

The Use of Bitumens as a Valuable Tool for the Timing of Charge in Basin Modeling

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The Upper Jurassic (Fulmar and equivalent) sandstones are major oil and gas condensate reservoirs in the North Sea, although many of the reservoirs also contain small, but still significant amounts of bitumens. These bitumens have been described as pyrobitumens previously generated by the cracking of an earlier oil charge to generate gas condensate and bitumen, although analytical data from the bitumen that support this formation mechanism have not been published. However, the analysis of the bitumens is very difficult using conventional petroleum geochemical techniques, due to the lack of free hydrocarbons. This problem can be overcome by using hydroxyprolysis (hypy) to release bound biomarkers. Using both drill cuttings and core fragments, bitumen-stained samples were successively extracted using n-heptane, toluene and DCM/methanol and the resultant asphaltenes subjected to hypy analysis.

Indeed, the bound hydrocarbons released via hypy from the bitumens have the same maturities as mid-mature oils found in many of the North Sea reservoirs. Thus, a formation mechanism is described in which the bitumens formed as result of an early oil charge that was subsequently degraded during the period of uplift and erosion that generates the base Cretaceous unconformity. This is significantly earlier than predicted by conventional basin modelling, and can only be modelled using the PresRo® kinetic model. Thermal cracking of oils was prohibited by the high fluid pressures that developed during the Plio-Pleistocene subsidence.