The effects of uncertainty on compaction, pressure, temperature and maturity modelling of the Sable Subbasin

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The approximation of physical parameters, such as porosity, thermal conductivity, heat flow and sediment grain size is a critical element in modelling a basin's hydrocarbon potential. This paper presents an analysis of the effect of variability in these poorly constrained physical parameters on compaction, pressure, temperature and maturity models of the Sable Subbasin.

Each parameter is varied by increments and the effects of the variation on the model is calculated. Model predictions are then compared with several measured values from Glenelg J-48: drill stem pressures, corrected bore-hole temperatures and vitrinite reflectance measurements.

Modelled burial history and predictions of pressure variation with depth are sensitive to changes in the porosity-depth profile. Porosity calculations from sonic transit time generate a porosity-depth profile that produces consistent predictions of fluid pressure. Measurements of bore hole temperatures constrain sediment thermal conductivity values. Pressure measurements constrain grain size assumptions. Organic maturity, calculated from vitrinite reflectance data using VITRIMAT, together with bore hole temperature results, control present-day heat flow values. Variations in heat flow through time strongly affect the modelled organic maturity of the source sediments.

Compaction, pressure, temperature and maturity models constrain porosity, grain size, thermal conductivity and present-day heat flow approximations. Organic maturity models of source depths in the Sable Subbasin are sensitive to changes in heat flow through time. Most passive margin rifting models predict heat flow variation, especially shortly after the rifting event. Future modelling of hydrocarbon generation in the Sable Subbasin must incorporate the results of these margin-scale rifting models with more detailed basin-scale thermal models.