

THE USE OF THE HYDROPYROLYSIS OF OIL AND RESERVOIR CORE ASPHALTENES TO IDENTIFY THE SOURCE OF THE CLAIR FIELD

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Catalytic hydropyrolysis (hypy), which refers to pyrolysis assisted by high hydrogen gas pressures (15 MPa) in the presence of a dispersed sulphided Mo catalyst, has been developed as a method for liberating covalently bound biomarkers from macromolecules in coals, source rocks and crude oils. It possesses the unique ability to produce very high yields of aliphatic biomarkers compared to mild catalytic hydrogenation or traditional pyrolysis methods, whilst minimising alteration to their isomeric distributions (Love *et al.*, 1995).

The Clair Field, located 75 km to the west of Shetland is one of the largest oil accumulations on the UKCS. The co-occurrence of 25-norphopanes and undegraded *n*-alkanes within oils from this field, together with their relatively low API gravity indicates that the field is a mixture of at least two oil charges separated by a major biodegradation event. While the source of the second charge has been attributed to the Upper Jurassic Kimmeridge Clay (KCF) (Scotchman *et al.*, 1998), oil mixing and extensive biodegradation make identification of the first charge problematical. Rooney *et al.* (1998) used the isotopic signature of the gasoline-range hydrocarbons released by pyrolysis from Clair oil asphaltenes (believed to represent the first oil charge), to attribute the volumetrically more important first charge to a KCF-equivalent source. In this study we describe the use of hypy to generate bound biomarker profiles from Clair oil asphaltenes, allowing for source characterisation to be made using both the biomarker and compound specific carbon isotopic compositions. In addition to the oil asphaltenes we have also characterised the asphaltenes extracted from two oil stained reservoir cores, the bound biomarkers from which are thought to represent the first charge of oil to come into contact with the reservoir rock (Russell *et al.*, 2004).

A number of potential source formations dating from the Devonian through to the Lower Cretaceous were investigated. The Devonian forms a rich potential source in the area and is known to source the Beatrice Field in the Moray Firth. However, the absence of diagnostic biomarkers such as carotane and gammacerane in both the oils and cores, together with the low abundance of C28 steranes (Figs. 1A & 1B) do not support a Devonian source.

The low abundance of C₂₈ steranes is indicative of a Middle Jurassic source horizon such as the shales found in the West Lewis Basin (Fig. 1C), which are thought to source the nearby Foinaven Field (Scotchman *et al.*, 1998). However the presence of C₃₀ steranes derived from marine pelagophyte algae in all of the Clair samples precludes this lacustrine sequence from being the sole source of the first Clair charge. The low C₂₈ sterane content is not typical of KCF derived oils from the North Sea, although KCF-equivalent sources with the requisite low abundance of C₂₈ steranes are found within the West Lewis Basin (Fig. 1D) and may be a potential source. The isotopic composition of the various sources are currently being characterised in order to assess their validity as a prospective source for the first oil charge, including a potential contribution from the Middle Jurassic.

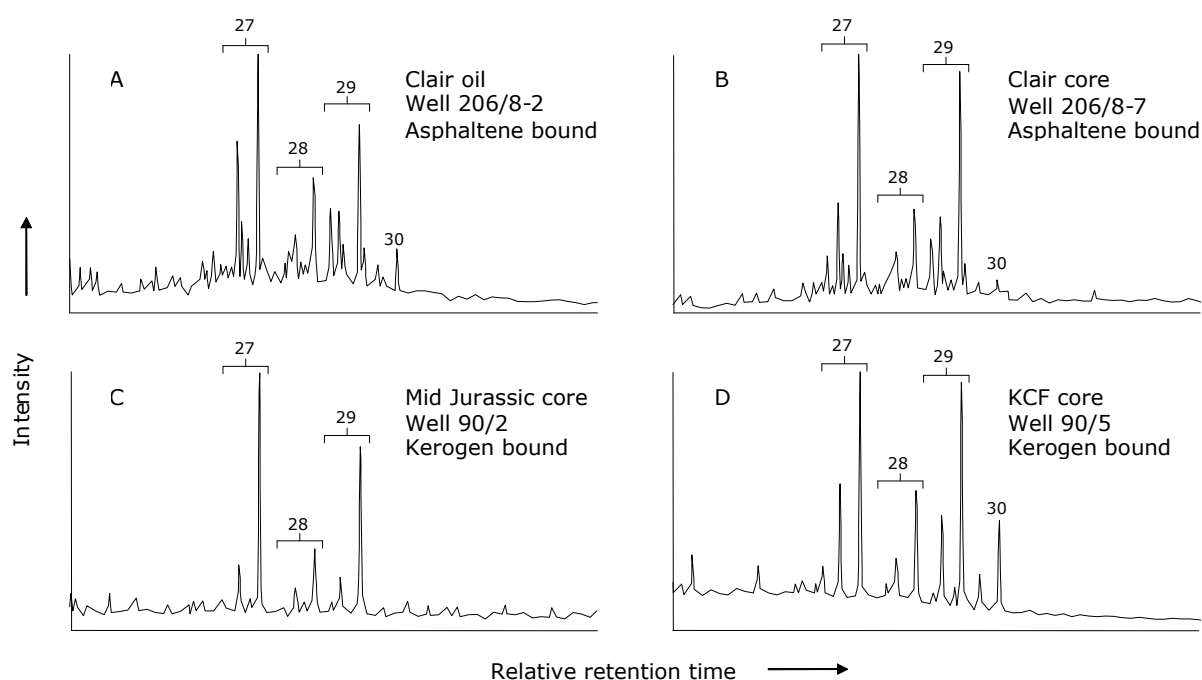


Figure 1. *m/z* 217 mass chromatogram of the steranes generated from the hypy of: A – Clair oil asphaltenes; B – Clair reservoir core adsorbed asphaltenes; C – West Lewis Basin, Mid Jurassic source kerogen; D – West Lewis Basin, Lower Cretaceous KCF source kerogen.

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