Predicting Fault and Top Seal Behaviour: Examples of Static and Dynamic Sealing from the Exploration to the Production Phase

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Different techniques are required to predict fault and top seal behaviour during the hydrocarbon exploration and the production phase. We show examples from different geological settings on how to predict seal behaviour during the different phases of the HC life cycle.

In the deep waters offshore NW Borneo, compressional deformation has resulted in a fold and thrust belt stretching more than 800 km along the southern margin of the NW Borneo Basin. Recent drilling results prove the presence of considerable HC amounts in the basin. Typical trapping geometries occur in elongated faulted hanging wall anticlines of buried folds and ridges. Experience has shown that hydrocarbon columns may be partially lost as a result of hydraulic leakage of the top seal caused by a combination of overpressure and recent uplift. A significant up-side potential of this trap style relies on the seal capacity of the fold propagaton faults between hanging wall and footwall. It appears that fault seal concepts derived from extensional basins also apply to compressional style fold and thrust belts.

Compartmentalisation of a field by faults in different blocks can seriously hamper the field's production performance. A well drilled into a compartmentalised field can only drain part of the field's hydrocarbons in an effective way on the production time scale. Faults can act as baffles or barriers to flow and necessitate drilling more wells to develop the field. On of the challenges in field development is how to realistically translate geological data from thin sections, core plugs, outcrops and seismic into parameter ranges that reservoir engineers can apply as fault seal multipliers in dynamic modelling. Several joined industry and academic efforts have been made to better constrain the geological fault parameters and we demonstrate how these have enabled us to better predict HC flow behaviour during production.