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Distribution of sterane maturity parameters in a lacustrine basin and its controls: A case study from Dongying sag, eastern china

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Abstract

The effect of burial related maturation on the molecular maturity ratios C29ββ/(ββ + αα) and C_{29}20S/(20S+20R) have been studied in the Dongying Sag, a lacustrine rift basin in the Bohai Bay Basin, Eastern China. At depths between 2800 and 4000 m in the Depression, source rocks are present in the Paleogene Shahejie Formation. The source rocks comprise fresh to brackish water mudstones in Member 3 and evaporites deposited in a hypersaline setting in Member 4. Bulk geochemical data define the hydrocarbon generation threshold at a depth of about 2800 m. Molecular maturity parameters in general proceed to equilibrium values with increasing burial depth but may be inverted in hypersaline intervals.

Progressive changes in molecular maturity parameters are associated with major changes in related biomarker concentrations. Increases in the ratios C_{29} ββ/(ββ + αα) and C_{29}20S/(20S +20 R) result from differences in the relative rates of generation and thermal degradation of the isomers involved: The transformation of 20R is faster than that of 20S, including some transformation from 20R to 20S; and αα isomers thermally degrade more rapidly than ββ isomers, including some transformation from αα isomers to ββ isomers.

The inversion of molecular maturity parameters indicates that biomarker isomerzation and thermal degradation has been inhibited or retarded in hyper-saline sedimentary environment in which evaporitic rocks deposited. The minerals in evaporites also retarded the conventional thermal indicators including vitrinite reflectance (R_o) and pyrolysis peak temperature T_{max}, which also show their another type of inhibition from overpressure. No evidence showed the inhibition due to overpressure on the biomarker thermal indicators C_{29}ββ/(ββ+αα) and C_{29}20S/(20S+20R). This observation will help with the interpretation and application of molecular maturity parameters in similar saline lacustrine basins.

Biography

Chen Zhonghong completed his Ph.D at the age of 28 years from China University of Petroleum, and studied biomarkers in Stanford University during 2009.6~2010.6. He is an associate professor, and his research field is oil and gas geology, now particularly interest in molecular biomarker. He has published more than 40 papers in professional journals as the first author.