Velocity – pore-pressure prediction enhanced with geomechanical modeling

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ABSTRACT

We present a new pore-pressure prediction workflow that couples seismic velocities with geomechanical modeling. Pore pressure is predicted (Fig. 1) using mean and shear stresses derived from a geomechanical model. This approach incorporates non-uniaxial loading, as well as the response of the geologic environment, and accounts for shear-induced pore pressures (Fig. 2). We demonstrate this new workflow using data from the Mad Dog field, in the Gulf of Mexico. We use a static geomechanical model to obtain total mean stress and shear stress values around the Mad Dog salt. We use measured data along a well in front of the salt to establish a velocity – equivalent-effective-stress relationship. We use this relationship together with the shear predicted from the geomechanical model to calculate the mean effective stress across the target field. And we calculate pore pressures as the difference between the total and effective *mean* stresses. Overall, our new workflow incorporates the geologic history, yields the full stress tensor for the target field and can predict pore pressures ahead of the drill bit.

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Figure 1: Predicted pore pressure at the Mad Dog field based on equivalent effective stress; the prediction accounts for the contribution of both total mean and shear stresses to overpressure.

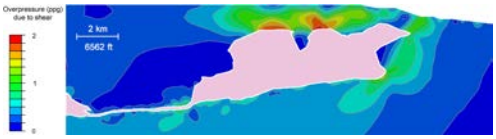

Figure 2: Overpressure caused by shear around Mad Dog salt, in pounds per gallon.

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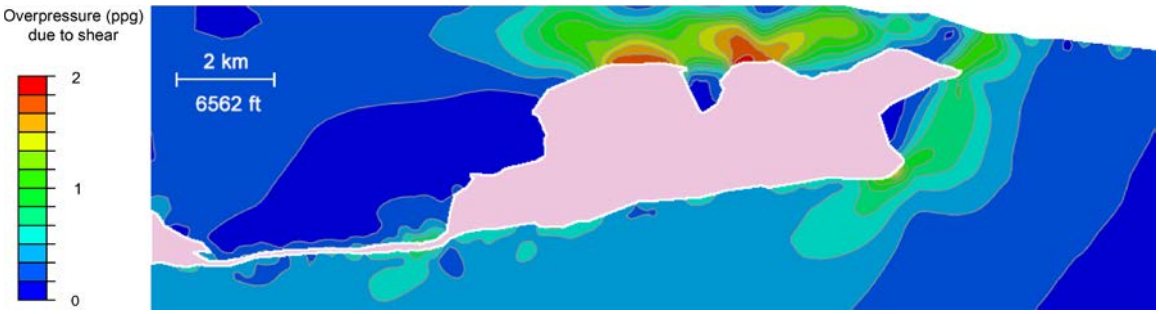

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