COMPARING SHALE GOUGE RATIO AND JUXTAPOSITION ANALYSIS USING STOCHASTIC TRAP ANALYSIS: EXAMPLES FROM GIPPSLAND, TARANAKI, OTWAY AND SOUTHERN NORTH SEA BASINS

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Exploration fault seal analysis of prospects is often focused on generating a probability of success. This risking considers sealing hydrocarbons against faults over geological periods of time, rather than production time. Typically the risking is based on cross-fault juxtaposition and/or sealing shale development on the faults, on a single “best” technical model, commonly referred to as a deterministic model. Considerable work has been done by a number of workers to calibrate the sealing shale development, for example, the Shale Gouge Ratio (SGR) algorithm, to predict free water contacts. These calibrations involve back-calculating the seal potential as SGR and determining a resulting across fault pressure difference (AFPD), to trap an observed free water level. Importantly, this back-fitting of SGR and AFPD has been conducted on single “best” technical models. In general, application of SGR methods on sealing across faults in prospects increases predicted column heights and enhances pre-drill chance of success. Prospects with large columns are typically generated and then discounted through geologic risk factors. If wells do not find the predicted columns, this is often “explained” by lack of charge or trap breach. It is proposed that the fault and stratigraphic uncertainties are significant and need to be included in the modelling of fault seal risk and inferred column heights. A process of model validation will be presented in which observed free water levels are compared with the results of single “best” technical versus probabilistic models for both juxtaposition and SGR. Case studies from the Gippsland, Taranaki, Otway & Southern North Sea Basins show that probabilistic models can accurately predict free water levels (sub 10m accuracy) and identify leaking faults. Probabilistic models better predict free water levels and are thus better define prospect fault seal risk than models such as SGR based on back-calculating from single ‘best” technical models. Incorporating uncertainties in a stochastic analysis typically yields smaller but much lower risk traps, rather than high risk traps based on overly optimistic calculations. Applying these models and methods to fault seal analysis will allow explorers to better define risks and rewards on prospects.