The Geometric and Kinematic Evolution of the Deepwater Thrust Folds of Sabah, Northwest Borneo

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The deep water thrustbelt of NW Borneo has proven to be an exploration heartland for Shell, partners and competitors over the last few years. Most proven traps are formed in hanging-wall folds above toe-thrusts, and tend to be confined to the four-way dip closure. As such, considerable volume potential in deep water NW Borneo resides in such traps. However, it is common to find that the geometries of thrusted folds are hard to interpret on seismic, due to wipeout effects associated with migrating gas and gas hydrates. This leads to the poor definition of fold/fault geometry and top seal retention capacity. All of these have a critical impact on the volumetric and economic assessment of the opportunity.

In addition to this, it is clear that the fore-limb geometries of such structures involve a degree of geological complexity that is beyond seismic resolution. This involves the inter-play between thrust propagation, on-lapping hanging-wall turbidites, pelagic drapes and the mass-wasting of the emergent fold by formation of slumps and related channelisation. These issues have a key bearing on column height predictions.

This contribution examines these issues by unravelling the evolution of several prospects within the NW Borneo toe-thrust belt. Detailed 3-D seismic volume interpretation, seismic facies mapping, section reconstruction and forward modelling have been applied in the analysis. A significant improvement in risk and volumetric assessment is demonstrated, by rigorous structural evaluation in this environment.