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ORAL PRESENTATION

Final Separation of Eastern Gondwana –

Plate Kinematics and Their Implications for Frontier Exploration

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The protracted separation of Australia, Antarctica and Zealandia spanned a period of over 100 Ma from Late Jurassic until the early Paleogene. Several key tectonic events punctuate this interval and have direct consequences for the plate kinematics and paleogeographic evolution of the southern / eastern Australian and New Zealand passive margin basins. Whilst existing hydrocarbon plays in the shallow waters of the Otway, Gippsland, and Taranaki basins offer great analogues for neighbouring deep-water frontiers, there are many significant risks to be addressed. A greater knowledge of the age, duration, and regional interaction of the various tectonic events, placed in the context of a high-resolution plate model, is a crucial first step in understanding basin histories and potential play types.

Extensive syntheses of public-domain stratigraphic, geochronological, and geophysical datasets have been incorporated into a revised plate model for the region. Revised continent-ocean boundaries have adjusted the pre-rift fit of respective margins and an integrated approach to modelling the entire set of rift systems has produced a more robust kinematic model. Global consistency is maintained through plate circuit constraints, whilst high-resolution regional kinematics help visualise tectonic events critical for creating, preserving, or destroying potential hydrocarbon play elements.

Several case studies will be used which highlight both the data underpinning the model and the importance of plate kinematics as tools for understanding prospective petroleum plays. Using the existing stratigraphic framework developed for basins along the southern margins of Australia and seismic examples from both here and the conjugate Antarctic margin, it is possible to assess recent models proposed for break-up. The preferred model has important consequences for deposition and preservation of speculative Late Cretaceous marine organic-rich units, the presence of which is a key risk in the deep-water frontier Bight Basin.

Assessing the rift and break-up model for the Tasman Sea allows for the evaluation of discrepancies in structural trend and burial history of the depocentres in the Taranaki Basin. As all potential thermogenic source rocks in the adjacent deep-water province are likely to reside in the syn-rift section, it is important to consider maturity risk of different depocentres. The variance between kitchens that are at maximum burial versus those that have had a more complex history is probably a far more complex situation than envisaged.

The Great South Basin of New Zealand contains a well-documented, thick prograding wedge of deltaic clastic lobes deposited during the Late Cretaceous and early Paleogene. The source of these potential reservoir units is unclear, and the present-day topography and drainage patterns of the margin are a false reflection of the likely situation at their time of deposition. Examining the relative kinematics of the north and south Zealandia continental blocks during their break-up and dispersal sheds light on likely zones of localised convergence that may have formed a paleo-hinterland source responsible for clastic supply.

With sparse data control, the vast offshore region from the Great Australian Bight to the Chatham Rise is currently deemed high risk for exploration. The use of high-resolution plate models supported by multi-disciplinary datasets can be a powerful tool for evaluating potential source rock deposition, preservation, and burial history, as well as hinterland uplift and clastic reservoir supply. By gaining a greater understanding of the region's paleogeographic and kinematic evolution, it becomes possible to begin the process of de-risking prospective plays and opening up the potential of one of Earth's largest underexplored offshore provinces.

SPEAKER BIOGRAPHY

Jamie joined Neftex (now part of Halliburton) in 2006 and has worked the majority of time since then on the geology of the Asia-Pacific region. Originally developing sequence stratigraphic and tectonic frameworks for Southeast Asia, he is now helping to build industry-focussed plate models.