08.09: Wave Velocity Behavior in Shearing

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ABSTRACT

Wave velocities are commonly considered to be constant during undrained shearing. It is assumed that along the effective stress paths (iso-porosity contours), the V_p and V_s values stay constant regardless of the changes in effective stress. Having a proper understanding of wave velocity behavior during undrained shearing would give us an insight into the stiffness behavior and possibly the stress state relative to failure. I have conducted undrained shearing tests on resedimented and normally consolidated mudrock specimens and measured V_p and V_s along the effective stress path. My test results show that V_p is controlled by porosity and insensitive to undrained shear (Fig. 1). This means for V_p, the iso-porosity line is also an iso-velocity line (Fig. 2). However, V_s reduces significantly with shear, suggesting a softening of the mudrock, with constant volume shearing (Fig. 1). As a result, the velocity ratio (V_p/V_s) and the poission's ratio are dependent on shear stress level.

CLICK ON IMAGE FOR LARGER VIEW

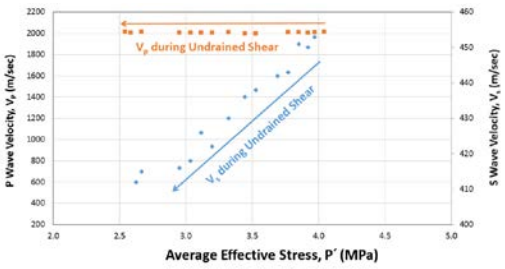

Fig 1: Shear wave velocity decrease and P wave velocity stays constant with a decrease in P', as the specimen is sheared.

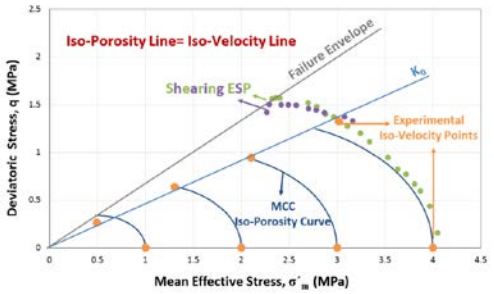

Fig 2: Experimental iso-velocity points compared to Modified Cam-Clay iso-posority curves for V_p, showing that P wave velocity is independent of stress level, with constant porosity.

