Finding and modelling oil sweetspots in New Zealand's coaly source rock systems

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New Zealand's primarily terrestrially sourced basins, such as Taranaki, Canterbury and Great South, are generally considered gas-condensate provinces. However, Taranaki contains a number of discoveries of small- to medium-sized <50 mmbbls) oil fields of considerable economic value. This presentation summarises some recent advances in knowledge and technology that have the potential to help increase the rate of oil discoveries in New Zealand basins, through improved understanding of the distribution of oil-prone coaly facies and better modelling of their expelled and reservoired fluid compositions through time. New Zealand coals and coaly mudstones contain predominantly humic vitrinite-rich) kerogen, which near the onset of oil expulsion, ranges in hydrogen index from ca. 200 to 450 mg HC g TOC. Maturation modelling of the end-member kerogens using standard Type III kinetics indicates a wide range of cumulative expelled gas:oil ratios, from ca. 4000 to >40,000 scf stb. Instantaneous gas:oil ratios may initially be as low as 200-500 scf stb, before rising steeply with increasing maturity. Source facies for the typically waxy and paraffinic n-alkane-rich) terrestrial oils must necessarily be rich in long-chain, paraffinic precursors. Integrated pyrolysis and petrographic studies of Taranaki and Canterbury basin coals have identified leaf cuticle as a major source of waxy, paraffinic oil. Moreover, thin, planar mire coals and associated coaly mudstones are more likely to produce waxy crude oils than are thick, raised mire coals, owing to greater input and or preservation of leaf biomass. The total oil potential of coaly facies is further enhanced by synsedimentary marine influence, which is widespread throughout many of the coal measure sequences in New Zealand basins. Abundant leaf biomass and strong marine influence may each reduce the temperature thresholds for the onset of oil generation by as much as ca. 20Â°C, resulting in significantly earlier and shallower expulsion of oil and, ultimately, a broader oil window. The recent development of multiple-independent frequency factor solutions for kerogen-to-petroleum kinetics enables more realistic modelling of early oil and late gas generation. In addition, new, so-called Phase Kinetics provide kinetic parameters for PVT-compatible, expelled petroleum components, enabling improved pre-drill predictions of reservoir gas:oil ratios. Examples of these new kinetics techniques are presented from Taranaki Basin.