High-Resolution Prediction of Rock Properties and Hydrocarbon Charge through an Integrated Basin Modeling/Seismic Inversion Approach

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Present day rock properties are a result of several physical and chemical processes occurring over millions of years in sedimentary basins. Compaction, clay transition and dehydration, quartz cementation, faulting and fracturing, salt movement and related thermal anomalies, chemical compaction, tectonics, etc., have direct impact on the evolution of rock properties such as porosity, permeability, and thermal conductivity. Basin modeling provides an integration platform where most of the processes are modeled.

Classical seismic inversion deals with present day data and rarely utilizes basin modeling results. In addition to the data derived from wells, fluid and gas distribution, temperature and pressure history derived from basin models can be used for calibration of seismic inversion. This paper presents an approach linking high resolution basin modeling with seismic inversion that led to better predictions of hydrocarbon distribution as well as to better constrained seismic inversion.

Plamuk field (Gulf of Thailand) was selected to demonstrate the workflows. Field selection was based on excellent well control (~200 wells), good quality seismic data, and existing production. Production data shows very complex fluid and gas types: methane, CO_2, light oil, heavy oil, and high wax oil. The difficulty in predicting fluid distribution, raise many questions regarding hydrocarbon sources, migration, charge history, re-migration, and mixing. The integrated basin modeling / seismic inversion approach was applied to explain the complex Plamuk petroleum system.