

Seismic and Potential Field Data Integration for Subsalt Exploration in the Red Sea, Saudi Arabia

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ABSTRACT

In the northern Red Sea shallow water transition zone, the best quality seismic reflection data are observed in areas related to bathymetric highs, precisely where the halite portion of the Mansiyah Formation has been completely withdrawn. Due to the factors like varying halite thickness and the block faulting, both Mansiyah and basement seismic responses were laterally discontinuous and hardly identifiable. Therefore, forward modelling of potential field data was employed to help the seismic interpretation performed in poor imaging areas, and to confirm the geometry and depth of deeper reflector including basement as suggested by 2D seismic data. The initial model to use for potential field analysis was created by interpreting depth migrated 2D seismic lines having acceptable imaging quality. The gravity response for seismically derived model was calculated and compared with the observed gravity profile. The misfit between the observed and the computed responses is taken to next step where the horizons interpretation and the modeled density values were iteratively updated until the misfit is minimized and get a reasonable fit. The density values of various formations were constrained by density from wells. In addition, magnetic response is calculated for previously derived model and compared with the observed magnetic data along the profile. The misfit between the calculated and the observed magnetic data was minimized by changing the magnetic susceptibility values of the basement rocks (i.e., property optimization). The final model obtained complied with gravity, magnetic (RTP), and also seismic data. The depth of different deeper horizons obtained from the integrated model satisfying multi geophysical data was found to be close to the actual drilling result.