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DISTINCTION OF LACUSTRINE AND FLUVIO-DELTAIC PETROLEUM SYSTEMS IN NON-MARINE SETTING OF SOUTHEAST ASIA

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In case of the age younger than late Cretaceous, the compounds related to higher plants such as oleanane and bicadinane are generally used to identify fluvio-deltaic petroleum systems. However, these compounds are also found in lacustrine petroleum systems, especially for light oil and condensate. These compounds are even observed in Tertiary marine petroleum systems. Therefore, distinguishing between lacustrine and fluvio-deltaic petroleum systems in non-marine settings of Southeast Asia is not easy.

The fact that oleanane and bicadinane demonstrate large peaks on m/z=191 mass chromatogram for light oil and condensate suggests that these compounds are resistant to thermal stress. Thinking of this hypothesis, the oleanane/C_{30} hopane ratio of crude oils from Southeast Asia was plotted against the Ts/Tm ratio, which is a maturity indicator. Generally, the oleanane/C_{30} hopane ratio increases as the Ts/Tm ratio increases and 2 groups were clearly identified on this diagram. One group contains crude oils collected from Sumatra and Cuu Long basins, where only a lacustrine petroleum system is working, and the other contains crude oils collected from Baram and Mahakam delta regions, where only a fluvio-deltaic petroleum system is working. This confirmed that the Ts/Tm - oleanane/C_{30} hopane diagram is useful to distinguish the two petroleum systems.

The validity of the Ts/Tm - oleanane/C_{30} hopane diagram was also checked by GC-MS-MS analysis. C_{30} 4α-methyl sterane identified on m/z=414-231 mass chromatogram is a useful marker to identify lacustrine petroleum systems. It was demonstrated that almost all of the crude oils grouped as from the lacustrine petroleum system on the Ts/Tm - oleanane/C_{30} hopane diagram contain this compound, which further confirms the hypothesis.

For condensates, hopanes and steranes cannot be used, since these heavy molecules are thermally degraded and then almost disappear in some cases. Alternative compounds should be introduced to distinguish lacustrine and fluvio-deltaic petroleum systems. Diamondoid compounds which are resistant to thermal stress were used to distinguish condensates originated from 2 petroleum systems. Various kinds of diagram were investigated and it was found that the diagram plotting methyl adamantane index (MAI) against the concentration of adamantanes is useful. Chen et al. (1996) revealed that methyl adamantane

index (MAI) is a maturity indicator for diamondoid compounds. Generally, the concentration of adamantanes increases as MAI increases on this diagram, maybe due to the generation of adamantanes with maturity. In addition, several groups were distinguished according to depositional environments. This fact was interpreted that clay works as a catalyst for the generation of adamantanes and clay input varies in each depositional environment. In fact, the condensates collected from marine carbonate environments where clay input is minimum exhibit lowest adamantane concentration on this diagram.

A case study in Vietnamese basins will be discussed integrating several methods discussed in this paper.

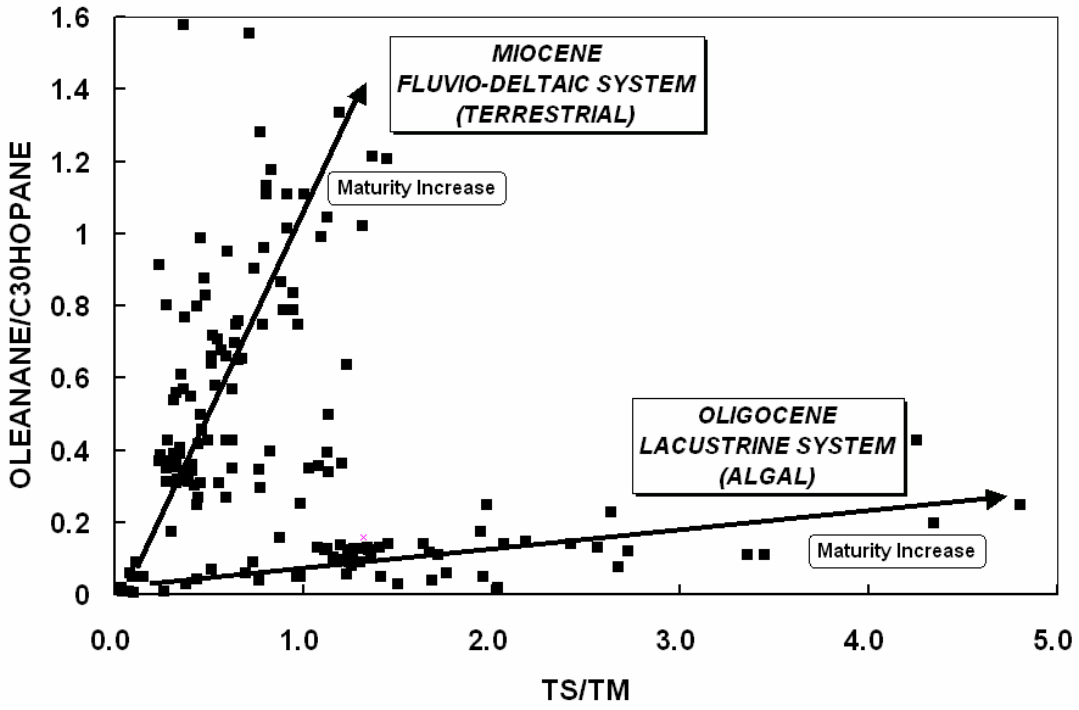

Figure 1. Ts/Tm - oleanane/C_{30} hopane diagram to distinguish lacustrine and fluvio-deltaic petroleum systems in non-marine setting of Southeast Asia

REFERENCE

Chen, J., Fu, J., Sheng, G., Liu, D. and Zhang, J. (1996) Diamondoid hydrocarbon ratios: Novel maturity indices for highly mature crude oils. Org. *Organic Geochemistry*, 25, 179-190.