

Advanced Geochemical Technologies Determine Source-Rock Depositional Environment, Crude Oil Thermal Maturity and the Extent of Oil Cracking in the Frontier Pegasus Basin, New Zealand

**Zachary F.M. Burton¹, J.Mike Moldowan², Allegra Hosford Scheirer¹, Leslie B. Magoon¹, Kenneth E. Peters³,
and Stephan A. Graham¹**

¹Stanford University

²Biomarker Technologies, Inc.

³Schlumberger Information Solutions

ABSTRACT

New Zealand's East Coast Province contains over 300 oil and gas seeps and shows, proving at least one active petroleum system and opportunity for successful oil and gas exploration. Despite more than 100 years of petroleum exploration interest, understanding of petroleum systems in the province's sedimentary basins is limited. Efforts thus far have focused primarily on the structurally complex East Coast Basin, while the nature of the deepwater Pegasus Basin is even less constrained. We performed biological marker (biomarker) and diamondoid analysis from five onshore oil seeps to investigate the origin of petroleum in the deepwater Pegasus Basin. The geochemical properties of each oil sample help to constrain the depositional setting and age of potential source rock(s) within the basin. Our results suggest an overall marine source-rock depositional environment but highlight distinctions in the relative amount of terrigenous input. We confirm previous assumptions of a Cretaceous or younger source rock age. We also present new evidence on the thermal maturity of potential source rock(s) and the extent of thermal cracking of oil in both the Pegasus and East Coast basins. Our study presents the first diamondoid-based assessment of these oils, and, to the extent of our knowledge, of any New Zealand oil samples. We place our results within a framework of previously compiled oil sample geochemical analyses for the whole of New Zealand. Taken together, these analyses may help to guide future exploration work in the Pegasus Basin.