Integration of Geology and Geophysical Data in Reservoir Characterisation - A Case Study of the K Field

Zaizakrani Md Salleh[1] and Kwong Poh[1]

[1]Talisman Malaysia Limited

Abstract

The K field, located offshore Sabah on the island of Borneo, was discovered in 1989. The main accumulation is dip-closed against a major SW-NE trending growth fault where some forty sand units formed the major part of the hydrocarbon accumulation. The reservoir consists of stacked marine shoreface sandstones of Miocene age and hydrocarbon occurs as oil and associated gas caps. To date, more than 40 development wells have been drilled since 1995. Talisman Malaysia Limited (TML) took over the operatorship of this matured oil field from the previous operator in 2012 and undertook a comprehensive review of all the sub-surface opportunities with a view of preparing a full redevelopment workscope of the field. An integrated geology and geophysics subsurface review was conducted to generate a full field 3D static model mainly to provide input for dynamic reservoir simulation and history matching. This paper describes the G&G integration process and examples of utilization of seismic input into the 3D static modeling process. One of the target reservoirs, X1, has a net sand thickness less than 60 ft, below tuning thickness. A broadband re-processing sequence was engaged and a high-resolution stochastic inversion was carried out on the re-processed data to map this reservoir. The resultant P-impedance and S-Impedance cubes were used to generate lithofacies probability cubes through a classification technique in the Vp/Vs-P impedance domain. In order to establish a relationship between seismic attributes and reservoir properties, cross-plots of seismic amplitude and P-impedance against reservoir properties such as volume of shale, net sand thickness, water saturation and porosity were performed from the target reservoir unit. Based on the cross-plots, stronger seismic amplitudes and lower AI generally represent better reservoir quality. The sand probability distribution map of the target reservoir shows better developed reservoir towards the northern region. This trend has been used as a soft constraint to guide the reservoir modelling process away from the wells. The P impedance distribution map also highlights the lower impedance in the northern region, which could be attributed to the reservoir depletion. The MDT pressure data collected from the recent drilling campaign indicates less pressure depletion in the northern region than the southern region of the field. An infill well has been planned to drain the oil in the northern region based on this study.