

12.23: Velocity Anisotropy of Intact vs. Resedimented Mudrock

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ABSTRACT

Basinal deposits are inherently anisotropic due to layered and oriented grains from sedimentation and uniaxial compression. In the laboratory, we test resedimented specimens to mitigate the effects of sampling disturbance from core retrieval. However, resedimentation creates homogeneous samples that lack stratigraphy-induced anisotropy. Studying how elastic anisotropy differs in intact and resedimented samples can help us enhance seismic imaging, soil property interpretation, and pore pressure prediction. This study determines five independent velocities and computes the stiffness matrix and Thomsen parameters at 1 MPa increments on intact and resedimented marine illitic clay (Boston Blue Clay). Stresses range from 1 to 11 MPa ($n = 0.3 - 0.5$) under uniaxial loading conditions. Results are compared to past velocity measurements of RBBC and show excellent agreement. P-wave anisotropy is weak at all stress levels and S-wave anisotropy is moderate ($\gamma = 0.3 - 0.5$) for both samples (Fig 1). Intact samples have slightly higher S-wave anisotropy but comparable P-wave anisotropy (Fig 2).

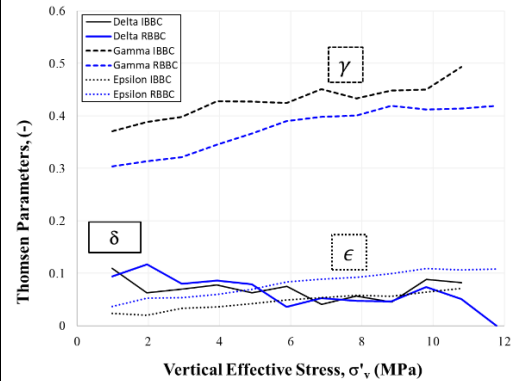


Fig 1: Delta, gamma, and epsilon with increasing vertical effective stress

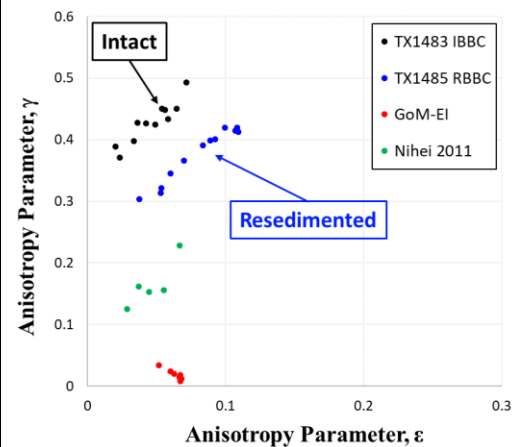


Fig 2: Material anisotropy comparison

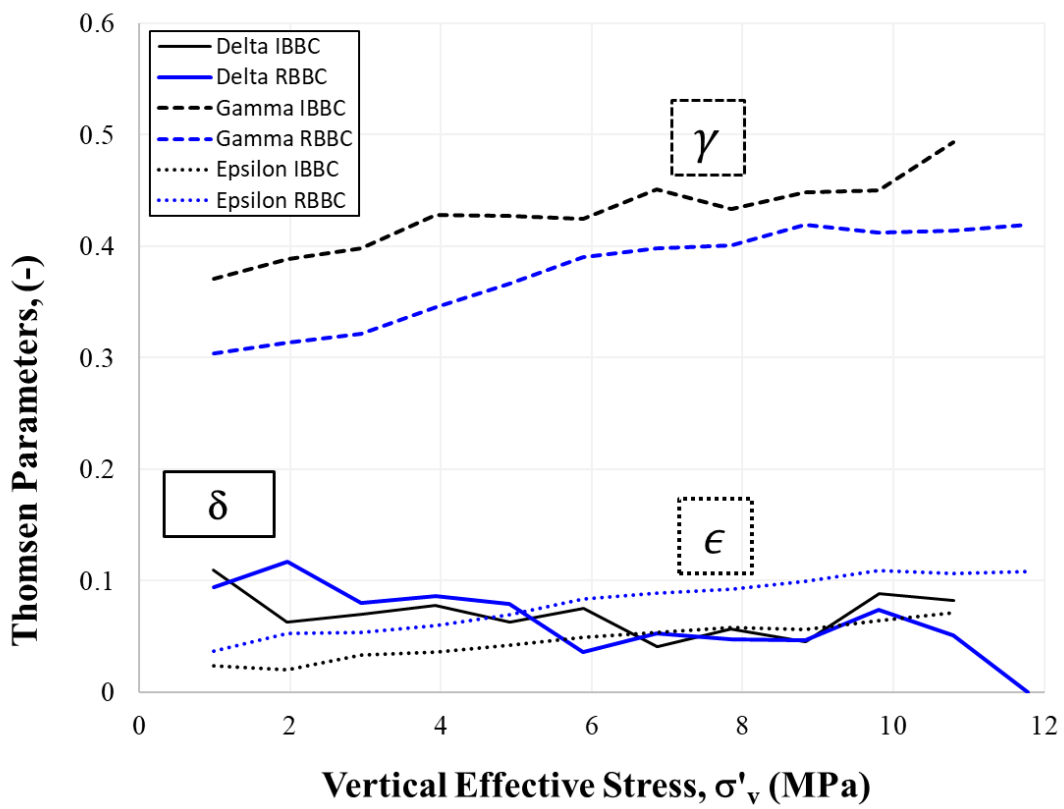
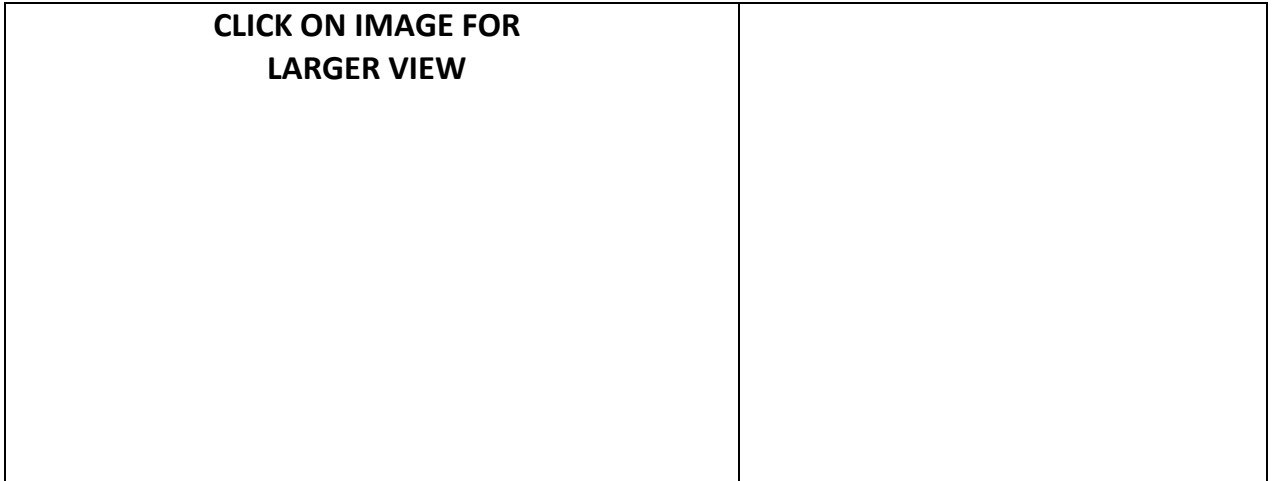


