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Poster 11

TWO-DIMENSIONAL STRATIGRAPHIC SIMULATION OF THE MALAY BASIN

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Stratigraphic simulation is a computer modelling technique that can be applied in petroleum exploration to understand the depositional geometries and architecture of a sedimentary basin. By making geologically reasonable assumptions about certain process parameters (e.g. sediment supply and tectonic subsidence rates), realistic stratigraphic geometries and attributes of sedimentary basins can be replicated by forward modelling. There are a number of proprietary and a few commercially available stratigraphic simulation packages designed for this task; ranging from simple 1D to more sophisticated 3D techniques (Ku Rafidah & Mazlan Madon, 2007). In this study we have used SEDPAK™, a 2D modelling package developed by the Stratigraphic Modelling Group at the University of South Carolina (Kendall et al., 1991), to simulate the stratigraphic evolution of the Malay Basin, offshore Peninsular Malaysia. The objective of the study is to investigate the relative influence of the main factors that controlled sedimentation in the basin. In a previous study of overpressure development in the basin (Madon, 2007), subsidence and sedimentation (burial) rates were found to be the main controlling factors in overpressure development. In this study, SEDPAK™ was used to reconstruct a depositional history of the basin by varying the rates of tectonic subsidence, sediment supply and eustatic sea-level change. We have used an interpreted seismic section across the basin as a starting model (Figure 1) and, upon applying a time-depth conversion, constructed a geologic cross-section to be simulated. Based on the published geologic ages of the seismic horizons and the measured thicknesses of the stratigraphic units, their average sediment accumulation rates were derived along the profile as input to the simulation. Figure 2 shows the three main input parameters. The input value for the modelling parameters is varied by trial-and-error iteration until there was agreement between the model result and the observed geometries in the seismic depth-section.

The results of the simulation are shown in Figure 3, where the stratal geometries obtained by the simulation are comparable to the observed seismic section (cf. Figure 1). We investigated two cases: one in which there was simple subsidence without faulting, and another with a major fault on the eastern margin (representing the Bergading Fault in Figure 1). The results show a difference in the subsidence pattern due to the activity on the normal fault, which has created accommodation space for deposition of a thicker wedge of sediment basinwards. This type of fault-controlled sedimentation is of interest, as it may result in deposition of reservoir facies across the fault, perhaps during falling sea level (lowstand). This study demonstrates the potential application of stratigraphic simulation techniques in predicting the controls on stratigraphic development and, hence, the distribution of reservoir, source and seal facies.

References

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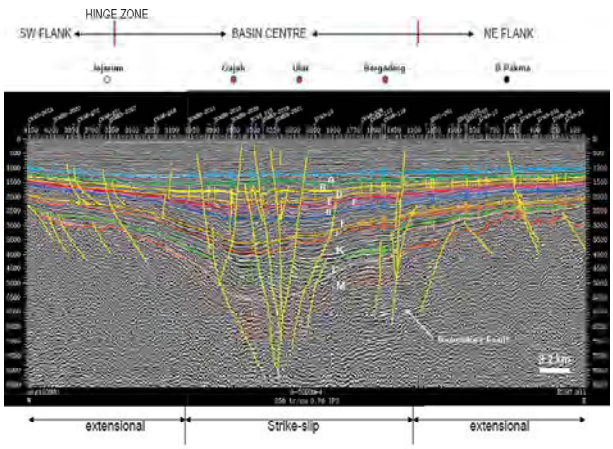

Figure 1: North Malay Basin regional seismic line (RC93-011) showing the main structural elements and architecture of the basin. This seismic line was used to reconstruct the basin model

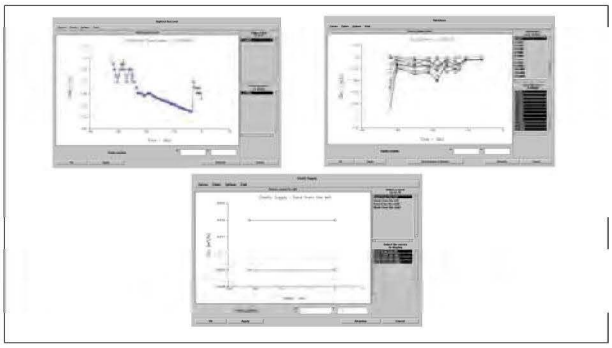

Figure 2: Input parameters for simulation of the northern Malay Basin. These parameters are the main controlling factor in development of the stratal pattern in this basin. (A) Sea level fluctuation in Malay Basin, based on the eustatic curve by Haq et al. (1987) which estimated sea-level oscillations within 100m, (B) Subsidence at 16 different locations in northern Malay Basin were assumed to be influenced by sedimentation accumulation rate, which was estimated by dividing the thickness of the unit by the time interval of deposition from observed seismic line (RC93-011). (C) Sediment supply was assumed to be constant and from both sides of the basin. The sediment is assumed to be 55% shale and 45% sand throughout the simulation..

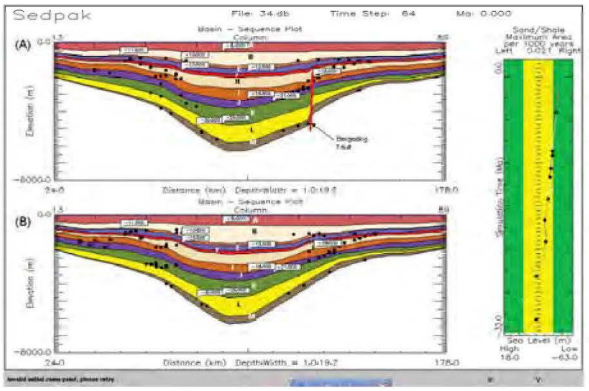

Figure 3: Modelled stratigraphic pattern of northern Malay Basin displayed in sequences (colour-coded) at present day. (A) Modelled basin with influence of normal fault (Bergading Fault) (B) Modelled basin without influence of the fault. Differential subsidence due to the fault has produced different system tracts as shown in Fig 2(A), and resulted in different stratal architecture..