RESERVOIR FACIES OPTIMIZATION WITH INTEGRATED PROBABILISTIC ROCK-PHYSICS TEMPLATES AND SEISMIC INVERSION

Wei Xie and Kyle T. Spikes

Department of Geological Sciences
The University of Texas at Austin

ABSTRACT

We show that the facies optimization workflow based on probabilistic rock-physics templates can provide important guidelines for seismic reservoir facies estimation. This workflow determines the optimal number and distribution parameters of reservoir facies while accounting for errors from well log, rock-physics modeling and seismic inversion. It evaluates facies models systematically at both well log and seismic scales. We applied this method to a clastic reservoir dataset in the Gulf of Mexico. Different scenarios with five to seven facies were tested using probabilistic rock-physics templates and Gassman equation. We then used the Backus average to account for resolution collapse from well log to seismic scales. We assessed error from seismic inversion by examining different low-frequency models and random errors in seismic inversion. Comparisons of different metrics suggested that the scenario with five facies was the optimal model. Using commercial software, we inverted seismic data using different low-frequency models and mapped seismic facies for each scenario, respectively. Finally, we determined reservoir areas with consistent interpretations based on the facies estimations. Our method determines the optimal number and distribution parameters of facies models when different types of errors are considered. More importantly, consideration of errors from seismic inversion allows us to better understand the estimated facies, which directly affects risk analysis in early exploration. It provides important guidelines and practical constraints for seismic reservoir facies characterization when limited reservoir data exist.