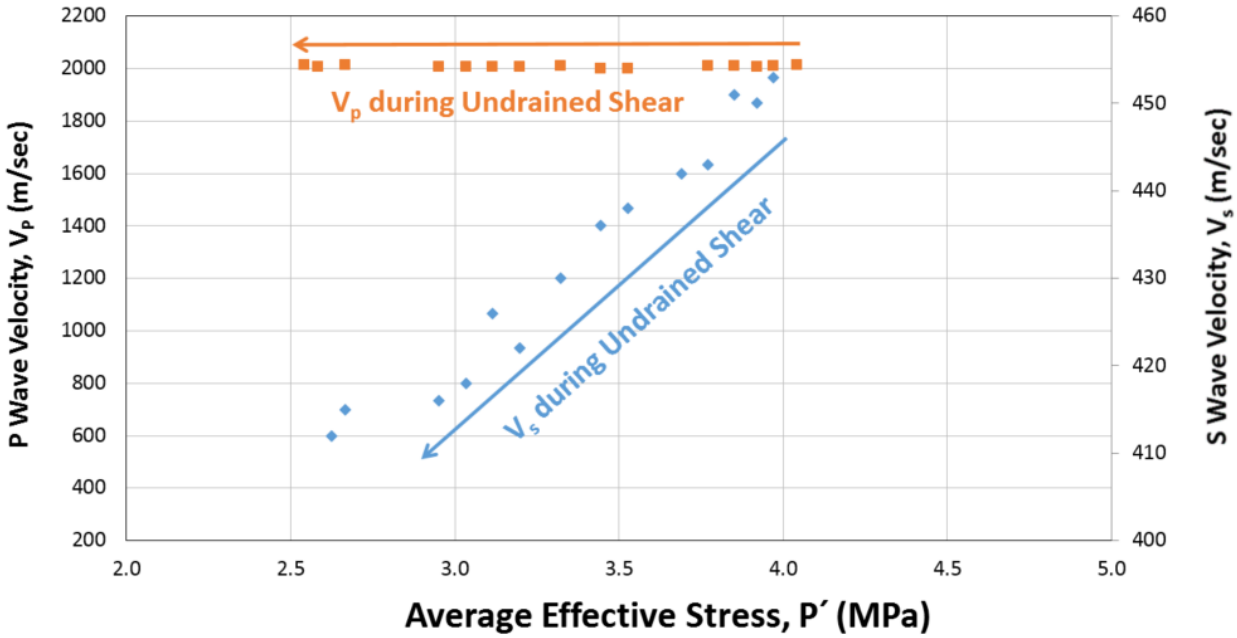

Fig. 1: Shear wave velocity decrease and P wave velocity stays constant with a decrease in P′, as the specimen is sheared.

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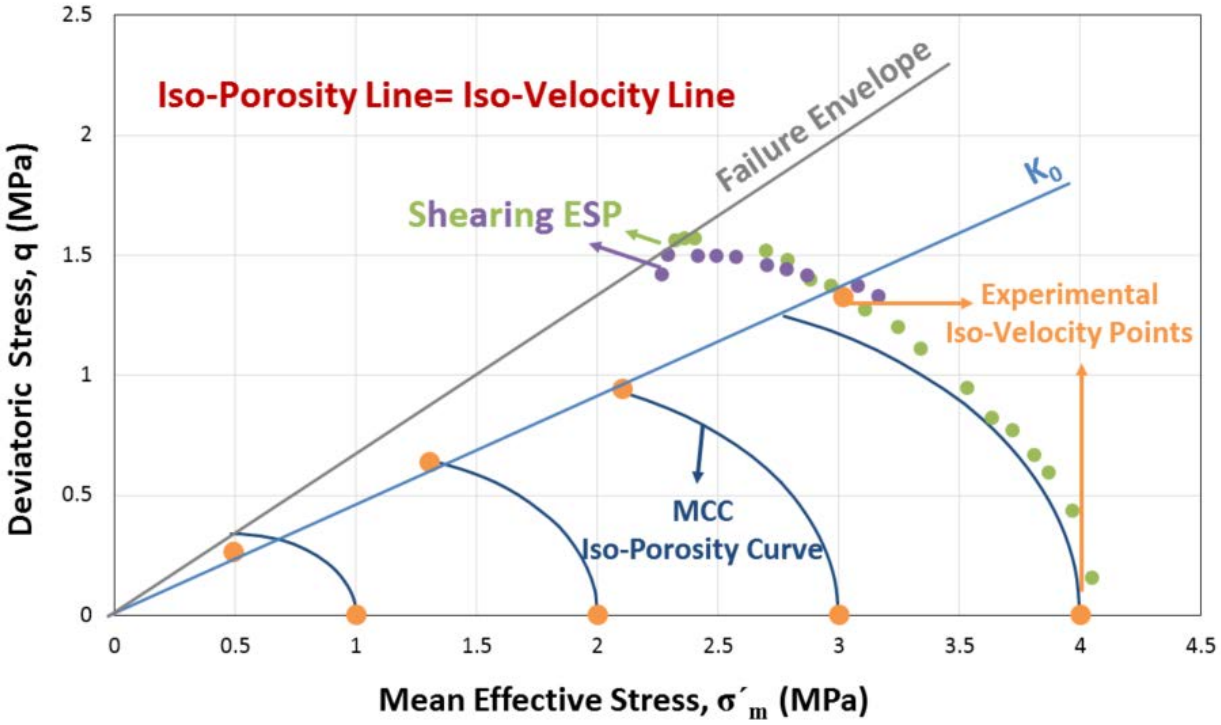

Fig. 2: Experimental iso-velocity points compared to Modified Cam-Clay iso-posority curves for V_p showing the independence of P wave velocity of stress level with constant porosity.

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