Paper 4

Sequence stratigraphy of the Group J, Tapis Field, Malay Basin

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The Tapis field was discovered in 1969. Ten exploration and eighty development wells had been drilled between 1969 and 182. In 1992, the Joint Research Study between EPMI and Carigali identified opportunities for further development which included Tapis C and D infill drillings, west and south flank development by the installation of two additional platforms. These opportunities were identified as a result of an integrated study of 3D seismic data, sequence stratigraphy and new log analysis calibrated by core data and production performance.

Tapis is a simple anticline cut by a number of faults which are interpreted to be post Group J in origin. The lack of tectonic activity during the Group J time, the flat nature of the basin and dense well control make Tapis an ideal field for detailed sequence stratigraphic analysis.

The Group J in the Malay Basin comprises of two third order sequence sets with the third order sequence boundaries at the base of the Group J and J-21 sequence.

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The Lower Group J is made up of a number of well-defined upward coarsening prograding lowstand clinoforms (J-70, J-60, J-40 and J-30). However it contains no reservoir rock in Tapis due to its rather distal location.

The lower part of the younger Group J sequence set is commonly called the Middle Group J (J-21, J-20.5, J-20, J-19.8, J-19.5, J-19, J-18). The J-21 through the J-19.8 sequences is aggradationally staked. The sequences then back-stepped through to the J-18. Each fourth order sequence is made up of a retrograditionally staked sandstone-claystone couplet. The Middle Group J is very sand prone. It contains the largest in-place reserve in the Malay Basin. This is also the major reservoir unit in Tapis.

The upper part of the younger Group J sequence set is called the Upper Group J (J-15, J-10, J-8, J-5, J-3). The J-15 through the J-3 sequences is retrograditionally staked. As in the Middle Group J, each fourth order sequence is made up of a retrogradationally staked sandstone-mudstone couplet, but unlike the Middle Group J, this unit is silt-prone.

The reservoir units of Middle Group J map out as elongated sand bodies aligned in a NW-SE to WNW-ESE direction. This direction is that of the strand line indicated by stratal downlaps and changes in depositional facies.

The Malay Basin is a closed-end, narrow structural trough which was connected to the ancestral South China Sea via the West Natuna Basin. The narrow restriction, experienced especially during lowstand sea level caused tidal currents to be extreme. This resulted in deposition of deltas which were skewed parallel to the shore-line. The constant reworking of bottom sediment by long shore tidal current resulted in the concentration of linear subtidal sand ridges parallel to the axis of the basin.

In the Middle J in Tapis, tidal currents are interpreted to have winnowed out the often heavily bioturbated sandstones into a series of clean, linear sand bodies resulting in a heterogeneous reservoir made up of good (>100 md) and intermediate quality (< 100 md) rock. The good quality rock can often be imaged as high amplitudes bodies on seismic.

The modern analogues for the Middle Group J sandstones in Tapis are the massive marine sand bars in the Malacca Straits which are reworked by the strong tides moving in and out of the narrow seaway. Tides in the Malacca Straits have an average mean spring range of 4.3 meters with average tidal current velocities of 1 to 1.5 m/sec. These tidal-ridge sands are aligned parallel to the axis of the seaway.

Detailed well log sequence stratigraphic analysis in conjunction with seismic imaging enable us to accurately map out the distribution of the Group J reservoir sand bodies in Tapis. This has resulted in the identification of development opportunities in Tapis and exploration potential in areas adjacent to Tapis.