Integrating Seismic Elastic Properties and Discontinuity Analysis into Reservoir Modeling and Simulation – A Case History from the Gulf of Mexico Shelf

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Abstract

Effective integration of seismic information into reservoir modeling and simulation may significantly improve the understanding of the reservoir, leading to enhanced field recovery, better field management decisions and improved identification of un-swept potential for new drilling opportunities.

Conventional reservoir modeling and simulation studies frequently underutilize seismic information. Wells sample the earth with high vertical resolution at a single location, but seismic provides highly sampled information in the intra-well space. The utilization of depth calibrated, properly conditioned intra-well seismic information can lead to better definition of the reservoir and simulation results.

The classification of elastic properties obtained from pre-stack seismic inversion can be used to populate lithology distributions in the reservoir model and to improve delineation of the reservoir. Seismic discontinuity analyses provide a framework for candidate reservoir compartment baffles and barriers. Together, these seismic properties serve to enhance the accuracy of the geologic model and lead to a better understanding of reservoir drainage dynamics.

A seismic to simulation study of the J6 ‘Pod B’ reservoir in Main Pass 61 demonstrates the value of integrating seismically derived litho-fluid properties to define reservoir boundaries and facies distributions. Effective porosity is modeled using well petrophysics and seismic trends obtained from a multivariate analysis of elastic properties including litho-fluid probability volumes derived from Bayesian rock physics classification. Further, seismic discontinuity analyses provided a means to identify compartment boundaries, baffles and lithologic barriers to fluid flow. The modeling and simulation results highlighted the complexities of reservoir and provided a key basis for new drilling designed to drain unswept oil. The drilling results from four successful post study wells served to substantiate the simulation model which identified 4MMBO of addi-tional recoverable reserves.