Fig. 1: Shown above are delta, gamma, and epsilon values with increasing vertical effective stress. Computationally intensive and error sensitive delta values show more scatter and the opposite trend as gamma and epsilon. Intact and Resedimented samples show little difference except for a 5% higher gamma for intact BBC.

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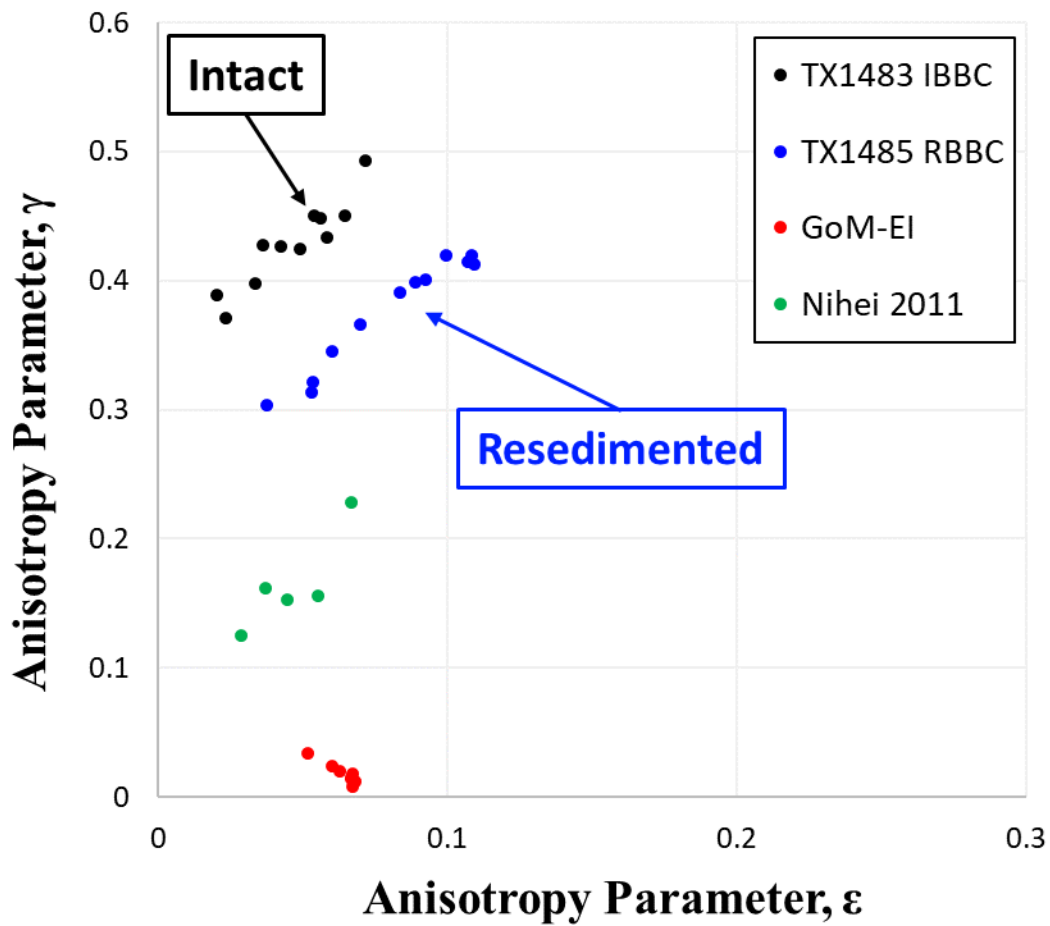


Fig. 2: Gamma and epsilon comparison shows more separation between the intact and resedimented BBC. Initial findings show 5-10% higher S-wave anisotropy for intact specimens, likely an effect of stratigraphy.

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