Carbonate Reservoir Characterization Based on Geological Setting of Shuaiba Formation in order to analogue to SE

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Abstract

Reservoir characterization in carbonate is one of the most challenging works due to very high heterogeneity of the carbonate rock. It is important to understand well in carbonate system in order predict facies distribution and characterize reservoir properties. This study aims to characterize and construct 3D static model of Aptain carbonate, Shuaiba Formation. The knowledge from this study would help to understand more about carbonate in order to apply this technique to the carbonate reservoirs in Asia region.

The Shuaiba Formation in the study area is divided into three parts; Upper, Middle and Lower Shuaiba. Main hydrocarbon distributor of the area is the Upper Shuaiba. Conventional core data reveal that in the study area Upper Shuaiba Formation is dominated by lime mudstone of deep-water lagoon, which considered as no porosity while wackstone and packstone moldic pore geometry are common in the shallower lagoon. Rudist-algae floatstone interparticle pore and coarse peoloidal packstone moldic and vuggy porosity represented carbonate build up demonstrate the better reservoir quality.

The analyses of the cores are used to define facies for the core intervals. Six facies are classified based on lithology and pore geometry as well as porosity and permeability cross plot from routine core measurement. Electrofacies logs are generated for both cored and un-cored intervals by using a supervised cluster analysis approach, Multi-Resolution Graph-Based Clustering (MRGC). Progradational slope deposition to the southeast direction is characterized by a clinoform feature in seismic of Upper Shuaiba. A conceptual geological model is then created based on integration of well data and the clinoform feature. From core interpretation, the distal part of each clinoform is nominated by lime mudstone which correspond to deep lagoon environment whereas the proximal part particularly at the crest of clinoform represents more carbonate build up texture of floatstone and coarse packstone.

Facies model is constructed based on the conceptual depositional model for the Upper Shuaiba reservoirs. Lateral distribution of facies is controlled by the clinoform feature from seismic while vertical distribution relies on electrofacies logs. The distribution of petrophysical properties are supervised by facies characterization according to the facies model. Petrophysical property models are consequently built by facies controlled.

The study described here was an example of such integration tasks. Given the very limited hard data (wells), the workflow applied tries to capitalize on the areal information coming from the 3D seismic, and conceptual geological model to construct the reliable 3D static model including capturing multi-scenarios and multi-realizations.