

# Oil-oil and oil-source rock correlations for selected oils and gas condensates from several New Zealand basins

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Oil–oil and oil–source rock correlations are an essential tool for assisting petroleum exploration in basins with multiple petroleum systems. To evaluate these relationships in several New Zealand basins, a set of 10 oils and gas condensates were investigated by standardised molecular organic-geochemical methods [gas chromatography (GC), GC-mass spectrometry (GC-MS), GC-isotope ratio-MS)] to assess oil quality, source and maturity, and to verify previous data and interpretations for these samples.

The 10 selected samples are from the Great South (Kawau-1A), Canterbury (Galleon-1), South Westland (Madagascar Beach), Grey River (Niagara-1, Petroleum Creek-3, Kotuku), Murchison (Blackwater-1), and East Coast basins (Rotokautuku, Totangi, Waitangi). Detailed comparisons are also made to Taranaki oils and condensates recently analysed using identical analytical protocols. The selected 10 samples extend the range of depositional environments covered by the oils and condensates from the Taranaki Basin.

The 10 samples include five seep oils and range from yellow gas condensates to black, waxy oils. Four of the seep oils, from the East Coast and South Westland basins have biomarker distributions consistent with marine oils with minor terrestrial input. The East Coast seep oils are similar to the Kora oil family of the Taranaki

Basin, but have  $\delta^{13}\text{C}$  isotope signatures consistent with derivation from the Late Cretaceous and Paleocene Whangai Formation. The East Coast seep oil from Rotokautuku appears to have a slightly different source, possibly the Upper Calcareous Member of the Whangai Formation of Late Cretaceous and Paleocene age, as inferred from several biomarkers such as  $\text{C}_{30}$  steranes. The gas condensates from the Canterbury and Murchison basins are derived from predominantly terrestrial source rocks, but with significant marine influence and relatively high anoxicity during deposition and/or early diagenesis. In contrast, oils from the Grey River Basin are more terrestrial, with the oils from Petroleum Creek-3 and Kotuku (seep oil) in particular having negligible marine influence.

Several biomarker compound classes have been used successfully to indicate genetic groupings among the 10 samples and recently analysed Taranaki oils and condensates. The Grey River oils and Galleon-1 gas condensate are derived predominantly from gymnosperm organic matter, which groups them with the Late Cretaceous Maui oil family of Taranaki. In contrast, the gas condensate from the Murchison Basin is the only current sample to contain elevated amounts of biomarkers indicative of angiosperm biomass and thus a Tertiary age is inferred. The remaining oils and condensates show no or only minor correlation to the Taranaki oil families within the current Taranaki oils database, reflecting the wide variety of source rock facies that exist within New Zealand sedimentary basins.

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