

## **How to Describe Heterogeneous Source Rocks in Basin and Petroleum System Modeling?,**

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Stratigraphic variability of source rocks significantly impacts the quantity and quality of hydrocarbon generated. Heterogeneity of source rocks exist in very small vertical scale, where TOC and HI usually vary in one scale and a few times respectively, Simple statistic of geochemical screen analysis data or more complicated chemical kinetical model cannot solve the problem of heterogeneity of source rocks. We have revealed that universal covariant relationship of HI and TOC exist for lacustrine and marine mudstone source rocks, to the less degree for terrestrial source rock. Therefore, characterization of type or hydrocarbon potentials of source rocks can be simplified to their counterparts TOC description. HI appears to increase with increasing TOC, asymptotic to 650-700mg/gTOC for above 3 wt% TOC lacustrine mudstones in immature phase, HI distribution and activation energy are peculiar for different TOC interval((0.5-1%,1-2%,2-3%,more than 3%) mudstone, Four TOC interval kinetic organofacies, each characterized by HI,TI,GOGI and bulk petroleum generation kinetics, have been established for lacustrine source rocks, which can be related to evaluation of source rock on wireline logs. Kinetic calibration to observed HI,TI and PI trend for different TOC interval source rocks can constrain hydrocarbon generation kinetics model and restore the initial HI and TOC. Two case studies will be presented to illustrate how to describe heterogeneous lacustrine source rocks, the first case is the upper Cretaceous lacustrine source rocks in Songliao Basin, where the thickness of four source rock members (K2qn1, K2qn2+3, K2n1 and K2n2) with different TOC intervals were calibrated with  $\Delta\log R$  algorithms for about 800+ wells, The second case is Paleocene lacustrine source rocks in Baihai Bay basin, where the thickness of four source rock members (Ed3, Es1, Es3 and Es4) with different TOC intervals were calibrated for more than 1000+ wells. The high-resolution distribution model of lacustrine source rocks were established integrated with stratigraphic architecture and sedimentological facies.