Facies Model for Recognition of Planar and Raised Mire Coals and Why the Former are More Oil-Prone

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Populating multi-dimensional basin models with meaningful source rock data generally requires prediction of the spatial distribution of key kerogen properties (e.g., TOC, HI and GOR) beyond sample locations, based on knowledge of paleoenvironmental and tectonic controls. This tends to be more challenging for humic coaly source rocks, which are particularly heterogeneous at all stratigraphic scales and commonly fluctuate between gas- and oil-prone. Systematic analysis of the bulk chemistry, petrography and pyrolysis-gas chromatography of humic coal seams in several New Zealand basins (Cretaceous–Tertiary) has enabled development of a facies model that distinguishes planar (rheotrophic) and raised (ombrotrophic) mire coals and which can be used to improve prediction of gas:oil ratios in terrestrially sourced petroleum systems.

Planar mire coals are typically thin and characterised by relatively abundant wood tissue within a collodetrinite-rich matrix, together with variable leaf biomass and clastics. In contrast, thick, raised mire coals contain abundant cork tissue in a largely cork-derived, vitrodetrinite-rich matrix, with rare leaf material and clastics. Multivariate analysis has shown that non-volatile paraffinic oil potentials are controlled primarily by the abundance of leaf-derived liptinites (cutinite and liptodetrinite). Planar mire coals (and associated coaly mudstones) tend to have greater oil potentials than raised mire coals as a result of greater leaf biomass input and/or preservation potential under higher groundwater levels. The formation of planar mire and thus more oil-prone coals is favoured by relatively high rates of accommodation increase, whereas raised mire, more gas-prone coals require relatively low–moderate rates of accommodation increase and an ever-wet climate.