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Abstract of Doctoral Dissertation

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Molecular and isotopic composition showing source and in-reservoir phase fractionation of crude oils and condensates in the Surma basin, NE Bangladesh
(分子・同位体組成が示す北東バングラデシュ、スルマ堆積盆地のオイル・コンデンセートの起源と貯留層内相分別作用)

**Molecular and isotopic composition showing source and in-reservoir phase
fractionation of crude oils and condensates in the Surma basin, NE Bangladesh**

Hossain MD. Ashique

Abstract

Origin and sources of crude oils and condensates from the Surma basin, NE Bangladesh have been investigated based on geochemical characteristics (Hossain et al., 2014). The study inferred that oils and condensates from the Surma basin were derived from the terrestrial source rocks and expelled from the source rock at the maturation stage of $R_o=1.0-1.3\%$. Oils from the southern margin of the basin were derived from marine influenced terrestrial source rock and at a relatively low maturity levels ($R_o=0.8-1.0\%$). Some oils were severely biodegraded. The similar distribution of diamondoid hydrocarbons, however, in both degraded and non-degraded oils from the Surma basin suggests similar type of source rock and identical maturity levels. Estimated maturity level of the oil/condensates and the depositional environment of the Surma basin suggest non-marine deposits ranging from the upper Kopili Shale of the late Eocene to lower Jenam Formation of the early Oligocene may be the most possible sources of the study oils and condensates. The relative abundance of C_7 aromatic, cyclic, and straight chain hydrocarbons in condensate to waxy oils and other molecular parameters suggested evaporative fractionation due to in-reservoir phase separation.

Stable carbon and hydrogen isotope compositions of individual *n*-alkanes in oils and condensates were analyzed for further understanding the origin and compositional fractionation. The $\delta^{13}C$ value of individual *n*-alkanes ranging from -32 to -25 ‰ tends to decrease with increasing

carbon number, showing the similar distribution pattern in all the oil/condensates samples. Nearly similar distribution of $\delta^{13}\text{C}$ values of *n*-alkanes reflecting consistency with source and maturity levels suggested by molecular parameters.

The δD values of individual *n*-alkanes range from -128 to -70 ‰ and linearly increases with increasing carbon number. The relationship between carbon number and δD value is significantly different among the oils and condensates. Waxy oils showed remarkable depletion in D compared to condensates. The distribution of δD value of *n*-alkanes clearly distinguishes condensates from heavy waxy oils. The variation in δD values of *n*-alkanes i.e. lighter condensates rich in D and heavy waxy oils depleted in D is interpreted as the result of ‘inverse hydrogen isotope fractionation’ associated with in-reservoir phase separation of oils. We report on the possible first observation of inverse hydrogen isotope fractionation of *n*-alkanes associated with in-reservoir phase separation of petroleum. On the other hand, small variation in $\delta^{13}\text{C}$ of *n*-alkanes indicate a minor effect of phase separation on $\delta^{13}\text{C}$ value of *n*-alkanes.