Quantifying Undiscovered Oil and Gas Potential in theTaranaki Basin Using a GIS Based Bayesian Probability Spatial Analysis Approach

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New Zealand's pre-eminent hydrocarbon producing basin, the Taranaki Basin, remains under-explored. Presented here is an effective approach to quantify regional scale undiscovered oil and gas potential, using existing multi-sourced data. Bayesian probability statistics are used to identify spatial correlations between the basin's hydrocarbon forming environment and locations of hydrocarbon accumulation. The model uses these correlations to predict new oil and gas accumulations.

Ten thematic data grids numerically describe the key petroleum geosystem elements; charge, reservoir, and entrapment, for the basin's four most promising reservoir intervals from the Paleocene to the late Miocene. Charge is represented by grids of oil and gas generation and expulsion, and effective migration, based on the 1D basin model Bassim and the flow-path tool PetroCharge Express. Reservoir is specified by grids of mapped sands, using paleogeographic maps, and predicted porosity, based on the maximum burial depth of the reservoir. Entrapment is represented by grids of regional faults, regional seal, mapped prospects and leads, and diverse structural zones.

Using discovery and simulated data, results show that Eocene and mid-late Miocene reservoirs have the highest probability of yielding new oil and gas discoveries in the basin. For the Eocene reservoirs the model predicts a high probability of a new discovery offshore in the Central Graben to the east of the Maui Field, and in the Northern Graben northeast of the Pohokura Field. The highest probability of a new discovery in mid-to-late Miocene reservoirs is offshore northeast of the Maui Field and onshore in the northern Taranaki peninsular area.