Overpressure Prediction and Modeling in a Field in the Niger Delta, Nigeria

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The preponderance of overpressures has been established for deeper horizons in many parts of the Niger Delta basin, Nigeria. Blowouts, damage to formation, or loss of equipment/personnel associated with overpressures can thus be avoided by understanding the overpressure characteristics in the area. In this study the available well logs and pressure data for the field were used to establish a relation between pressure, effective stress, and sonic or seismic interval velocity. The interval velocity fields were derived from appropriate 3D stacking velocities, and the generated interval velocities were converted to depths. These interval velocity fields were compared with velocities at the well locations to derive an anisotropy factor and hence to establish a predictive pressure-depth model for other drilling locations in the field where only seismic velocities are known.

Another approach used involved calculating the fluid pressures using depths of the key marker beds/sequence boundaries and the corresponding sand-shale ratio obtained from a pressure/sand-shale relationship model between the marker beds. Hence the pressure/sand-shale ratio relation served as a pressure predictive model for other horizons with known depth (sand-shale ratio) alone.

Finally, a comparison is made of the results of the different approaches in terms of efficiency and accuracy in pressure prediction using the pressure-depth calibration functions thus obtained. The results contribute effectively to the planning of the drilling program in the area, leading to a reduction in drilling risks. Also, better reservoir characterization and optimization are achieved through precise and quantitative computation of trap integrity, reservoir compartment/continuity, prospect evaluation and ranking from reliable pressure data for the test area.