Subsurface carbocation processes revealed by detailed study of the aromatic UCM

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The monoaromatic, diaromatic and triaromatic fractions of a severely biodegraded crude oil (Leatherjacket-1) from the Gippsland Basin (Australia, Cretaceous) were oxidised using ruthenium tetroxide to obtain alkyl substituents as carboxylic acids. Each set of monocarboxylic acids was then reduced to monodeuterated hydrocarbons and characterised by GC-MS. These saturated hydrocarbons (consisting of homologs of *n*-alkanes, methylalkanes, alkylalkanes, alkylcyclohexanes, methylalkylcyclohexanes, isoprenoids and bicyclics) are similar for all three fractions. Interestingly, they are also similar to the saturated hydrocarbon isolate of a non-biodegraded oil also from the the Gippsland Basin (Murray, 1998). The δ^{13}C values for the individual *n*-alkanes (from C_8 to $C_{29)}$ in all three samples are similar, and are also similar to those for the saturated hydrocarbon isolate of the non-biodegraded oil.

These similarities between the three sets of alkyl moieties isolated from the aromatic fractions, and the saturated fraction of a related oil suggest a genetic relationship. The alkyl side chains, (and the saturated hydrocarbon fraction) may have a common origin independent of the type of aromatic moiety to which they were originally attached. We believe these observations are consistent with the occurrence in the source rock of carbocation intermediates which are either captured by aromatic species to give complex mixtures of (poly)alkyl aromatics (the aromatic UCM), or are quenched to give the familiar saturated hydrocarbon types commonly observed in crude oils.

References

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Spatial and temporal variation of tritium activities in coastal marine sediments of the Severn Estuary, U.K.

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Amersham plc routinely discharge ^{3}H into the Severn Estuary, UK, as part of their authorised marine discharges. It is usually assumed that ^{3}H is present as HTO and as such is rapidly diluted and dispersed in the water column. However, the discharges from Amersham are unusual in that they contain a proportion of the ^{3}H bound to organic molecules. Recent studies have shown that the presence of such tritiated species have resulted in elevated levels of ^{3}H in the foodchain, with ^{3}H activities in flounder ranging from 20000 to 120000 Bq/kg wet weight. It is therefore clear that the traditional view of ^{3}H dispersion in the marine environment is not appropriate in this instance.

In addition to elevated levels of ^{3}H in marine biota, ^{3}H activities up to 900 Bq/kg have been measured in coastal sediments collected in the vicinity of the Amersham discharge point. It has been suggested that ^{3}H-labelled sediment may play an important role in the persistence of ^{3}H in the Severn Estuary. This paper reports the interim results of a three year investigation into the spatial and temporal variability of ^{3}H in sediments in the Severn Estuary and the factors that may control the release of ^{3}H in the sediment. The importance of this sediment-bound ^{3}H on the dispersion and long-term impact of the Amersham discharge is also discussed.