GEOCHEMICAL CHARACTERISTICS UNDER A SEQUENCE STRATIGRAPHIC FRAMEWORK: TAKING THE TERMIT BASIN AS AN EXAMPLE

Hongfei Lai[1], Meijun Li[1]*, Jiguo liu[2], Fengjun Mao[2], Hong Xiao[1], Jiang Kuang[1], Lu Yang[1]

[1] State Key Laboratory of Petroleum Resources and Engineering, China University of Petroleum, Beijing, China
[2] Research Institute of Petroleum Exploration and Development, PetroChina, Beijing, China

Introduction

Sequence stratigraphic geochemistry[1],[2] has high theoretic value and practical application signification in hydrocarbon exploration. Using this method, more accurate genetic classification of potential source rocks can be identified by adding the sequence stratigraphic methodology into source rock evaluation; and the geochemical characteristics of source rocks can be predicted through the predictive effects of sequence evolution especially in lower degree exploration basins that lack of drilling wells or samples. For a better understanding of hydrocarbon potential of Termit basin, SE Niger, correlation between sequence stratigraphy and organic geochemistry is used.

Results

This study is focus on the upper Cretaceous deposits of Termit Basin, SE Niger, which is well characterized as an integrated marine trangressive-regresive cycle (a second-order sequence). 6 three-order sequences (DSq1, DSq2, YSq1, YSq2, YSq3 and MSq1, from the bottom up) can be identified in the upper Cretaceous strata, which indicate a change in the depositional environment from shoreface to offshore to braided delta. The MSq1 consist of huge thick sandstones with very few mudstones can be regard as source rock. The DSq2, YSq1 and YSq2 mainly deposited in a shallow marine environment restricted by the Western African Rift, resulting in the huge thick, high continuity source rock widely distributed throughout the study area; and the DSq1 and YSq3 mainly in a paralic environment with the development of the thin, low continuity and multilayer source rocks.

The organic geochemistry is carried out on side wall core samples from 8 drill wells to characterize origin and variability of the organic matter in relation to the sequence stratigraphic data. Analyses of the aliphatic and aromatic hydrocarbons were performed using GC-MS and focused on biomarker distribution and molecular signatures. The biomarkers indicated that the contribution of terrestrial and marine organic matter is varied in different sequences (e.g. the ratio of *gammacerane* to C_{30} *hopane* ($Ga/C_{30}H$, 0.43~0.51) of DSq2, YSq1 and YSq2 source rocks is higher than other sequences), and the changes in molecular signatures are related to variations in the source of organic matter, preservation conditions, and environmental oxidation-reduction. Lower Pr/Ph value (0.68~0.84) and lower $C_{24}TeT/C_{26}TT$ (the ratio of C_{24} tetracyclic terpane to C_{26} tricyclic terpane, 0.23~0.28) in the marine trangressive stratigraphy (DSq2, YSq1 and YSq2) suggest that a moderately saline environment under a suboxic to relatively anoxic conditions within an underfilled basin, while other sequences (DSq1, YSq3 and MSq1) source rocks with a higher Pr/Ph value (1.08~2.28) and $C_{24}TeT/C_{26}TT$ index (0.31~0.85) indicated that a lightly saline environment under oxic to anoxic conditions within an balanced to overfilled basin.

We observe a good relationship between molecular geochemical signatures and the depositional cycles under a sequence stratigraphic framework.

References

[1] Peters K E., Snedden J W., Sulaeman A., et al. A new geochmical-sequence stratigraphic model for the Mahakam Delta and Makassar Slope. Kalimantan, Indonesia [J]. AAPG Bulletin, 2000, 84(1):12~44.

[2] Bohacs K M., Carrol A R., Neal J E., et al. Lake-basin type, source potential, and hydrocarbon character; an integrated sequence-stratigraphic-geochemical framework [A] Gierlowski E H, Kordesch, Kelts K R. Lake Basins Through Space and Time[C]. AAPG Studies in Geology 46, 2000:3~34.