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Fibrous Illite and the Critical Moment of Oil Charge in the Northern North Sea

The Penguin Field of the Northern North Sea is a complex array of four distinct hydrocarbon traps spanning the Magnus and Brent Provinces of the East Shetland Basin. The field is also juxtaposed between the petroleum systems of the Viking Graben and the More Basin. The field has been diagenetically altered during the later stages of burial by fibrous illite. K-Ar ages for fine fractions of illite cement extracted from reservoir sandstones within the Penguin field display an unusual range of ages with respect to other studies for the East Shetland Basin and the Magnus oil field. Ages for the Penguin field appear to range from as much as 120 Ma to 30 Ma. Data sets similar to this exist for other fields in the vicinity, and have, without exception, been interpreted as artefacts of detrital contamination resulting from the separation method employed. However, the Penguin field separates appear to be of high quality after characterisation by XRD, and TEM analysis. An alternative geological model is proposed to explain these unusual ages. Namely, fibrous illite diagenesis in the Penguin Field is a response to the onset of oil migration in both local kitchen areas and deeper, more remote source areas associated with the Atlantic margin. This model is additionally supported by oxygen and deuterium stable isotope data. The general population of illite ages published for the East Shetland Basin are reinterpreted in light of these findings.