compared to Modified Cam Clay yield surfaces for three tests on GoM-EI. Compressional velocities are average values during shear

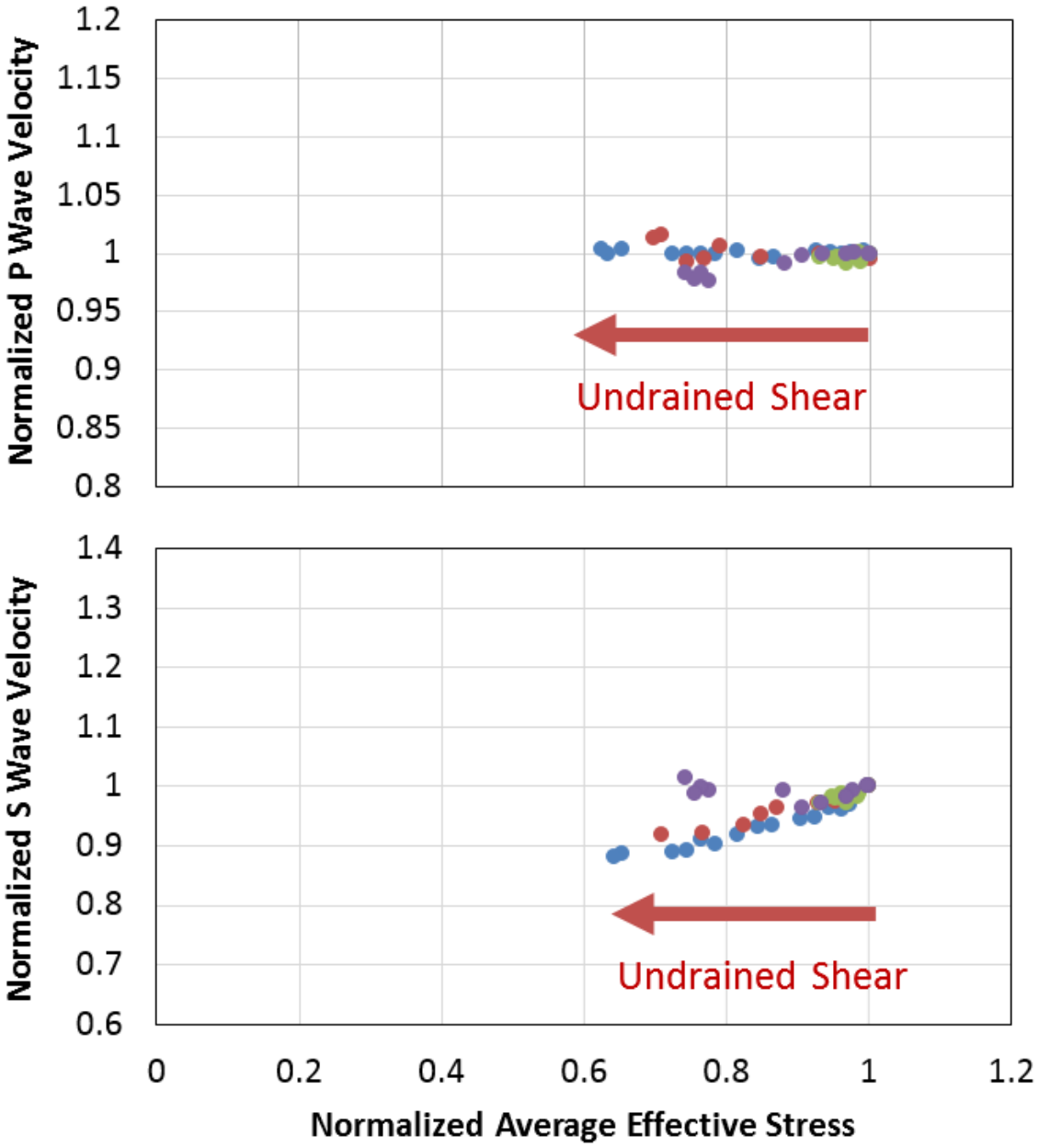

Fig. 1: Normalized P and S velocities during undrained shear

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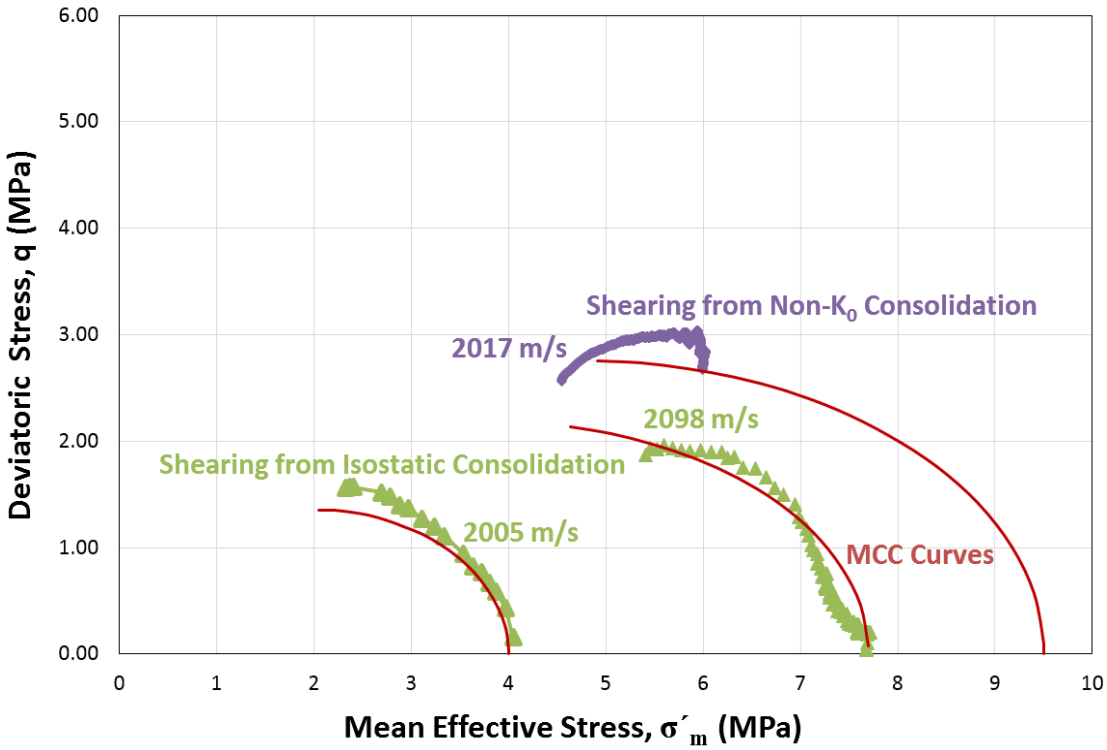

Fig. 2: Experimental effective stress paths compared to Modified Cam Clay curves

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